

**Utah Conference on  
Undergraduate Research  
2023 - Program**



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Undergraduate  
Research 2023 -  
Program**

**UNIVERSITY OF UTAH**

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University of Utah • Salt Lake City





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# Welcome to UCUR 2023

It is an honor to serve as the co-chairs for the Utah Conference on Undergraduate Research 2023 which was held at the University of Utah, February 17, 2023. This year, the conference features 644 different presentations: poster, oral, and performance. As conference goers and post-conference folks, visit the program, they will find that it is organized by areas of research: arts, business, dentistry, education, engineering, health and medicine, humanities, nursing, science and technology, social sciences, social work, interdisciplinary, and other. Participants self-selected the area that represents their research.

We recognize that research is made possible because of the interests, commitment and curiosities in undergraduate researchers, in collaboration with mentors, and for some, research teams of students, faculty and staff. UCUR represents the problems being solved by students across the state of Utah and the dynamic methods, modalities, and questions they seek to answer.

This year's conference was organized by a conference committee, included sponsors, and partnerships within the University of Utah and beyond – it is because of this collective work that this conference was made possible. We are grateful

for the partnerships that have made possible this state-wide conference featuring undergraduate research across the state.

UCUR 2023 Co-Chairs

Dr. Annie Isabel Fukushima, Associate Dean, Undergraduate Studies and Director, Office of Undergraduate Research, University of Utah

Cindy Greaves, Program Manager, Office of Undergraduate Research, University of Utah

Megan Shannahan, Academic Program Manager, University of Utah

# Overview of UCUR

## 2023

### Mission

The mission of the Utah Conference on Undergraduate Research (UCUR) is to promote undergraduate research, scholarship, and creative activity, done with the mentorship of a faculty member or others, through an annual conference. Undergraduate research has been demonstrated as one of the truly high-impact educational practices. Student presentations are welcome in all fields and disciplines from the creative and performing arts to biomedical, engineering, and social science research.

## History

The Utah Conference on Undergraduate Research (UCUR) is modeled after the National Conference on Undergraduate Research (NCUR) and organized by a committee of representatives from educational institutions across the state. The conference celebrates academic, professional, and personal achievements resulting from undergraduate research projects or creative endeavors.

Undergraduates from all disciplines are invited to apply for the conference, which provides an excellent opportunity for students to present their work in a scholarly setting to students, faculty, field specialists, and community members. Presentations may include both visual and oral displays of work in all academic disciplines, from art history to molecular biology as well as performance of creative research within the visual and performing arts.

### History of UCUR Sites and Conference Chairs

#### **2007 – University of Utah**

Chairs: Joyce Kinkead (USU), Steve Roens (UofU), and Jill Baeder (UofU)

#### **2008 – Utah Valley University**

Chairs: Lori Palmer (UVU) and Nancy Davis (BYU)

#### **2009 – Westminster College**

Chairs: Tim Dolan and Carolyn Connel

#### **2010 – Southern Utah University**

Chairs: Lynn White

#### **2011 – Weber State University**

Chairs: John Cavitt, Lauren Fowler, Amy Douangdara, and Jennifer Wozab



**2012 – Weber State University**

NCUR hosted at Weber State University

**2013 – Utah State University**

Chairs: Scott Bates

[View abstracts](#)

**2014 – Brigham Young University**

Chairs: Chadra Poulson, Gene Larson, Josh Leavitt

[View abstracts](#)

**2015 – Dixie State University**

Chairs: Stephen Armstrong, Christine Arlotti

[View abstracts](#)

**2016 – University of Utah**

Chairs: Rachel Hayes-Harb and Stephanie Shiver

[View abstracts](#)

**2017 – Utah Valley University**

**2018 – Southern Utah University**

[View abstracts](#)

**2019 – Weber State University**

Chairs: John Cavitt and Erin Bryner Kendall

**2020 – Utah State University**

Chairs: Alexa Sand and Athena Dupont

[View Abstracts](#)

**2021 – Brigham Young University**

Chairs: Larry Howell and Lynn Patten

[View Abstracts](#)

**2022 – Dixie State University**

Chair: Rico Del Sesto

[View Abstracts](#)

**2023 – University of Utah**

Chairs: Annie Isabel Fukushima, Cindy Greaves, Megan Shannahan

## **UCUR 2023 Sponsors:**

Undergraduate Studies  
Office of Undergraduate Research  
Vice President for Research  
College of Mines & Earth Sciences  
Graduate School  
J. Willard Marriott Library

## **UCUR 2023 PARTICIPATING INSTITUTIONS:**

UNIVERSITY OF UTAH (HOST)  
BRIGHAM YOUNG UNIVERSITY  
SALT LAKE COMMUNITY COLLEGE  
SOUTHERN UTAH UNIVERSITY  
UTAH STATE UNIVERSITY  
UTAH TECH UNIVERSITY  
UTAH VALLEY UNIVERSITY  
WEBER STATE UNIVERSITY

# Visit the University of Utah

## Transportation

Visit Commuter Services

UTA Bus Routes that stop in front of the Union Building:  
Route 9, Route 17, Route 21, Route 213

TRAX Red Line – The University South Campus stop is a  
10-15 minute walk to the Union Building.

To plan your trip, you can use the Transit App or Google  
Maps.

## Conference Maps

The University of Utah is a public research university in Salt Lake City, Utah. It is the flagship institution of the Utah System of Higher Education

### Maps

Visit the U's Interactive Campus Map

#### **A. Ray Olpin Student Union** (map)

- Register
- Breakfast mixers
- Poster, oral, & creative presentations

#### **Alumni House** (map)

- Breakfast mixer
- Oral presentations
- Graduate School workshop
- Lunch & lunch remarks

**Utah Museum of Fine Arts** – Guided tours (map)

**Marriott Library** – Place to practice presentations (map)

**Campus Parking** (map)

# **Check-In and Breakfast: 8AM - 9AM**

Registered presenters and participants, check-in at the A. Ray Olpin University Union. This event is open to the public, and any person may attend presentations without registering. Please note, lunch and event gifts are for registered participants only. Check-in may occur anytime throughout the day. Presenters are encouraged to check-in early.

**Breakfast Mixers are open to the public,**

## **presenters and mentors**

- College of Engineering – Catmull Gallery at the Warnock Building
- Equity, Diversity & Inclusion, Transform – West Ballroom, A. Ray Olpin University Union
- Graduate School – Alumni House Ballroom
- College of Humanities – 2110 Language & Communication Building
- College of Science and College of Mines & Earth Sciences- Saltair Room, A. Ray Olpin University Union

# **Session A: 9AM - 10:30AM**





**Architecture:  
Session A - Poster  
Presentations,  
Ballroom, Union**

**Location: Ballroom, A. Ray Olpin University  
Union**

**Is Ornament in Architecture beautiful or  
criminal?**

**Jacob Harris, Utah Valley University**

Faculty Mentor: Brandon Ro, Utah Valley University

SESSION A (9:00-10:30AM)

POSTER A1

Ornament in architecture is the placement of sculpture or

art on a building. This design strategy is common in classical architecture, and ornament can be seen on doors, windows, columns, cornices, facades, and more. In the eye of the classical architect this adds to the overall beauty of classical buildings. It is common for modern architecture to utilize little to no ornament. A famous modern architect by the name of Adolf Loos was even bold enough to refer to ornament in architecture as a “crime”. The classical architect sees ornament as good, whereas the modern architect sees ornament as bad. This research project seeks to understand what the average person is drawn to when it comes to this topic, whether that be ornament or no ornament. Using an eye tracking emulation software it is my hypothesis that the average person is more attracted to a building with ornament. I will be doing a comparison of two temples built by the Church of Jesus Christ of Latter Day Saints that reside in the same city. This includes the Provo Utah and Provo City Center temples. Using the software I will be able to determine where people are more likely to look as well as their gaze sequence. This study aims to reinforce that an increase in ornament will hold our attention more than a building without it.

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## **Designing for the Eye: Using Virtual Reality to Test Proportions in Intercolumniation**

### **Ben Varnell, Utah Valley University**

Faculty Mentor: Brandon Ro, Utah Valley University

## SESSION A (9:00-10:30AM)

## POSTER A2

The poetic use of classical architecture to portray beauty though proportions is being lost in the modern world. Architectural theorists, Vitruvius and Le Corbusier, agreed that beautiful architecture uses the proportions of the body to bring harmony between all the parts of a structure. A challenge architects face today is communicating their designs using plans and sections to those who have trouble visualizing the three-dimensional qualities of two-dimensional drawing. In his research article "The Digital Perception of Architectural Space," Hugo C. Gomez, a professor of architectural urbanism in Peru, found that virtual reality is the most "highly-rated medium" to understand and visualize architecture. The current research builds upon Hugo's findings and will present what proportions in intercolumniation are most pleasing to the eye by utilizing three mediums to collect data: three-dimensional virtual reality environment, 360 augmented reality images, and two-dimensional images. Participants in the survey were asked questions evaluating their visual preference and comfort levels of five SketchUp-modeled Tuscan columns. These columns were rendered and displayed in the virtual reality helmet using the software Twinmotion. The sample size of this survey comprises 55 non-architects who are untrained in the classical rules of proportion. Data was collected using the Likert scale via a google form. The constants in the study are the height and size of the column and entablature of the Tuscan order and are based on the proportions specified by The American Vignola. The variable in the study is the spacing between the columns. Each spacing was created using the square, golden ratio, or double square in the vertical or horizontal directions. Survey results showed that the most visually pleasing and comfortably

spaced columns used the golden ratio spacing in the horizontal and vertical directions. Further research methods could entail the use of other classical orders or a comparison of modern and classical designs.

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## **Tiny Home Housing Project for Utah's Homeless Community-The Other Side Village**

**Jose Cisneros Jr., Snow College**

**Eli Beagley, Snow College**

Faculty Mentor: David Barker, Snow College

SESSION A (9:00-10:30AM)

POSTER A3

Professor Barker, my advisor, is a brand new faculty member who was recently hired at Snow College to teach in the Construction Dept. He comes from an architectural design background. This year, we are able to construct a tiny home which will assist in the development of the prototype "The Other Side Village" designed specifically to assist with the homeless concerns in Salt Lake County. A similar village to this was constructed in Austin, Texas, and recently received approval by the Salt Lake City Council and Mayor. This planning project has received quite a bit of news media attention recently. I am excited be part of this project and learn about building design, social concerns, and how the

architectural design and construction industry can assist society in addressing these issues.

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## **The Anatomy of St. Pauls Dome**

### **Taylor Cherrington, Utah Valley University**

Faculty Mentor: Brandon Ro, Other: High School

SESSION A (9:00-10:30AM)

POSTER A4

St. Paul's Cathedral features an innovative triple dome structure that advanced building methods through religious traditions from late medieval methods. Even though the building exterior evoked classical tradition. When Christopher Wren designed the dome at St. Paul's Cathedral, he did so without using any exposed scaffolding, he demonstrated the ability to control the construction process in its structural essence. The inner dome revolves around a circular drum that is visible from the cathedral interior. Above the inner dome, a brick coned structure rises to support the 850-ton lantern. This cone also supports the enclosed wooden structure beneath the frame of the outer dome. This three-dome system allowed Wren to support such a heavy lantern, while achieving a great height needed to be a historical London landmark. With the use of 3D printing for the study of cultural content to comprehend the principles that stand at the base of a circular dome. These principles are necessary to understand the work of the architect and the reasoning behind time-honored construction that explores the future of architectural design. By constructing a three-dimensional model these principles can be easily

explained and understood. The result of this study should produce a greater understanding of building strength and stability in architectural construction of historical methods of design.

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## **Newness or Classical ? Using Visual Attention Software Method to Test Viewers' Reaction to Architectural Images**

**Ping Kei Cheung, Utah Valley University**

Faculty Mentor: Brandon Ro, Utah Valley University

SESSION A (9:00-10:30AM)

POSTER A7

Juhani Pallasmaa, the architect and former dean at the Helsinki University of Technology, proposes the idea that great work requires a sense of historical continuum; “An embodiment of the sense of tradition’ as a precursor for ‘meaningful creativity.” Great work has an eternal freshness, it attracts our eyes immediately when we see the structure. In our age of progress, our eyes are only on the present and the future. Uniqueness and novelty have become universal standards of quality in architecture, rich historical layers are no longer seen as essential architectural goals. However, classical architecture still stands the test of time and engagement in this modern day. My research aims to find out why classical architecture is more engaging and pleasant. What is the relationship between classical architecture and history/culture? My research methodology involves using the 3M Eye Tracking Method. It

is an artificial intelligence application developed using experimental data from eye tracking. It will analyze images of different buildings (Dresden Museum in Germany, Musée du Louvre, Havenhuis) to predict audience responses to images. Diagrams and analysis from 3M Eye tracking will be provided to explain why classical architecture is more engaging. I am expecting to find out that classical architecture is more engaging and Pallasmaa is correct. If these findings are correct, we should follow the precedents of the past in order to produce great work.

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## **Vineyard site selection using GIS**

**Jason Cowley, Utah Tech University**

Faculty Mentor: Zhenyu Jin, Utah Tech University

SESSION A (9:00-10:30AM)

POSTER A8

Selecting suitable land for a vineyard is important for sustainable grape production. This project used two approaches to using GIS to identify areas that are suitable for wine grape growth in Washington county, southern Utah based on criteria from several sources (e.g., experts' knowledge, literature review). Several different GIS layers were used in this study including Digital Elevation Model, Soil Type, Land Ownership, Vegetation (DVNI), and climatic variables. The first method used overlay analysis to create a binary suitability map, while the second method used fuzzy logic to create a suitability map which ranges from 0 to 1, where 0 represents non-suitable and 1 represents most suitable. The maps were evaluated by comparing the location of current vineyard sites with the

suitability map, and the results revealed that less than 10% of the suitable areas were already used for vineyards.

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## **A Study on the Classical Orders and Personality Types**

### **Blake Gneiting, Utah Valley University**

Faculty Mentor: Brandon Ro, Utah Valley University

SESSION A (9:00-10:30AM)

POSTER A9

The five classical orders have often been associated with gender, and occupational roles throughout history. This project is to determine if there are still ties between the classical columns and people. This will be explored by firstly discovering if traditional ties to gender and occupation and the orders still exist today and then will test if there is a correlation between personality types and the classical orders. The classical orders have been tied to physical and occupational traits of people in the past and will be tested in this study to see if these ties and others exist today. This study will be conducted in the form of a survey gathering general demographic information and a series of questions to determine personality types based on Don Lowry's True Colors personality quiz and to evaluate preference of the classical orders. Expected results of this study include that woman and those who work in white collar professions will tend to prefer the Ionic, Corinthian and Composite columns while men and blue-collar professions will be more inclined to prefer Tuscan and Doric columns. This will be displayed in a series of graphs and charts showing correlations between genders, ages and occupations to five



orders. It is also expected to find strong correlations between personality types and the orders. This will also be displayed in series of graphs and charts showing which percentage of those who participated in the survey correspond to personality types as well as rankings of column preference.

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## **Testing Visual Sameness and Materiality**

### **Zachary Cooper, Utah Valley University**

Faculty Mentor: Brandon Ro, Utah Valley University

SESSION A (9:00-10:30AM)

POSTER A10

In what ways does the material affect a craftsman and their connection to the thing they are crafting? What materials are best suited for architectural ornamentation? In order to explore these questions I have decided to make or build the same architectural ornament four times using four different materials; stone, wood, plaster, and 3D printed plastic. Each involves a different level of involvement by the craftsman. This will allow me to discover which crafting methods most connect a craftsman to the piece they are crafting. I suspect that my experience will determine that the plaster will be the most involved piece in this circumstance, followed by wood, and then stone and 3D print. This is because the level of involvement I will have in each of these methods will directly reflect which I feel the most connected to. I will also be conducting a short research survey by laying out all four of the finished ornaments and asking questions in order to see what the general public's perception is as to which of the

four materials are most desirable, most authentic, or most reproducible. I suspect that wood will be the most desirable material because of its natural qualities with the grain and richness of color, followed by the stone piece since it will also have some natural quality to it, but also its texture and sense of weight or strength. I suspect that the plaster mold will be liked because of how it feels more sculpted and artistic than the others might. I suspect the 3D print to be the last one because it is plastic, hard, and gives a fake feel. Materiality is extremely impactful on the end user experience and therefore this research will inform me on the importance of utilizing the best and most appropriate materials per a given application.

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## **Reassessing the Authenticity of Place: Lessons Learned from Venice and Las Vegas**

**Steven Hawker, Utah Valley University**

Faculty Mentor: Brandon Ro , Utah Valley University

SESSION A (9:00-10:30AM)

POSTER A11

The Venetian hotel is one of the largest hotels in Vegas. Based around Venetian Architecture, there are many elements, attractions, and famous landmarks from Venice recreated in various ways all around the hotel. But how does this experience translate from the original authentic architecture to the recreations made as attractions for guests? In this study I will be utilizing photoshop simulated 3D eye tracking software, as

well as a survey of architectural students and professionals in order to dive into whether or not the authentic experience of seeing these architectural elements was effectively translated from Venice, Italy to the Venetian. I will then compare these two separate case studies in order to see how the software compares to the “real world experience”. The software will take A.I. data and create a color map of what areas the eye is most drawn to on an image. The survey will ask to compare how authentic each image feels, but will be limited to just people that work in the Architectural industry. This will in turn help distinguish if there is a difference between the general populace and a more trained eye when it comes to experiencing these recreations, and will help give a more well rounded understanding of what the Venetian does in their creation of place and user experience. I expect to find that both from the software and the survey, the results will show that the experience and context of being in Venice will always be the more authentic experience, and that the Venetian cannot truly capture what it would be like to be on the streets of Venice. I don’t expect to see a major difference between the survey and A.I results. While the Venetian can recreate the elements, context and authenticity of place can never be truly recreated.

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## **The Embodiment of Place: Studying Through the Lens of French Architecture Taylor Jensen, Utah Valley University**

Faculty Mentor: Brandon Ro , Utah Valley University

SESSION A (9:00-10:30AM)

POSTER A12

ABSTRACT: How we perceive the world around us and what gives a place its identity can largely be perceived through the built structures we are constantly surrounded by. Place identity can be defined as design features, architectural elements, the building process, materiality, symbolism, texture, and color. Characteristics such as context, environment, and architectural elements can give meaning to a place helping us discern one from another. Identity helps define the connection between the built environment and culture. In order to understand how the built environment affects the identity of a place, this study looks at the top ten places to visit in France. The study of these locations will be broken down into how many pertain to built structures and environments. Key characteristics such as motifs, ornamentation, building style, materials, etc. will be examined and studied. From these findings and noticing similarities between the ten locations, we will determine if place identity has to do with the built structures in said place. We will identify the identity of the place and how the culture and environment shaped the architecture. Or how the architecture shaped the culture and environment. The ten locations being studied will include The Eiffel tower, Miser de louvre, chateau de Versailles, cote d Azur, mint saint Michael, Loire valley chateaux, cathedral notes dame Chartes, Provence, Chamonix Mont Blanc, Alsace villages. This study aims to reveal that the identity of a place can be identified through the built structures it is surrounded by. Key architectural details can speak the name of a place better than words and communicate culture to all educated levels just by being perceived through the lens of your eye.

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# **The Human Body is Architecture: How the Human Body Informs the Proportions in the Corinthian Order**

**Jayne Lee, Utah Valley University**

Faculty Mentor: Brandon Ro, Utah Valley University

SESSION A (9:00-10:30AM)

POSTER A13

As humans we want to be able to relate to our surroundings. Those interpersonal connections in architecture let us connect to the outside world. My goal is to find out what proportions in the Corinthian order relate to the human body and how I can implement those proportions in my future design projects. The human body and classical architecture are interconnected. Architects took the proportions of the human body and included them into the elements that created their buildings. The span of a column is based on the width of the human reach. The entablature proportions are based on the human face's proportions. The column height is based on the height of a human head. Each element is influenced by the thing we interact with most, ourselves. By researching this subject, a greater knowledge of why certain elements were designed to look a certain way, and a greater understanding of what the thought process was behind each of the classical elements in the Corinthian order is developed. In order to show these findings in a creative and understandable way, I will be creating an analytique showing these proportions compared to the Corinthian order.

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## **Does it matter where we learn? Insight into nature's benefits for educational building design for architecture students**

**Jordan Meyer, Utah Valley University**

Faculty Mentor: Brandon Ro, Utah Valley University

SESSION A (9:00-10:30AM)

POSTER A14

Daylighting in buildings has been a topic of research in both architectural and neuroscientific fields of study. In the realm of higher education, research is beginning to blossom regarding the positive impact of daylighting in learning environments for any level of student. Likewise, views of nature add to this positive learning experience with deep, inherent neurological effects (also known as biophilia). The effects are generally higher brain activity and reduced overall stress—two characteristics that arguably determine academic performance. The intent of this study is to add to this rather unknown research niche and promote the incorporation of windows with views of nature into classrooms to give students an adequate learning environment. Architecture students at Utah Valley University are tasked with relatively difficult projects that require both hemispheres of the brain. These students were surveyed about their individual preferences in classroom design and how it impacted their learning experience. They were also questioned about what views were ideal in the classroom. Ultimately, this survey supports the previously stated evidence, highlighting that students viewed sunlight as

one of the most important design features of a classroom, with a standpoint that sunlight has a “positive impact” on their overall learning experience. In addition, survey results show an overall consensus that natural elements in their view from the window are preferred and helpful in their learning experience. To confirm the survey results, Artificial Intelligence eye-tracking software was applied to photos of the classrooms that these students learn in. The software showed increased attention to natural elements through the view of the window—confirming the biophilic response that is innate in human nature.

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## **Contemporary Sustainable Architecture**

### **Sara Miner, Utah State University**

Faculty Mentor: Marissa Vigneault, Utah State University

SESSION A (9:00-10:30AM)

POSTER A17

Architecture and design often reflect socio-political concerns. For example, contemporary architectural practices focused on sustainable design and materials evidence the increasingly important role art, architecture, and design occupy at the forefront of conversations and solutions around climate change. As carbon emissions continue to rise and global climate change is becoming ever harder to ignore, it is imperative that architectural design incorporate sustainable materials and practices accessible to all. Using data from artists, architects, and designers, who are often working in geographic areas more susceptible to climate change, my presentation will focus on answers to the following questions:

- i. How does contemporary architecture and design reflect increased awareness of environmental concerns?
- ii. How have architectural and design practices changed in response to demands for sustainability?
  - Do developments in sustainable design correlate with changes in carbon emissions?
- iii. How are regions that are more susceptible to the effects of climate change leading discussions around sustainable architecture, technology, and design?
  - How is Utah addressing this at State and University levels?

My presentation will focus on sustainable architecture, its historical roots, and its contemporary application to areas particularly susceptible to climate change. I will share my research and analysis of Utah-specific solutions to climate change, including the state's overall sustainability practices, the construction of LEED-certified buildings and environment-friendly designs on university campuses, and site-specific examples of sustainable design. This includes a case study I will conduct on-site of Community Rebuilds in Moab, UT, as well as first-hand study examples of sustainable architecture in Salt Lake City.

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# **Imitation is a Form of Flattery and Learning: how the method of imitation can produce new designs in stained glass windows**

**Rebekah Phillips, Utah Valley University**

Faculty Mentor: Brandon Ro, Utah Valley University

SESSION A (9:00-10:30AM)

POSTER A18

‘Imitation is a form a flattery...and learning: How the method of imitation can produce new designs in stained glass window’

There is a misconception that imitation and copy are one and the same. An ongoing debate in the realm of art and architecture is that to imitate one work is equal to creating an exact replica. However, imitation is a crucial method in learning to create and develop originality. To elaborate, imitation is using influences to shape one’s work into something new and different by studying past models, models meaning art, buildings, or other creative works. A copy, however, is creating a model to be identical to the model studied. But this does not mean copying is bad. Copying is the first step to this learning process. “First, do as I do to then reach an understanding to possess as your own creative process.” The purpose of this project is to show how studying past models can create a new design. The process for this creative project is to draw replicas or copies of window designs, then with each drawing, create a new stained glass window

design by taking the best parts of each drawing and combining it into one design. This method of imitation applies to many other scenarios, not just the drawing aspect. In architecture school, the study of precedents is highly encouraged. Like in this window design experiment, students analyze building facades, floor plans sections and elevations and study proportions and geometry to use in their final designs. Window details and motif designs can be applied as a floor plan shape or garden design. Imitation of nature is often used as well to create furniture designs, patterns for fabric or wallpaper. Imitation is an important process that involves the study of past designs to aid one in developing the creative skills to produce a new model or design. Copying is a part of this process and is the first step to learning new creative skills. One important aspect of imitation is to study many precedents to build a list of references to draw from and generate ideas in the numerous creative work fields.

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## **Constructing a Typology of Latter-day Saint Temples**

**Killian Poulter, Utah Valley University**

Faculty Mentor: Brandon Ro, Utah Valley University

SESSION A (9:00-10:30AM)

POSTER A19

In the Church of Jesus Christ of Latter-Day Saints (LDS) the most sacred spaces are temples. In these buildings considered the “House of the Lord” members of the Church take part in

saving ordinances of the most significant degree. As such, the architecture of the temple is a significant part of the cultural identity for members of the Church. Throughout the history of the church there have been numerous architectural designs that identify a temple.

This project will look at the typology of LDS temple exterior design and attempt to distill it down to its most fundamental parts to determine what makes a temple recognizable. This has relevance for practicing design firms in Utah and around the globe as temple design and construction is a global endeavor. Cataloging temple typologies can create a guide for architects working in this field and help them to strike a balance between creating a building that is unique but identifiable while creating harmony with the local context. The primary focus of the project will be a cataloging of temples and their major design types. It will be visualized by a large matrix that will organize a representative sample of temples from diverse time periods and geographic locations to demonstrate typologies found in temples. This will show what design types exist and how many temples share these features. It will also show how temples and the type categories have changed over time. This can determine if there are typologies shared by all temple exteriors and help designers in creating new temples that are both distinct and recognizable.

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## **BEAUTY AND JUDGMENT: Analyzing Libeskind's Modern Additions to Classical Museums**

## Madison Rosser, Utah Valley University

Faculty Mentor: Brandon Ro, Utah Valley University

SESSION A (9:00-10:30AM)

POSTER A20

Background: Daniel Libeskind has designed modern additions to classical buildings throughout his career.

My research project revolves around the subject of architectural beauty and judgment. This topic was chosen because the presentation of the relationship between coexisting architectural elements needs to be explored. An analysis of judgments made towards buildings that meet the criteria listed below will be performed. It will be interesting to discover which architectural elements will attract more attention- the classical or the modern elements. When one comes across a building's façade, they make an immediate and subconscious decision of what exactly draws their attention. Two buildings will be analyzed through eye tracking emulation software. These two buildings will meet the following criteria below:

- The building has an addition/extension designed by Daniel Libeskind.
- Both modern and classical architectural elements coexist on the building's main façade. The building is a museum.

The following points listed below will be evident throughout this research project:

- Beauty is measurable.
- Formal and spatial beauty help create a successful façade.
- There are physical characteristics that

## help identify beautiful buildings.

Using the Photoshop 3M VAS software, an experiment will be conducted to analyze two buildings (that meet the criteria listed above) to analyze the user's experience further. Located in Germany, the main facades of both the Military History Museum and the Jewish Museum will be analyzed.

It is proposed that the software will reveal that the classical architectural elements will draw more attention than the modern architectural elements on a building's façade.

**Arts. Session A -  
Poster  
Presentations,  
Ballroom, Union**

**SESSION A (9:00-10:30AM)**

**Location: Ballroom, A. Ray Olpin University  
Union**

**The Presence of Absence: Exploring the  
Shadows of Death**

**Mckenna Goade, Utah Valley University**

Faculty Mentor: Alexandra Giannell, Utah Valley University

SESSION A (9:00-10:30AM)

POSTER 05

Shadow is an ephemeral index that implies a presence and absence simultaneously, a duality I am curious about in relation to something non-physical. Shadow is a reference that connects something that is there, to something that is not. This body of work-informed by the post-traumatic stress I suffer from due to my dad's colon cancer and subsequent death-interrogates the skewed perception of time and memory brought about by this loss through the examination of shadows. I explore shadows as a reference to something that is physically absent but is present through memory and objecthood-and how that energy transfers into our possessions after we die. When experiencing a PTSD (Post Traumatic Stress Disorder) flashback, the subject is forced out of the present and into the past-the boundaries of time dissolve and invade the current moment. It is an ever-present challenge for people with PTSD to remain in the now. As an individual suffering from PTSD, I choose processes that allow uninterrupted access to memory and allow my hands to continuously connect to the surface, supporting unbroken streams of connection. I intentionally access memory by recalling a specific sense, the color of a hospital blanket, the sound of an oxygen machine, or the smell of disinfectant-these memories fuel the imagery and materials of the works. I aim to communicate the importance of an uninterrupted stream of memory through my sustained drawing process, choosing materials that support continuous mark-making. This process is a means of exploring how potential energy becomes kinetic, moving trauma through my hands and onto the surface, parallel to the way one's objects house their energy post-mortally. These works are observations of my father's worldly objects and the diverse ways their shadows interact with different surfaces-they become representations of time and memory melting into one present. I use projected images of

these shadows onto varied surfaces to interrogate the mixed outcomes of implied absence or presence. The intent of this research is to personally order re-emergences of past traumatic memories disguised as present moments and to allow the viewer to experience disjointed memory and feel the presence of absence, to observe the bodily sensations of post-mortal energy through objecthood.

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## **Finding Meaning: The Combination of Mapping and Altered Image to Access Intangibility**

**Jessica Downs, Utah Valley University**

Faculty Mentor: Alexandra Giannell, Utah Valley University

SESSION A (9:00-10:30AM)

POSTER 06

Searching for meaning within my practice has led me down a path of deep contemplation in order to find an effective visual language that harnesses the feelings and thoughts that I am unable to articulate. The act of creating a visual representation of something intangible through the use of mapping, altered image, and a deep meditative practice allows for the accessibility of a force outside of human consciousness. Inspired by the continuous research of several contemporary artists like Louise Despont, who uses mapping in a meditative way, and Julie Mehretu, who maps atmospheres and networks, my work seeks to merge those separate mapping techniques to effectively describe the vibrations and patterns of emotions



and internal landscapes. Images, memory, maps, topography, and intuitive mark making work together to create a visual language that hums with life and possibility.

This research has broadened my thought processes and allowed for the creation of more meaningful connections within my work. This awareness will continue to influence future work that strives to effectively describe this universal energy.

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## **My Culture & My Art**

### **Kessley Durrant, Utah Valley University**

Faculty Mentor: Alexandra Giannell, Utah Valley University

SESSION A (9:00-10:30AM)

#### **POSTER 15**

As a Mexican-American, I work hard on representing my culture in my art. I feel as if I have to fight harder in order to show who I am and who I am willing to become. I often feel a sense of being lost in a community where there isn't a lot of diversity or main-stream media where we are finally getting representation after years of being ignored. I realized that I don't want others to feel this way either, so I work with a community called Ella Rises to help others like me, so they don't feel lost. We give a sense of security and diversity; we help empower young women and give them a community where they can fit in and don't have to fight as hard. I make sure to include people of color in my lessons, I work with them in order to lift them up and help the girls realize they are powerful, regardless of background or the color of their skin. In my pieces I normally portray women, I make their skin

different colors, I make them cry but I always put a sparkle of Mexican culture in my pieces. When we think of artist, we always think of the Artists of the Renaissance, such as Michelangelo, Rafael, Leonardo, Donatello, or Monet, Van Gogh etc. All of these artist who I have come to love myself, but other than Frida Kahlo, Pablo Picasso, or Diego Rivera, can you name any other Hispanic artists? We focus on people who are white and mostly men, I think we need more representation. How are kids with ethnic backgrounds going to realize that they too can accomplish bigger and better things such as our counterparts? In a culture that comes from the sun and the most vibrant colors you've ever seen, I think it's about time we get to shine a little brighter. I think it's about time for us to stand up and show others that regardless of background we can accomplish things. That's what I teach at Ella Rises, that's why I put some of my culture into my paintings, so I can shine, so my ancestors can shine, so we can all shine.

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## **Amassment**

### **Brian George, Utah Valley University**

Faculty Mentor: Alexandra Giannell, Utah Valley University

SESSION A (9:00-10:30AM)

POSTER 16

Our natural environment plays a critical role in shaping who we are. Every interaction with the landscape, synthetic or natural, defines our perception of reality in physical terms. The limits of our tactile experiences create an understanding of truth through a process of trial and error. Confirming what

can and cannot be. It is equally apparent that unexplained phenomena in the environment require the mind to establish narratives that cannot be confirmed through tangible evidence. A non-physical structure forms within the mind to explain the unexplainable. Each structure is unique to an individual's upbringing and personal experience. Whether constructed from religious ideology, personal experience, or emotional recognition -the non-structure is the direct result of physicality. My research investigates the relationship between non-physical or spiritual narratives upheld by physical institutions. Exploring my upbringing in a devout Christian home, I engage in broader contexts of historicity, American nationalism, and the hierarchy of Western ideals. While engaging in the work, it is essential to confront my personal relationship with the systems and structures I critique and benefit from. Confronting closely held beliefs uncovers a complex emotional connection to death, spiritual surety, and acceptance. As I wrestle with personal biases, the image reflects a similar tension between abstract mark-making and traditional painting techniques. The visual language is negotiating with itself as new elements are introduced to challenge compositional strategies. I approach each artwork like a collage -building up layers of found imagery to challenge the context each element relies on. After a rigorous application of tension, addition, and subtraction I hope to arrive at unsettled conclusions that prompt more questions than answers.

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## **Drawing The Live Figure, To See with**

## **Clarity is to Draw from Life**

### **Hannah Brown Anderton, Utah Valley University**

Faculty Mentor: Alexandra Giannell, Utah Valley University

SESSION A (9:00-10:30AM)

POSTER 21

While studying the figure from life, greater clarity can be found in creating marks that the eyes see directly in front of them rather than from a photo or reference. Capturing something in real time that is living requires a greater amount of conscious examination from the artist. Additionally, varying amounts of clarity and true forms can be created differently through additive methods with graphite pencil than through subtractive methods with graphite powder and erasure.

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## **Recalling Memory**

### **Zoe Elwood, Utah Valley University**

Faculty Mentor: Alexandra Giannell, Utah Valley University

SESSION A (9:00-10:30AM)

POSTER 22

What is memory? How do we form and recall memories-what limits or enables this exercise? How does memory affect our self identity and the way we interact with the world around us? My project is to research these questions and explore new ways of depicting the answers I may find. I am interested in the intangible and subjective nature of memory, the ambiguous effect on reality that one's perception can incur; as well as the

actual physiological nature of the brain, its neuroplasticity and potential for memory recall. In producing this body of work I seek to evoke these counter truths as they exist together. Without explicit use of imagery or direct representation my aim is to uninhibit the work from any preconceived notions a viewer may bring and to instead draw out an unassumed response from the viewer. The material quality of paint as a medium for research is an important element for understanding the work. Its capacity for permanence, expressed once a mark dries or is reiterated, plays against its own dual nature of impermanence, as something that can be destroyed, manipulated, washed away, covered up etc. In applying such an ambiguous tool to our examination of memory we can approach the subject with a broader understanding, and allow for the flexibility of thought that such engagement requires.

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## **Beyond the Surface**

### **Ruth Voss, Utah Valley University**

Faculty Mentor: Alexandar Giannell, Utah Valley University

SESSION A (9:00-10:30AM)

POSTER 23

The theme of this body of work stems from humanity's fascination for the non-physical/spiritual realm. Non-physical phenomena such as dreams, premonitions, religious miracles, psychic perceptions, coincidental happenings after the death of a loved one, or near death experiences fuel my pondering. Without isolating singular events, this work explores the points of intersection between the physical and non-physical/spiritual

realms. Specific use of imagery and mark-making techniques point either to physicality or spirituality. Blurred figures that appear to stand perpendicular to the viewer reach down as if to touch the canvas surface. This alludes to curious moments in the human experience when perception breaks through the physical barrier into the non-physical/spiritual realm. An interplay of additive and subtractive mark-making techniques inform the work. The application of paint relates to physicality, while the removal of paint relates to spirituality. This approach allows the viewer to contemplate the relationship between the physical and non-physical/spiritual realms.

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## **Mother, Not Martyr: Claiming Identity and Taking Up Space**

### **Hollie Anderson, Utah Valley University**

Faculty Mentor: Alexandra Giannell, Utah Valley University

SESSION A (9:00-10:30AM)

POSTER 24

The urge to resolve the dichotomy between selflessness in mothering and self identity in taking up space as an artist inspired this arts-based exploration and research. The globally-reaching construct that “good” mothers are selfless and all-sacrificing is one that has been passed down generation to generation and internalized by many who become mothers. As I began to pursue my passion and career as an artist I grappled not only with the patriarchal representation of motherhood “that depicts an ideological, sentimental portrayal of

selflessness and self-sacrifice” (Ciciola-Izzo, 2014), but also with a hesitation about my lived experience mothering as subject matter for my visual work. Insistent to separate my selfhood from motherhood, I purposely kept motherhood off the table as content for my pieces. As I grew in my abilities and became more conceptual with my art I learned that my experiences as a mother and my identity as an artist are inseparable. The pieces in this series are the product of allowing my lived experience to be present in my work along with a study of literature on the coexistence of art and motherhood.

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## **The Way the Wind Blows**

**Jolene Matheson, Utah Valley University**

Faculty Mentor: Alexandra Giannell, Utah Valley University

SESSION A (9:00-10:30AM)

POSTER 25

This 30” x 40” work of art is a commentary on the nuclear bomb testing program in Nevada during 1957. The Atomic Energy Commission conducted testing of nuclear bombs above ground in Nevada from 1951 until 1963, when the Limited Test Ban Treaty went into effect. From 1963 to 1992, testing was conducted underground. Tests were planned for days when the wind would be blowing over St. George, Utah. Shots would not be fired if the wind was blowing toward California. This work focuses on the experience of my family during 1957, the year of my birth in Cedar City, Utah, and two years following, until my family moved to California. Long-term consequences of exposure to radioactive fallout has also been visually suggested

in the work.

I used acrylic paint on canvas, collaged photos relevant to my family members living in southern Utah in 1957-1959, and uranium-containing grit gathered from the Morrison Formation in southeastern Utah. The image depicts family members, sheep, and mushroom clouds over a background landscape depicting the Chinli Formation, of which the Morrison Formation is a portion. Grit embedded in matte medium is used to represent fallout.

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## **Identity Explorations Through Relationships Jenny Mecham Carbajal, Utah Valley University**

Faculty Mentor: Alexandra Giannell, Utah Valley University

SESSION A (9:00-10:30AM)

POSTER 26

The context of my research project is focused on the exploration of relationships and the affects they implicate on self identity and individuals. Acknowledging each of these aspect can be there own area of exploration will inform the connectivity that is trying to be achieved. Though relationship can be applied to objects which includes tangibility, the area I'm explore is intangible. This calls for attention as to what context can be investigated to apply tangibility to the subject of relationship. The area of which I've chosen is the human form. This form behaves in a incapsulating matter that harnesses all



of the ingredients of which make up relationships. Emotions, feelings and experiences are some examples. But all of which are intangible and influence how we feed and what we invest into our relationship. But these internal areas can surface within the human form through gesture, posture and body language. The ambiguity and variation between each individual can be achieved by specific and expressive mark making within my artistic practice. Understanding and researching the anatomical features of the human form to achieve high reality is of importance for this research and is the overall area of which I'm exploring. Relationships vary between individuals and as well as the role they play such as personal, romantic, platonic or family oriented. This will impact the context within the works produced. How the individual perceives and implicates themselves within these levels relationships can impede on how the portrayal of the specific relationship. Inevitably, because I am the artist producing the work, my own relationship with myself and my identity will begin to surface. Which brings the importance of my own exploration of self identity and how my relationships affect me. Exploring the specification of the marks made to reflect how I perceive myself will allow the ability to decipher the marks made to represent another individual other than myself.

**Arts. Session A -  
Performance, East  
Ballroom, Union**

**SESSION A (9:00-10:30AM)**

**Location: East Ballroom, A. Ray Olpin  
University Union**

## Uncovered: A Dance Performance Using Music Created by the Movement

Miranda Squire, Brigham Young University

Cassidy Schroyer, Brigham Young University

Christian Maucotel, Brigham Young University

Faculty Mentor Shani Robison, Brigham Young  
University

SESSION A 9:00-9:15AM

East Ballroom, Union

Arts

For my undergraduate senior capstone project at Brigham Young University, I choreographed an original contemporary dance solo to original music created by the dancer's movement in real-time as the dancer performs the choreography. The title of this choreographic work was *Uncovered* and explored the challenge of many dancers—that of overcoming perfectionism. This project was a creative collaboration with Christian Maucotel, an undergraduate music major at Brigham Young University who used the application TouchOSC to create music that senses the actions of the dancer using a MUGIC, a handmade device. Through this creative process, Christian and I experimented and researched a new and innovative way to merge music composition and choreography, one that has not been previously accomplished. This innovation has provided a new way for the dancer to interact with the music, resulting in a unique approach to performance. Instead of following our own preferences in choreography and music composition, we

were mutually guided through the process of how to better enhance both the music and choreography to create a powerful and unified product. This collaborative creative project has been a very enriching and educational process and we are pleased with the innovative and ground-breaking product we have been able to create together.

## Exploring Trisha Brown's Methodical Approaches to Choreography Melanie Allridge, Southern Utah University

Faculty Mentor Andrea Vazquez-Aguirre, Southern Utah University

SESSION A 9:20-9:35AM

East Ballroom, Union

Arts

When it comes to Trisha Brown, most people in the modern dance community know who she is, or they know of her because of how iconic she was when exploring new movement ideas in modern dance. She seemed to lead the evolution of modern dance for decades throughout her career, and almost every new work she presented was ground-breaking. The question is then, what about Brown's approaches made her outcomes so successful at each point in her career? To name a few of her approaches, Brown used internal rhythms, postmodernism, accumulations, Locus (her famous cube), and intense examination of musical scores to create her works. Brown created her own choreographic devices and combined them with improvisation and trial and error to create her works. Oftentimes, she had to write down or draw her new

concept on a piece of paper before being able to translate that idea into her dancers' bodies. Although each of her approaches was unique and different from the next, I primarily used an interview I conducted with one of Brown's dancers, Mariah Maloney to uncover Brown's recipe for success. This interview, coupled with primary and secondary information from books, performance reviews, and peer-reviewed articles, led me to find one prominent theme between all of Brown's processes. Which is, Brown always kept her dancers' abilities in mind when creating a new work, which brought a sense of comfortability that showed from her dancers. Through this research, I hope to help other choreographers utilize Brown's way of working to find success in their own processes.

**Business. Session A**  
**- Poster**  
**Presentations,**  
**Ballroom, Union**

**Location: Ballroom, A. Ray Olpin University**  
**Union**

# **Racial empathy gap in the workplace: The existence of and consequences for racial workplace disparity through lack of empathy**

**Kathleen Bahr, Brigham Young University**

Faculty Mentor: Taeya Howell, Brigham Young University

SESSION A (9:00-10:30AM)

POSTER A27

My research will focus on an empathy gap in a workplace context, including outcomes like where the disparities and lack of empathy are amplified. Years of research has shown the benefits of diversity in the workplace, specifically better team performance. Research has also shown the many existing biases and disparities in the workplace. A 2016 study (Trawalter, Hoffman, & Waytz) showed that doctors and nurses are more empathetic towards whites than towards blacks when administering medical treatment and responding to patient pain, which led to the terminology “racial empathy gap”. This research will move a step further and specifically map racial disparities onto an empathy construct. It will explore a racial gap on many different levels – exist peer to peer, manager to peer, or peer to manager. This research will use organizational and psychological principles to support my hypotheses and findings, such as in-group out-group dynamics. It will also incorporate research on perspective taking (adam Galinsky). Power can be used as a moderator to help understand this empathy gap even more. The current planned methodology is an online survey using a scenario followed by behavior based questions that will show if empathy is applied in a situation or

not. The scenario will manipulate the racial background of the central character. This research is in progress, so no results or conclusions have been made yet.

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## **What Works In Reskilling?**

**Brenden Bodily, Utah State University**

Faculty Mentor: Megan Jenkins, Utah State University

SESSION A (9:00-10:30AM)

POSTER A28

Economies and technologies shift rapidly, which at times leaves workers behind with skills that are no longer as relevant as they used to be. Employers may also have difficulty finding employees who have the skills needed to take advantage of these new technologies. For example, the IDC estimates that the global shortage of web developers could rise from 1.4 million in 2021 to 4 million in 2025. My research asks the question: What works in reskilling? To answer this question, I review the academic literature and analysis from trade associations to examine best practices in reskilling workers for a changing job market. I look at ways that governments, companies, and educational institutions can help retrain displaced workers with the skills they need to stay competitive. Many large companies, such as Amazon, retrain their employees themselves to help them move into better jobs inside and outside of the company. Government programs also play a role in reskilling workers, and I examine what qualities make those programs more effective. Generalized “workforce development” programs that many states offer do not appear



to be very successful at fulfilling either the needs of workers or the companies that would hire them. I compare examples of more generalized workforce programs like Utah, which has only a 36% placement rate, to more targeted programs in states like Maryland, which works directly with employers and has an 80% placement rate. As workers are equipped with specific, industry-relevant skills, they become more valuable in the job market and find fulfilling careers more easily. State and local governments should collaborate with local employers to identify the skills for which employers are most in need. According to those needs, funds could then be allocated towards putting workers through trade schools, coding boot camps, or apprenticeship programs, each of which has high placement rates into relatively high-paying jobs. This approach lifts workers into better careers and simultaneously fills the skills gap that employers are experiencing.

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## **Opportunities and Constraints on Battery Supplies: Setting Policy for an Electrified Future**

**Matthew McCarthy, Utah State University**

Faculty Mentor: Brian Isom, Utah State University

SESSION A (9:00-10:30AM)

POSTER A29

In the span of a few decades, Lithium-ion batteries have gone from a relatively new technology to the foundation upon which many policymakers and entrepreneurs plan to build a

carbon-free future. With demand for these batteries expected to grow exponentially in the coming years, it is crucial to ensure sustainable access to supplies in order to keep up with demand. Failing to do so could have major consequences for a green energy future. This paper explores many of the issues that battery supplies may face in coming decades, the impacts those issues may have, and possible solutions to reduce or eliminate those risks. Rare metals such as Lithium, Nickel, and Cobalt, are necessary to produce Lithium-ion batteries, yet there exist a number of barriers, both domestic and international, that could severely limit US access to these resources. These include a lack of domestic reserves, environmental risks from mining and extraction, and reliance on other, sometimes hostile nations for raw inputs and manufacturing capacity. In order to establish a strong and sustainable domestic market for batteries for both electric vehicles and electricity storage, policymakers and innovators should seek opportunities now to identify and solve these potential issues. Some of these solutions include growing sustainable mining and manufacturing in the US, focusing on increasing recycling capabilities for lithium-ion batteries, and incentivizing the innovation of new battery technologies that can reduce reliance on these rare-earth metals.

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# **The State of US Transit Electrification and Associated Public Policy: A Quantitative Analysis**

**Tyler Rich, Utah State University**

Faculty Mentor: Antje Graul, Utah State University

SESSION A (9:00-10:30AM)

POSTER A30

Fostering widespread electrification of modes of transportation is a crucial agenda for economic, social, and environmental entities. The electrification of vehicles within the bus industry is still in its infancy, but we have already seen the far-reaching potential of electric public transportation within states such as Washington (Satterfield, 2020). This paper provides a broad, quantitative account of the current state of transit electrification within the United States. We draw from two large-scale transit authority datasets to examine the current state of the adoption of electric transportation with an emphasis on public buses. We have discovered factors generally present in agencies that have more widely adopted and employed electric buses, and we include important implications for managers and public policymakers involved in this adoption process. Some of these important factors include the source of funds, the bus manufacturer, and the current size of the agency. We conclude with avenues for future research and insights on how to progress the electric bus industry across the nation.

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## **Utah's Inland Port: The Future of Logistics in the Intermountain Region or Gambling with Taxpayer Money?**

**Austin Simonson, Brigham Young University**

Faculty Mentor: Simon Greathead, Brigham Young University  
SESSION A (9:00-10:30AM)

POSTER A31

Over the last 20 years, US imports and consumer demand have steadily grown with no clear end in sight. Despite this, approximately 40% of all our containerized imports are processed through only two ports – the Port of Long Beach and the Port of Los Angeles. In 2021, these two locations alone moved over 10 million import containers. In order to help ease the strain on our nationwide supply chain – an issue that came clearly into view during the COVID-19 pandemic – in 2016, the University of Utah submitted an assessment regarding a possible inland port in the region and Governor Gary Herbert created the Inland Port Exploratory Committee to further the development of this concept. These plans were more formalized in 2018 with the creation of the Inland Port Authority and Inland Port, legal entities created by the Utah State Legislature in bill SB234. However, since its inception, the Utah Inland Port has come with its fair share of criticisms and controversy despite the organization's claim that they will "future-proof Utah by creating a robust supply chain and establishing a trade and logistics hub for the Intermountain West." Through the use of interviews with key stakeholders, analysis of past publications (including scholarly articles and media coverage),

and retrospective analyses of other inland ports in the United States, this paper will seek to present detailed and objective findings regarding the proposed inland port project, including both the positive and negative impacts it would have on the region and a proposal as to its future.

**Business. Session A**  
**- Oral**  
**Presentations,**  
**Boyer Conference,**  
**Alumni House**

**SESSION A (9:00-10:30AM)**  
**Location: Boyer Conference (2nd**  
**floor), Alumni House**

**Evaluating Loan-to-Value Ratios of**  
**Post-War/Contemporary Art as Collateral**  
**Bennett Blake, University of Utah**

Faculty Mentor Jeffery Coles, University of Utah

## SESSION A 9:00-9:15AM

Boyer Conference (2nd floor), Alumni House

Business

Gallerists to art market theorists maintain that art is a stable asset, but private banks, who create loans with art as collateral, reject this belief considering other asset-backed loans receive higher loan-to-value (LTV) ratios. The current industry standard that private banks use for an art-secured loan is 50% of the value of a piece/collection. For other tangible assets, such as real estate, LTV ratios can soar over 80%. With the number of high-net-worth art collectors increasing, and their desire for private banking to be a one-stop shop for their finances, private banking's historical position on art-secured lending is being challenged by current necessity. While art lending is not thought of as a revenue generating practice for private banks, it is important for the purpose of retaining clients and engaging in more lucrative deals. I examine how banks have arrived at the LTV ratio of 50% and whether banks could safely increase that ratio. Using a multidisciplinary literature review, I analyze the trade cycle of art-secured lending, focusing on the terms of loans, insurance requirements, and the securitization of art. While many researchers talk about the advantages and obstacles to art-secured lending, their work has not examined the 50% LTV ratio, nor the possibility of increases. A statistical analysis of art's volatility over the period of 2000-2022 examines the extent of stability of art as an asset. I examine practical limitations around keeping art on a balance sheet, including concerns about the liquidity of art as well as legal/financial issues such as ownership, authenticity, and attribution. I anticipate that data from art indexes will suggest that art exhibits a lower volatility than U.S. equity indexes, but due to the complexities around securitizing and selling art it is

likely that lenders will continue to be hesitant about lending at higher LTV ratios.

## **How does SSI influence employment of disabled people?**

**Olga Krylova, Southern Utah University**

Faculty Mentor Joshua Price, Southern Utah University

SESSION A 9:20-9:35AM

Boyer Conference (2nd floor), Alumni House

Business

It seems that researchers have reached an agreement that corruption is detrimental for country development. However, there is no consensus on what is the ideal candidate for a president post. For instance, in American history incumbents varied from those with no graduate degree (William Henry Harrison, Abraham Lincoln, Harry S. Truman) to those with degrees in different fields (e.g. law school, Business school). Woodrow Wilson was the only person who earned PHD. At the same time, it seems that education can be a predictor of the success of the president or lower level governor. In addition to knowledge, education teaches a person academic ethics and the wish to prefer long run benefits to short term ones (Abalkina 2020, Ravanilla 2016). It can be crucial for involvement of a person in office into corruption. Thus, I can use level of corruption as a proxy for the quality of the governor. My research asks how education influences the involvement of governor in corruption? This effect depends on the number of factors. According to (Abalkina 2020, governors with plagiarized PHD dissertations aren't subject to this effect of an education as a constraint on corruption. (I'll exclude these



governors from my sample.) Besides, if country's education system is corrupt the education has positive effect of corruption (Kaffenberger, 2012). It means I should control for the country where education was acquired by governor. My results can help in implementing anticorruption policies and policies of electing officials. The concern that voters rely on education when electing an official while education plays minor role in governor's success was expressed by (Freier, 2016). I'm exploring what insentives make officials reframe from corruptions. Whether these insentives are formed by education or by some laws and punishments for corrupted official. Even if the country has invented the best laws, and system of checks and ballances, there still exists a human factor that's why citizens would like to elect a governor who is not only competent but also responsible and honest.

## **Coming of Age: Young Investors and the Rise in Riskier Investments**

### **Kacey Tollefson, University of Utah**

Faculty Mentor Nathan Seegert, University of Utah

SESSION A 9:40-9:55AM

Boyer Conference (2nd floor), Alumni House

Business

As our society has progressed and evolved with technology, an increasing number of individuals have access to security exchange markets than ever before. Low commission trading costs coupled with social media trends have led to much higher participation from young investors, more especially those who may not know about the risks of investing. As the composition

of participants in the investment sphere skews young, the quality of investments being made can be called into question. Currently, young investors have the largest economic power than any other preceding generation due to higher earnings, larger savings accounts, and earlier participation in security trading. While market participation has grown, 60% of Millennial and Gen Z investors are also turning to alternative investment forms as a means of wealth creation. According to Motley Fool, 91% of Gen Z have used social media as a credible information source when making investments. Evident in the GameStop boom of 2021, social media has a significant impact on their financial decision-making behavior. My current research incorporates changes in investor demographics coupled with the quality of investments being made. This includes analyzing social media movements and just how impactful influencers, whether of an educated background or not, are encouraging people to take on high risks. Credible sources include my own analytical research comparing stock prices with social media trends, a survey of University of Utah students and their risk preferences/social media usage, and incorporation of peer-reviewed research by financial analyst professionals. In this analysis, I am challenging the assumption that uneducated, riskier investments are being made by Gen Z/newer generations because of 'get rich quick' trends and movements on social media. I believe risk tolerances have changed and up-and-coming investors will carry a large impact on market

**Education. Session**

**A - Poster**

**Presentations,**

**Ballroom, Union**

**Location: Ballroom, A. Ray Olpin University  
Union**

# **What Should the Main Roles of Public Elementary Education Be? An Exploratory Study Based on Survey Responses of Teachers During the Pandemic**

**Tessa Cahoon, University of Utah**

Faculty Mentor: Mary Burbank, University of Utah

SESSION A (9:00-10:30AM)

POSTER A32

Education is an important value in American society. Public schools are expected to fill many spoken and unspoken roles in our society: teaching academics, preparing students for the workforce, fostering engaged citizens, creating equity, and serving as community and daycare centers, to name just a few. The COVID-19 pandemic heightened the public's focus on education and magnified cracks and inequalities present in our educational system. During the pandemic, teachers were forced to constantly reassess their teaching priorities and adapt their teaching strategies and goals, all while dealing with the extra challenges (both personal and public) of the pandemic. The present study prompted an examination on the purpose of public schools, focusing on teachers' valuable perspectives. The central question guiding this research is: What should the main roles of public elementary schools be in our society? In order to address this question, an online survey was sent out to educators in seven elementary schools in City View District (a pseudonym). The survey's open-ended questions were analyzed quantitatively by grouping responses into themes and categories, and the survey's close-ended questions were analyzed using descriptive statistics. Seven teaching

expectations were listed in the survey based on the 2013 Interstate New Teaching Assessment and Support Consortium (InTASC) and Utah Effective Teaching standards (UETS). These expectations focused on covering the content in the Utah Core Standards; adapting/updating teaching instruction; using culturally responsive instruction; meeting students' individual needs; building relationships with students; collaborating with families, colleagues, and other professionals; and maintaining physical safety. While the majority of teachers (76%) felt that the seven educational priorities were realistic during an average school year, the majority of teachers (72%) felt that these expectations were not realistic during the 2020-21 school year. The results indicate that teachers' highest priority is building strong relationships with students, and they are most likely to be successful at meeting this goal. The pandemic made it more difficult for teachers to meet all expectations, especially meeting the individual needs of all students, which was a challenge before the pandemic. Teachers also expressed the need for mental health support, both for students and for themselves, and overall, they felt they needed more support to be able to meet the many expectations placed before them.

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## **Evaluating the Efficacy of Asynchronous and Synchronous Problem-Solving Teleconsultation with Teacher who Serve Rural Students with Disabilities Kenzie Fleming, University of Utah**

Faculty Mentor: Aaron Fischer, University of Utah

SESSION A (9:00-10:30AM)

POSTER A33

Special education services are available to help children who are classified with disabilities including Autism, Intellectual Disability, and Developmental Disability. This includes one-on-one support to allow teachers to focus on individual needs of their students. To help better serve students and teachers, implementing teleconsultations via asynchronous and synchronous communication into the curriculum can be beneficial. This includes videoconferencing, animated software such as Vyond, and other types of online feedback.

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## **Frameworks for Social Justice Education in Montessori Classrooms: Educator Perceptions and Implementation Madeleine Kelly, University of Utah**

Faculty Mentor: Mary Burbank, University of Utah

## SESSION A (9:00-10:30AM)

## POSTER A34

As American schools continue to diversify, issues of equity remain unresolved and disparities between different racial and cultural groups have become more pronounced (Paris, 2012). Key components of the Montessori Method seem to align with aspects of a Social Justice Education (SJE) framework. These features include an emphasis on autonomy, high expectations, individualized learning, and a focus on interconnectedness (Montessori, 1912; Lillard et al., 2021). Both frameworks have numerous benefits for diverse students, including improved academic performance, higher self-esteem, and increased motivation (Culclasure et al., 2018; Graham & Hudley, 2005; Lillard et al., 2017). Frameworks for SJE also provide educators with practices and attitudes with which to better support and empower students from diverse backgrounds. However, Montessori classrooms still exhibit patterns of bias towards students from diverse backgrounds, indicating room for improvement (Brown & Steele, 2015). Data were collected using a mixed-methods survey with participants at two local Montessori schools. Findings indicate that Montessori educators from two urban elementary education programs agree with key features of SJE. In addition, they report they can and should implement SJE within the classroom, and that the Montessori framework aligns well with the practices and goals of frameworks for SJE.

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## **Middle school student-generated ideas about mathematics: definitions and utility**

## Alyssa Lee, University of Utah

Faculty Mentor: Tracy Dobie, University of Utah

SESSION A (9:00-10:30AM)

POSTER A35

Literature in educational psychology supports utility value, or perceived usefulness, as a core intrinsic motivator for learning. However, in mathematics students often struggle to perceive usefulness due to the common disconnect between content and context. There are several factors potentially contributing to this disconnect including story problems that do not connect to students' own lives, a lack of opportunities for students to form their own conceptions of math's usefulness, and emphasis on practicing math skills over applying math knowledge. Connecting content and context requires understanding what math content students include in their definitions of mathematics. How students define math may influence the types of math they are able to see in their own lives, and thus has the potential to limit or bolster connections between in-class math instruction and its applicability. Thus, I use this study to explore these questions: How do middle school students define mathematics? How do those definitions connect with or relate to their ideas of math utility? To answer these questions, interviews were conducted with 7th- and 8th-grade students attending an urban charter school in the Mountain West. Students were asked about their definitions of math; as well as when, where, and how it may be used. Student responses were coded and analyzed to consider potential connections between students' definitions of math and perceptions of its utility. Understanding this relationship is critical for teachers to improve math instruction by tapping into their students' intrinsic motivation for math learning.

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## **Best Practices for Undergraduate Research Journals to Support Student Researchers**

### **Eliana Massey, University of Utah**

Faculty Mentor: Annie Fukushima , University of Utah

SESSION A (9:00-10:30AM)

POSTER A36

In recent decades, undergraduate research has grown dramatically. As more undergraduate students participate in research, supportive structures have developed at universities across the United States. Hundreds of undergraduate research journals showcase and archive the work of student researchers. This presentation identifies and analyzes best practices for undergraduate research journals to support student researchers. To identify best practices, I performed a literature review of existing scholarship on the characteristics of successful undergraduate research journals. As reviewed the scholarship, I developed inductive codes to represent trends in the qualitative data. I also engaged in participatory research by working with the University of Utah's Office of Undergraduate Research to redesign their undergraduate research journal. This presentation succinctly demonstrates best practices based on previous scholarship and suggests areas for future research and experimentation.

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## **How do Students Describe their Social**

## **Belonging in General Chemistry: A Qualitative Study**

### **Olivia Schmitz, University of Utah**

Faculty Mentor: Gina Frey, University of Utah

SESSION A (9:00-10:30AM)

POSTER A37

This study focuses on the factors that students use to describe their feeling of social belonging in General Chemistry 1, specifically the factors they use to describe their level of comfort with their instructors in the classroom. Previous studies conducted by the Frey group conclude that students' social belonging affects persistence and academic success in general chemistry and physics 1 at the University of Utah. The aforementioned studies have also characterized two important components of social belonging: sense of social belonging and the belonging uncertainty. A sense of social belonging in the context of a college course is the perception of an individual's connectedness with people such as peers and instructors and the significance of course environment in fostering inclusivity. An important aspect of course-level sense of belonging is the amount of comfort that students have with their instructors. While recent quantitative studies show that social belonging affects student performance and retention in introductory STEM courses, there are very few studies that ask students what factors they consider when describing their belonging in these courses. In this current study, student responses from General Chemistry 1 about their comfort level with their instructors were analyzed to generate a codebook that contains nine remote and non-remote categories: Flexible and Amiable, Communicative and Organized, Human Aspect of Teaching,

Perception of Instructor Knowledge, Perception of Instructor Teaching Practices, Perception of a Growth Mindset Culture, Identity, Non-Specific, and Non-Codable. In this presentation, I will present these categories with their definitions and representative quotes compiled from student responses. I will also discuss the implications for instructors to improve the inclusivity of their STEM courses, and the next steps for this project.

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## **Cognitive learning differences between sexes in organic chemistry**

**Derek Baker, Southern Utah University**

**Jacob Mcarthur, Southern Utah University**

**Lauren Jensen, Southern Utah University**

**Cassidy Wilkes, Southern Utah University**

**Seunghwan Shin, Southern Utah University**

Faculty Mentor: Guizella Rocabado, Southern Utah University

SESSION A (9:00-10:30AM)

POSTER A38

Differences in sexes have long been speculated, yet their application in chemistry learning environments has not been well researched. Literature shows that males have larger cerebral volumes for visual capacities more often associated with hands-on projects and courses than female brains. And female brains have larger cerebral volumes for areas associated

with memorization and socialization which more highly correlate with lecture-based learning. Given the high attrition of women in chemistry courses, we investigated this phenomenon in organic chemistry topics that are highly visual (e.g. chirality, Newman projections, chair conformations, bond rotations, etc.) and topics that require more memorization (e.g., functional groups, energy values associated with sterics, nomenclature, definitions, etc.). We conducted an anonymous survey with students who are currently enrolled in organic chemistry or have taken organic chemistry in the past. The questions varied in difficulty as well as levels of visualization or memorization required. The results show correlation with the literature that males score better in the visual-based questions, and females score better in the memorization-based questions. With these results, we have designed course interventions to bridge the gaps between the extremes of visualization vs. memorization-based concepts for the students.

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## **Perceived costs in organic chemistry and their relationship to course performance**

**Cassidy Wilkes, Southern Utah University**

**Derek Baker, Southern Utah University**

**Jacob Mcarthur, Southern Utah University**

**Lauren Jensen, Southern Utah University**

**Seunghwan Shin, Southern Utah University**

Faculty Mentor: Guizella Rocabado, Southern Utah University

SESSION A (9:00-10:30AM)

POSTER A39

Organic chemistry is one of the most feared and failed courses in the undergraduate curriculum. Consequently, studying what makes this course “too difficult” as perceived by students is worthwhile because these perceptions result in many students not considering STEM majors because they require chemistry courses. Our research group has investigated perceived costs in general chemistry, and this study expands our understanding of these constructs in organic chemistry. Students’ perceived costs of a chemistry class can be many, such as task effort, loss of valued alternatives, emotional, and others. These costs might be overcome by students’ interests and goals, yet the level of perceived costs might have a lasting impact on the students’ overall perception of chemistry and their desire to pursue chemistry and other STEM careers in the future. In this mixed methods study we investigated the mentioned subclasses of perceived costs, other salient perceived costs, and mastery or performance goal orientations and the impact these constructs may have on achievement

in organic chemistry classrooms. Utilizing cluster analysis as well as student interviews, we investigated students' profile of perceived cost and goal orientation as it relates to their final grades. Our results show some similarities in the student profiles we have found in general chemistry and also some distinct differences unique to the reputation of organic chemistry. Other interesting results have also emerged from this research, which have the potential to have an impact on future instruction of these courses.

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## **Unleashing the Power of USB Keystroke Injection: A Study on Cybersecurity Implications Christopher Wilkinson , Utah Valley University**

Faculty Mentor: Sayeed Sajal, Utah Valley University

SESSION A (9:00-10:30AM)

POSTER A40

One of the most important elements a technology user in this day and age is to know of the cybersecurity threats your particular system faces which is especially relevant to both those who program devices, as well as those physically designing them. Technology users should educate themselves on potential threats and vulnerabilities that exist in their code or products, how to defend and protect themselves, and how to respond after an event has occurred. After working with

the Utah Valley University Cybersecurity Club I have come to realize how important it is to protect and defend the physical hardware infrastructure. This research paper holistically examines USB-based Keypress Injection Attacks in the following three parts: One, the increasing availability, accessibility, and use of USB-based Keypress Injection Attacks, two, what can be done to prevent a USB-based Keypress Injection Attacks on personal devices, and lastly, the increasing availability of the hardware and tools necessary to the general public to perform these attacks. The USB-based Keypress Injection Attacks will be broken into two categories. The first are scripts that only run when the hardware is attached. The second category will focus on persistent attacks that stay on the victims device. My primary goal of this paper is to examine and discuss the results from writing and running ten unique scripts from my very own Hak5 USB Rubber Ducky and related USB-based Keypress Injection Attack hardware. Having educated myself on the ever increasing reality of USB-based Keypress Injection Attacks I will be able to better protect myself and educate others on preventative measures, what signs of a potential threat could look like, and how to get started yourself.

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**Diagnostic Accuracy of Nonword  
Repetition in Dual Language Learners  
Elizabeth Hunt, Brigham Young University  
Carolyn Ferguson, Brigham Young  
University**

## **Mark Lambeth, Brigham Young University**

Faculty Mentor: Connie Summers, Brigham Young University  
SESSION A (9:00-10:30AM)

### **POSTER A41**

Traditional language assessment measures for dual language learners (DLLs) can be biased. Nonword repetition (NWR) shows potential for being a less-biased measure of language ability. The purpose of this research was to establish guidelines for the use of NWR in clinical settings. Diagnostic accuracy and optimal cut-off scores for NWR tasks inform these guidelines. Participants included 100 Spanish-English DLLs from elementary schools in the Mountain West region. All participants were between the ages of 5 and 8 with Spanish reported as the home language. Participants included typically developing children (TD) and children with language disorder (DLD). NWR tasks were administered to all participants in both English and Spanish within classroom settings. Nonwords were scored according to the number of percent phonemes correct (PPC). Preliminary results showed that the NWR tasks were accurate in differentiating language disorder in DLL children with English PPC and Spanish PPC scores both presenting sufficient sensitivity and specificity. Spanish NWR tasks yielded higher scores for TD and DLD participants alike, when compared with English NWR scores. Appropriate cut-off scores were calculated to ensure the most accurate sensitivity and specificity for every task, as well as every combination of tasks. These findings indicate that NWR tasks are useful clinical assessment tools to evaluate language abilities in DLLs.

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## **Workbook style learning integrated into the classroom**

**Willow Park, Southern Utah University**

**Caysen Crum, Southern Utah University**

Faculty Mentor: Caleb Hiller, Southern Utah University

SESSION A (9:00-10:30AM)

POSTER A42

Work-book style learning has been a popular approach among primary and secondary schooling. It is well known that the transition between high-school and college may be a difficult transition. The intended purpose of this study is to directly access work-book learning in a professional classroom. Throughout our analysis we aim to quantify our data by determining if it is more effective providing them a) before class, b) in class, or c) after class. After coming to a conclusion we aim to provide a better learning experience in the classroom, along with a retention of the information. We want students to feel secure in their education and take their knowledge beyond the classroom.

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# **Evaluation of Automated Transcription for Language Sample Analysis: The Impact of Accent on Word Error Rates**

## **Haven Broadhurst, Utah State University**

Faculty Mentor: Sandra Gillam, Utah State University

SESSION A (9:00-10:30AM)

POSTER A43

Language sample analysis is considered a gold-standard procedure when assessing language disorders. It is an unbiased, reliable way to provide information regarding an individual's language abilities. Although Speech Language Pathologists would consider it a critical part of the assessment, the procedure can be very time-consuming. Recently, research evaluating the clinical application of automatic speech recognition software (ASR), Google Cloud Speech (GCS), for the purpose of transcription has been conducted on monolingual English-speaking children. The current study expanded upon these findings, by assessing the use of GCS with bilingual Spanish-speaking children, to examine the effect accented speech has on ASR transcription accuracy. To do this, audio samples elicited from school-aged bilingual children were transcribed with GCS and then evaluated for accuracy. 54 oral narrative samples elicited from Spanish-speaking bilingual children between the ages of 6;0-10;11 were transcribed by hand, and automatically, using Google Cloud Speech (GCS). A weighted word-error rate was used to calculate the minimum edit distance between the gold-standard transcripts and those transcribed with GCS, as a measure of transcription error. On average, the weighted word-error rate was 0.38 (SD = 0.15),

meaning that 38% of words were incorrectly transcribed. The range of error rates was quite large. A follow-up analysis was conducted to determine whether there were significant differences in the transcription error of audio files elicited from children with perceived accents and those without. Results of the analysis indicated that there was not a statistically significant difference in transcription error for accented ( $M = 0.37$ ,  $SD = 0.08$ ) and non-accented ( $M = 0.39$ ,  $SD = 0.19$ ) audio samples controlling for age and gender of the narrator. The implications of these findings are that GCS may be a useful tool for SLPs to use in assessment of accented language.

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## **Most Useful Study Practices Used by Students in Human Anatomy: Does it Vary by Grade?**

**Cassidy Chamberlain, Southern Utah  
University**

Faculty Mentor: Jennifer Mraz-Craig, Southern Utah University

SESSION A (9:00-10:30AM)

POSTER A44

Human Anatomy is a challenging, rigorous course and students often struggle with finding the most useful study practices to use. During 2019-2022, Human Anatomy students completed an end-of-semester questionnaire on the study practices they found to be most useful in the course. The responses from the students that received a final grade of A

and A- in the class versus C- or below were ranked based on percentage for comparison. Preliminary data analysis is still ongoing. This information can be used for future Human Anatomy students as a way to determine more successful study practices, as well as a guide for instructors on what type of study material student's find most helpful.

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## **Student Views of Science Ideas: From Evolution to Vaccines???**

**Jon Lund, Utah Valley University**

Faculty Mentor: Heath Ogden, Utah Valley University

SESSION A (9:00-10:30AM)

POSTER A45

Controversy and skepticism have often followed the discovery of scientific theories. We investigated the acceptance of important scientific topics. Focusing on four foundational topics in biology: evolution (human and non-human), the age of the earth, climate change, and vaccination safety. We sought to understand what percent of Utah Valley University (UVU) students disagreed with well-known and understood scientific discoveries. We used quantitative questions in an anonymous survey to ask and find out the acceptance of these topics among UVU students. At the beginning of the 2022 Fall semester, a survey was administered by 7 instructors across 13 sections to 1268 students in BIOL 1010. BIOL 1010 represents the general student population because it is a required class for all degree-seeking students. This survey consisted of 22 questions

addressing views of scientific ideas. The data was analyzed using R studio. The results can help provide a greater foundational understanding of incoming viewpoints. This understanding is crucial to help us learn what topics require more focus in science education.

**Engineering.  
Session A - Oral  
Presentations,  
Henriksen, Alumni  
House**

**SESSION A (9:00-10:30AM)**

**Location: Henriksen Room, Alumni House**

# Synthesis and Characterization of Clickable Polyproline Based Materials

Clara Coffey, University of Utah

Faculty Mentor Dr. Jessica Kramer, University of Utah

SESSION A 9:00-9:15AM

Henriksen Room (1st floor), Alumni House

Engineering

Mucus, collagen, and proteoglycans serve crucial roles in the human body, yet current research on these structures is limited. Mucus is the interface and first line of defense to the world around us; it lubricates and hydrates epithelial surfaces, houses the microbiome, and allows for the diffusion of drugs and nutrients while trapping pathogens by acting as a selectively permeable membrane. Mucus is a hydrogel made primarily of water and ions and is 5-9wt% glycoproteins, known as mucins. These mucins are characterized by high molecular weight repeat domains rich in proline and O-glycosylated serine and threonine (PTS domains). Proline, an amino acid contributing to the rigidity of proteins, possesses unique properties in mucus, collagen, and proteoglycans. Despite polyproline-based materials having additional applications including surface coatings, hydrogels, antithrombotics, as ordered materials, and in probing protein structure, current mucin research is limited to reconstituted mucins, often from intestinal scrapings of farm animals. These glycoproteins vary greatly between samples in both structure and chemistry due to inherent heterogeneity in mucins between species, tissues, and pathologies. In response, we have synthesized the building blocks of proline-based mucin, collagen, and proteoglycan mimics working towards allowing

for the modeling of mucins and mucus, structure-function relationships, related diseases, and novel lubricating therapeutics. Through N-carboxyanhydride polymerization, we have synthesized three proline analog polypeptides. These analogs support the exploration of simpler materials to create a synthetic PTS domain and capture hydrophilic PPII structure. Our findings will be advantageous in next steps exploring azide-alkyne cycloaddition “click” reactions of these proline analogs with sugars in exploring structure-function relationships, the contributions of individual amino acid residues, and sugar and glycan patterns in mucin function.

## Electromyography Controlled Robotic Leg Prosthesis for Individuals with Above/Knee Amputations

Suzi Creveling, University of Utah

Faculty Mentor Tommaso Lenzi, University of Utah

SESSION A 9:20-9:35AM

Henriksen Room (1st floor), Alumni House

Engineering

Every 5 minutes, a person in the U.S. loses their ability to move due to a lower limb amputation. Even the best available prostheses cannot move like biological legs, lacking the ability to actively generate movements and provide power during gait. Due to these limitations, even performing simple activities like walking and climbing stairs become very challenging for individuals with amputation. Emerging robotic leg prostheses



have the potential to address these limitations. By using motors, batteries, and controls, robotic prostheses have the potential to move similarly to biological legs. However, available robotic leg prostheses controllers perform prerecorded movements that are disconnected from the user's intentions to move. Therefore, amputees have no voluntary control of their prosthetic leg. The goal of my undergraduate research is to connect the human neural systems with robotic leg prostheses to give amputees voluntary control. To accomplish this goal, I propose using non-invasive, surface electromyography, the measurement of muscle activations. Using electromyography, I can measure the muscle activations in the residual limb, the remaining part of the leg after amputation. These muscle contractions encode the user's intention to move the missing lower limb. For example, a contraction of the residual quadriceps, when the foot is off the ground, encodes the intention of the user to swing the leg forward. Based on this idea, I developed a neural controller that allows robotic prostheses to perform movements intended by the user. I tested this controller with three individuals with an above-knee amputation. The test included daily activities like walking and climbing stairs using the robotic leg prosthesis. The proposed neural controller enabled the users to walk, climb up and down stairs, stand up and sit down by controlling the prosthesis movements with their muscle contractions. This study provides new evidence that voluntary control of lower limb prosthetics is possible. Electromyography and neural control have the potential to revolutionize the field of prosthetics by giving amputees voluntary control of their prostheses.

## Modeling Coupled Thermomechanical Systems for Refill Friction Stir Spot Welding (RFSSW)

Jacob Hansen, Brigham Young University

Faculty Mentor Yuri Hovanski, Brigham Young University

SESSION A 9:40-9:55AM

Henriksen Room (1st floor), Alumni House

Engineering

Refill Friction Stir Spot Welding (RFSSW) as a novel joining technique has the ability to open the door to allow for the joining of materials previously thought difficult or impossible to join by conventional processes. RFSSW incorporates the friction welding physics of traditional linear friction stir welding and has already proven very effective in joining aluminum and similar materials. In recent years much of the development has been funded by aerospace and automotive industries. However, studies regarding the thermomechanical outcomes of RFSSW are very limited in both quantity and scope. Previous studies have investigated thermal and mechanical models separately; however, the majority of these studies were within the scope of Linear Friction Stir Welding (FSW). Further research into the thermomechanical characteristics are critical to the development of RFSSW. This research seeks to improve the feasibility by which to digitally model, and predict the thermomechanical characteristics created during the RFSSW process. This research utilized Finite Element Analysis (FEA) to help realize its objective. The objective of the investigation was to develop realistic predictive models for RFSSW on Aluminum lap joints. Several models, iterations, and weld orders were developed. Models were validated in part by previous work done by Wichita State

University. Accurate thermal models were developed and the mechanical models developed (while not numerically accurate) were accurate when comparing distortion caused by different welds orders. This indicates that with further development and research fully articulate predictive models could be developed. This would greatly advance the field RFSSW as experiments could be realized digitally before moving to the physical stage, saving time, money, and resources.

## User-Friendly Music Theory Application for Education and Analysis

Anita Riddle, Salt Lake Community College

Sierra Schmidt, Salt Lake Community College

Faculty Mentor Nick Safai, Salt Lake Community College

SESSION A 10:00-10:15AM

Henriksen Room (1st floor), Alumni House

Undergraduate students invented, built, and implemented a user-friendly computer and mobile phone tool that accelerates music education and analysis. A key enabler was collaboration among first- and second-year community college students of music and engineering. This is one of two unrelated projects by this undergraduate student research group. While in the classroom, a music student contrived the idea for the tool. The student reached out to engineering students with skills to program logic into a spreadsheet. The tool is used by students with positive reviews. Tonal music comprises the musical keys, scales, and chords used most since the 1600's. Tonal music is complex and highly mathematical. Understanding music

theory takes several semesters. Music analysis is time consuming. This user-friendly tool reduces the information that must be looked up in textbooks or committed to memory. SLCC music theory course material provided the data and numerical relationships for each musical key. Researchers input the relationships into mathematical databases and programmed handy look-up tables. Attractive features include:

- (1) Tonal Music Guide: User types in the musical key; tool provides chords, notes, and typical chord sequences.
- (2) Diatonic Post-Tonal Music Guide: User types in the name of collection. Tool offers proper ordering of notes in ionian, dorian, phrygian, lydian, mixolydian, aeolian, & locrian modes.
- (3) Octatonic and Hexatonic Music Guide: User reads notes off the provided charts.
- (4) Twelve Note Serialism Guide: User applies the tool to create a 12×12 matrix that offers proper note order.

Online research generated several music theory applications. However, none were free nor as focused for music theory academic studies nor for music analysis. Link to User-Friendly Music Theory tool: <https://docs.google.com/spreadsheets/d/1EQ05ppdQU9bpME3OvFgRv7tuBa4JB0R/edit#gid=281206229>

**Education. Session**  
**A - Oral**  
**Presentations,**  
**Conference Room,**  
**Sill Center**

**SESSION A (9AM – 10:30AM)**  
**Location: Conference Room, Sill Center**

The Secondary School Writing Center  
University Partnership  
Braden Slater, Brigham Young University

## Quinn Blackley, Brigham Young University

Faculty Mentor Amber Jensen, Brigham Young University

SESSION A 10:00-10:15AM

Sill Center

Education

As writing tutors from BYU's Research and Writing Center (RWC) and preservice English teachers, we wanted to leverage our unique experiences as tutors and future teachers to build sustainable secondary school writing centers in Utah. We understand the benefit that peer tutoring is to all participating students, and we were disappointed to learn that very few writing centers exist in Utah secondary schools. Mentored by an English education professor and the director of the RWC, we proposed a project guided by our primary research question: How can universities partner with secondary schools to build and sustain peer writing centers? We wanted to know how we could support teacher-directors, develop training for new tutors, and work together as a partnership that benefits participants at both secondary and postsecondary institutions. Following the principles of participatory action research, we formed a partnership with teachers, administrators, and student tutors at Provo High School, which introduced a writing center course for students just this year. In this project, we are both researchers and participants, working together with our partners to identify the context-specific needs of this emerging writing center and to develop resources as necessary. Using action, research, and reflection, we and our school-based partners work together to build a program that can be sustainable and potentially replicable in other secondary settings. So far, our actions have included preparing and delivering tutor trainings and sharing additional resources to

begin and sustain a new writing center. We have used student and teacher-director feedback to inform our lesson-planning decisions and to improve the quality of our trainings. Our learning from designing and enacting the original project grew into the Secondary School Writing Center University Partnership (SSWCUP), a model we hope will enable future collaborations. SSWCUP aims to not only foster a relationship between the BYU RWC and secondary schools in Utah Valley, but identifies and includes additional participants invested in peer collaborative learning, which is foundational to writing center work. Our partnership is modeled after the one implemented by Deans and Courtmanche at the University of Connecticut. But rather than being a partnership totally dependent upon the university, as the UCONN model is, we wanted members of our partnership to be in connection with and support of each other to ensure equal participation and sustainability. Our network of partners includes the BYU English Teaching program, the Secondary School Writing Centers Association, and The Journal of Peer Tutoring in Secondary Schools. By creating a network through which these organizations can interact, SSWCUP aims to build a collaborative community that supports, enriches, and expands writing center work. This network is a model that other universities, their local secondary schools, and other relevant writing organizations can adopt.

## Teaching & Learning Principles in the Pirkei Avot: A Jewish Educative Perspective

## Nicholas Bown, Brigham Young University

Faculty Mentor Isaac Calvert, Brigham Young University

SESSION A 9:20-9:35AM

Sill Center

Education

This article outlines the principles of teaching and learning found within the Pirkei Avot (פרקי אבות), a primary sacred text within Mishnaic Jewish textual tradition. This project seeks to contribute to a growing scholarly conversation about educative principles from the perspective of various cross-cultural and multifaith traditions around the world. In other words, seeing that there are educative perspectives which have been largely under-researched among contemporary educationalists because of their origins in sacred texts, we seek to bring some of these perspectives (in this case, those within the Pirkei Avot) into the conversation based on the assumption that they may be of philosophical, historical and practical value in contexts outside those of confessional religious education. In order to identify the salient teaching and learning principles found within the Pirkei Avot, we did a qualitative textual analysis of an English translation while consulting with the original Hebrew text. We began with a preliminary analysis of the text and created an initial list of salient passages thematically related to educative principles (e.g., teaching, learning, etc.). We then conducted secondary and tertiary analyses that further honed these salient themes into six core principles. These include orality as a sacred mode of instruction, diligence as essential to a student's character and practice, reverence as a core dimension of the student-teacher relationship, the need to act in accordance with one's knowledge, the importance of an ethic of care in pursuit of knowledge, and that learning



with others is essentially more efficacious than learning alone. It is our hope that these principles will add further context to and perhaps come to more deeply inform contemporary perspectives not only regarding the history and philosophy of education, but concerning current practices of teaching and learning, as well.

## The Impact of Nevada's "Read By Grade 3" Legislation on Student Performance Cody Dirks, Southern Utah University

Faculty Mentor Joshua Price, Southern Utah University

SESSION A 9:40-9:55AM

Sill Center

Education

In 2015, Nevada adopted a statewide systems aimed at accelerating reading proficiency in students who are k-3. Students who were in kindergarten are now of the age to take their high school reading proficiencies to graduate high school. Did this legalization actually aid students, or did it have a negative impact on their reading scores.

## Investigating Student Engagement Patterns in First-Year Engineering Research Cohorts

## Summer Stevens, University of Utah

Faculty Mentor Doug Schmucker, University of Utah

SESSION A 10:00-10:15AM

Sill Center

Education

Across the academic world, countless universities have implemented first-year experience programs in order to improve student GPA and second-year retention. Backed by research-supported learning communities, freshman seminars, and one-on-one faculty mentorships, these programs focus on developing social and academic foundations for each student as they begin their academic careers. The University of Utah's College of Engineering implemented its own freshman program in the Fall of 2022 by welcoming its first cohort of Engineering Scholars. As the academic year progressed, however, faculty, advisors, and staff noticed a decrease in event attendance and response to emails across all departments. Through individual consultations with current Engineering Scholars, this study seeks to understand how these students' social and academic experiences in the program are affecting them, what the program is missing and doing well from the student's perspective, and what they expect to gain from a first-year program. By combining the results from these consultations with feedback from program managers, faculty advisors, and previous research, the researchers will create recommendations for future engineering first-year cohort initiatives that seek to better support research-oriented students in their freshman year.

**Health and  
Medicine. Session  
A - Poster  
Presentations,  
Ballroom, Union**

**SESSION A (9:00-10:30AM)**

**Location: Ballroom, A. Ray Olpin University  
Union**

**Isothiocyanates as NRF2 upregulators in  
the prevention of neural tube defects in  
chick embryos**

**Claire Bruno, Brigham Young University**

## **Cailey Winn, Brigham Young University**

## **Katrina Lantz, Brigham Young University**

Faculty Mentor: Michael Stark, Brigham Young University

SESSION A (9:00-10:30AM)

POSTER A66

Neural Tube Defects (NTDs)-anencephaly and spina bifida-remain a persistent problem across the globe, despite folic acid (FA) supplementation in many nations. NTDs rates in areas with insufficient FA supplementation are higher. In India the prevalence of NTDs is estimated at 4.5 per 1000 live births. In some rural areas, the prevalence peaked at 18 NTDs per 1000 live births. Recent studies suggest a role for oxidative stress in the pathogenesis of NTDs. Isopropyl isothiocyanate (IPI), active ingredient in the leaves/seeds of the Moringa tree (*Moringa oleifera*) is a known antidiabetic compound countering inflammation, an oxidative stress condition. It is known to activate NRF2 cofactor, an important regulator for oxidative stress. We hypothesize IPI will promote NRF2 activity in chick embryos and reduce chemically-induced oxidative stress to prevent the formation of NTDs. Because Moringa thrives along the equator where medical and nutritional access are historically poor, if shown to be effective, it may increase access to protection from developmental insults in places without FA supplementation programs. Using a cell viability assay in cultured cells, the optimum concentration of IPI was determined. Chick embryos were pretreated or cotreated with IPI 6 hours before plating on chemicals known to induce NTDs-ceramide or valproic acid (VPA)-and left for 24 hours. Embryos were then collected, scored for frequency of NTDs, and measured against control embryos pretreated with increasing

dosage of FA, which is known to rescue NTDs, and control embryos receiving no pretreatment. The redox state of the tissue was evaluated. NRF2 target gene expression analysis by quantitative PCR is planned. This project may advance the developmental biology field, ascertaining whether IPI effectively regulates NRF2 expression and oxidative stress, potentially preventing the pathogenesis of NTDs. Next steps include confirming results in the mammalian model to establish relevance to humans.

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## **Spinning Disk as a Novel Method for Isolation of Plasma Prior to Cell-free Ribonucleic Acid (cfRNA) Extraction and Utilization**

**Mae-Lynn Hutchinson, Brigham Young  
University**

Faculty Mentor: Bill Pitt, Brigham Young University

SESSION A (9:00-10:30AM)

POSTER A67

The utilization of cell-free ribonucleic acids (cfRNA), such as found in a liquid biopsy, has revolutionized the early detection and monitoring of some health conditions. Such conditions include pregnancy complications, viral infections, and cancer. cfRNA is typically isolated through a rapid centrifugation procedure; however, the use of an inexpensive spinning disk

has been considered in some locations and applications. Briefly, this approach involves applying a centrifugal field to a hollow spinning disk to remove cellular material, with RNA remaining, from the blood sample in ~2 minutes. To examine the effectiveness of these two methods, blood was collected from healthy donors into pairs of Streck RNA Complete BCT tubes. Sample hematocrit was measured and samples were diluted with phosphate buffered saline (PBS) to a consistent hematocrit of 32. From each pair of samples, one control sample underwent the standard centrifugation process, while the other sample underwent the spinning disk procedure to collect plasma. Plasma hemolysis was evaluated using spectrophotometry according to the Harboe method with the Allen correction prior to cfRNA isolation. Following cfRNA isolation, qRT-PCR of the GAPDH and beta-actin transcripts was performed to evaluate quality and quantity of the cfRNA recovered by each method. We found that cfRNA yield from the centrifugation and the spinning disk methods did not differ significantly ( $p = 0.077$ ), though there was significantly more hemolysis in the plasma from the spinning disk method ( $p = 0.004$ ). Our findings suggest that the spinning disk could expand possibilities for rapid, effective, high-quality treatment and monitoring of patients living in areas where a full-size high speed centrifuge is not accessible since the disk is much smaller and cheaper than other platforms.

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## **Role of LRP1ab Receptor In Microglia**

## **Inflammatory and Phagocytosis Response**

### **Aasutosh Acharya, University of Utah**

Faculty Mentor: Peter Hitchcock, Other: High School

SESSION A (9:00-10:30AM)

POSTER A68

Unlike mammals, zebrafish have the ability to regenerate their central nervous system. We study the regeneration process that takes place in zebrafish retinas after their photoreceptors have been damaged. This regeneration requires an inflammatory response, mediated cells called microglia. Midkine-a is a cytokine required for microglia to phagocytose dying photoreceptors, a key step in regulating inflammation. In the absence of midkine-a, microglial phagocytosis fails. This project tested the hypothesis that the putative midkine-a and microglia-specific receptor, Lrp1ab, is also required for the microglial phagocytosis of dying photoreceptors. After creating a photoreceptor lesion in a Lrp1ab mutant (-/-) fish, we investigate how the microglia phagocytosis process is affected without the presence of the Lrp1ab receptor by staining for microglia. To study the effect even further, we go beyond just microglia and also stain for proliferating cells. The results of the staining revealed the nature of microglia and proliferation cells, however, some unexpected changes to the morphology of the microglia were also observed.

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## **Establishing Baseline Numbers for**

## **Isometric Back Muscle Endurance in the Dance Population**

**Megan Brooks, University of Utah**

Faculty Mentor: Justin Rigby, University of Utah

SESSION A (9:00-10:30AM)

POSTER 69

Context: Medical providers can better recognize and treat injuries caused by deviation, such as back pain when normative and baseline values are known. Dancers are often a forgotten population. Researchers have yet to determine dancers' normative back and core muscle endurance values. Study Purpose: This study aims to 1) fill a gap and collect normative and baseline values after four trunk muscle endurance tests and 2) determine if the normative values differ between dancers with a history of back pain. Hypothesis: I hypothesized that the dance population's normative values for trunk muscle endurance tests would differ from those for other athletes. I also hypothesized that dancers with back pain would have lower endurance times. Methods: We tested university dance majoring students using McGill's Torso Muscular Endurance Test. We applied McGill's test according to standard procedures. We measured the amount of time, in seconds, dancers could hold four different positions (trunk extension, trunk flexion, and right and left side plank). We used descriptive statistics to create normative values for our dance population and compared the results to existing other athletic populations' research literature. Results: Dancers could hold the back extension position the longest ( $188.2 \pm 64.7$  s), followed by trunk flexion ( $124.8 \pm 79.2$  s), right side plank ( $82.9 \pm 31.9$  s), and left side plank ( $80.2 \pm 20.1$  s). When the data



was separated into dancers with a history of lower back pain and dancers with no history, those with a history of pain had slightly lower normative averages. Conclusion: Dancers have higher extension endurance ability than other populations. Clinicians should consider normative trunk endurance values when treating dancers. They may appear to have normal levels of extension strength compared to other athletic populations but have decreased ability compared to dancer norms. Understanding dancers' trunk muscular abilities is vital to treating them effectively.

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## **Lower Limb Kinematics and Kinetics Associated with Walking in Older Adults with End-Stage Hip Osteoarthritis Hunter Carlson, University of Utah**

Faculty Mentor: Jesse Christensen, University of Utah

SESSION A (9:00-10:30AM)

POSTER A70

Osteoarthritis is the most common joint disease in the world. [12] Its prevalence in the hip joint is observed to have dramatic adverse effects on the quality of life of aging adults and can contribute to more significant health issues. [1] Hip osteoarthritis (HOA) reflects a breakdown in hip mechanics, muscle strength, and decreased biomechanics. [4, 8] The purpose of this study is to compare the relationship between deficits in hip mechanics of the frontal (primary) and sagittal

(secondary) planes onto physical function, using validated physical performance and muscle strength metrics in adults with HOA. We hypothesized that more significant deficits in the involved limb's hip mechanics (angle, moment, power) would be associated with poorer Two-Minute Walk Test and 30-Second Sit-to-Stand Test performance. We also hypothesized that more significant deficits in hip mechanics would be associated with greater hip abduction, knee extension, and knee flexion weakness of the involved limb. The data collection and processing have been assisted by Chelsea Wilbur and Bennet Browning. This study is still in progress; results and discussion will be added upon completion.

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## **Effects of Increasing Sleep Duration on CRP Levels, Insulin Sensitivity, and Blood Pressure in Adults with Habitual Insufficient Sleep**

**Alisha Chong, University of Utah**

Faculty Mentor: Christopher Depner, University of Utah

SESSION A (9:00-10:30AM)

POSTER A71

Insufficient sleep is highly prevalent in the adult population and often goes unaddressed during patient visits in health clinics. Previous studies demonstrate that receiving insufficient sleep is linked to an increased risk of other health issues like

type 2 diabetes and heart disease. However, the relationships and mechanisms underlying how sleep affects these health issues is not well known. Thus, the current study aims to investigate the impact of insufficient sleep on C-reactive protein (CRP) levels, insulin sensitivity, and blood pressure. CRP is an inflammatory marker which has been linked to a greater risk of cardiovascular events, and prior research has found conflicting information on whether insufficient sleep significantly affects CRP levels. Additionally, reduced insulin sensitivity is associated with type 2 diabetes, and both type 2 diabetes and high blood pressure may increase cardiovascular disease risk. Understanding how insufficient sleep affects insulin sensitivity as well as blood pressure and CRP levels may provide insight into the means by which insufficient sleep increases type 2 diabetes and cardiovascular disease risk. Data collection is ongoing with 12 participants completing the study to date. The study protocol consists of measuring CRP levels, insulin sensitivity, and blood pressure of healthy individuals aged 18-35 who chronically receive insufficient sleep (<6.5h). After baseline assessments, participants complete a 4-week intervention aiming to increase their sleep duration to the recommended 7 hours of sleep per night. Sleep duration throughout the study is monitored using an Actiwatch and sleep logs. Of the 12 participants who have completed the study, sleep duration was  $5.7 \pm 0.2$  ( $\pm$ SEM) hours at baseline and significantly increased ( $p < 0.001$ ) by  $\sim 38.4 \pm 5.4$  minutes during sleep extension. Further analyses of CRP, blood pressure, and insulin sensitivity data at baseline and at intervention will provide insight into how or whether increasing sleep duration can mitigate risk of diabetes and cardiovascular disease. The current hypothesis is that increasing sleep duration of people chronically receiving <6.5h of sleep per night will lower plasma

CRP levels, decrease blood pressure, and increase insulin sensitivity. A better understanding of how insufficient sleep increases risk of cardiometabolic disease could help inform interventions designed to prevent chronic diseases like diabetes and cardiovascular disease.

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## **Effects of Increasing Sleep Duration and Sleep Efficiency**

### **Hailee Fell, University of Utah**

Faculty Mentor: Christopher Depner, University of Utah

SESSION A (9:00-10:30AM)

POSTER A72

**Introduction:** Short sleep duration and reduced sleep efficiency are two dimensions of sleep health that are associated with adverse effects on overall health including mortality, coronary heart disease, hypertension, and diabetes. However, we have limited knowledge on the efficacy of interventions (sleep extension) to improve sleep and if improving sleep can mitigate these adverse health outcomes. In this research, we will define the effects of a sleep extension intervention on multiple dimensions of sleep health in people who report habitual short sleep duration. **Methods:** Data collection is still ongoing. To date, 12 healthy participants (8 male, 4 female), aged  $20.7 \pm 2.5$  y (mean $\pm$ SD), BMI  $21.8 \pm 2.3$  kg/m<sup>2</sup> with reported habitual short sleep duration (<6.5h per night) have completed the study. For the study protocol,

participants complete 2 weeks of baseline at-home monitoring followed by 4 weeks of sleep extension, where participants are asked to extend their time in bed to 8 hours per night. Sleep is measured by self-report sleep diaries and wrist-actigraphy. The dimensions of sleep health measured are sleep duration, timing (midpoint of sleep), efficiency (percent of sleep time out of total time in bed), and regularity (standard deviation of sleep duration during baseline and sleep extension segments).

Results: Sleep duration was  $5.7 \pm 0.2$  (mean  $\pm$  SEM) hours at baseline and significantly increased ( $p < 0.001$ ) by  $38.4 \pm 5.4$  (mean  $\pm$  SEM) minutes during sleep extension. Sleep midpoint was  $4:58 \text{ am} \pm 17$  minutes (mean  $\pm$  SEM) at baseline and shifted significantly earlier ( $p < 0.05$ ) to  $4:38 \text{ am} \pm 7$  minutes (mean  $\pm$  SEM) during sleep extension. No statistically significant differences were detected between baseline and sleep extension for sleep regularity and efficiency. Conclusion: Short average sleep duration and reduced sleep efficiency are linked to a range of health problems such as mortality, coronary heart disease, hypertension, and diabetes. Data show our sleep extension intervention where participants were asked to extend their nightly time in bed to 8 hours has the capacity to increase sleep duration and shift the timing of sleep earlier in the night. These changes are considered positive changes to sleep and future studies are needed to understand if these changes can lead to improved health outcomes. Our findings also show sleep extension did not influence sleep regularity or efficiency, and thus different interventions are likely needed that target these dimensions of sleep health. Support: NIH-UL1TR002538, NIH-K01HL145099, Colorado Clinical Translational Science Institute Pilot (CO-J-20-119), University of Utah Seed Grant-10060570, Margolis Foundation, LEAP Program.

## **The Effect of mild Traumatic Brain Injuries on Turning Smoothness**

**Cameron Jensen, University of Utah**

Faculty Mentor: Peter Fino, University of Utah

SESSION A (9:00-10:30AM)

POSTER A73

Purpose: Mild traumatic brain injuries (mTBIs; i.e. concussions) can impair a person's motor function, and lead to worse static balance than healthy individuals (Haran, 2016), and emerging research suggests that more dynamic tasks, such as turning, are particularly susceptible to the effects of mTBI (Fino, 2016, 2018a). While previous work has focused on speed and balance during turning (Fino, 2016, 2018a), the smoothness of a turn may also be important; the ability to perform pre-planned movements in a smooth, non-jerky manner is an important marker of a neurologically healthy motor control (Hogan, 2009). Smoothness is a relevant and valid way to quantify movement quality in people with impaired functional mobility, such as individuals with an mTBI, and it can be a good indicator of pathology (Beck, 2018; Pinto, 2019). As the effects of mTBI on the smoothness of turning remain unclear, this study sought to examine the acute and longitudinal effects of mTBI on movement smoothness during turning. We hypothesized that those with an mTBI would exhibit less smooth turns, and smoothness would improve as individuals recovered from their mTBI. Methods: As part of a larger IRB-approved protocol, 11 healthy controls and 10 mTBI subjects

walked around a turning course for 140 seconds after providing informed written consent. The turning course was made up of turns of varying angles. Participants completed three separate conditions: single-task, dual-task (turning while simultaneously counting down by 3's), and fast walking. Each subject was tested at an acute time point (within 2 weeks of receiving an mTBI) and then tested again three months later. Kinematic data was recorded from inertial measurement units (IMUs), and smoothness of axial rotation was quantified using log dimensionless jerk from the angular velocity data in the transverse (yaw) plane. Movements with less jerk are described as being smoother. For each of the three conditions, comparisons were made, in the form of t-tests, between the controls' two visits, between the mTBI subjects' two visits, and between the controls and mTBI subjects at each visit. Results: During the single task condition, participants with mTBI exhibited less smooth turns at the follow-up visit compared to the acute visit (Acute mean (SD): -30.18 (0.75) a.u.; Follow-up mean (SD): -30.73 (0.88) a.u. ;  $p=0.004$ ). No other significant results were found during the preliminary analysis. Conclusions : The decreased smoothness over time was the opposite of our hypothesis, but these results may indicate that people with mTBI prioritize smoothness initially to avoid provoking symptoms. Alternatively, smoother turns in those with acute mTBI may be due to slower turning speeds; future work will consider turning speed as a covariate to account for this potential confounding factor.

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## **Identification of 42 Potential Intestinal Oncogenes via a RNAi Screen Using Fruit Flies**

**Carter Niedert, University of Utah**

Faculty Mentor: Bruce Edgar, University of Utah

SESSION A (9:00-10:30AM)

POSTER A74

Colorectal cancer is the third most common cancer in the United States and the second leading cause of cancer related deaths. Cancer deaths occur due to the disruption of normal physiological processes caused by rapid and uncontrolled cell proliferation. Cell proliferation in cells is often triggered through cellular damage sensing pathways. A better understanding of these pathways could lead to cancer treatments that dampen these pathways and control cell proliferation. Cell proliferation occurs rapidly in the gut due to constant exposure to stressors from the external environment. Cells in the gut can sense damage caused by these stressors and trigger renewal of gut epithelial tissues via intestinal stem cell (ISC) proliferation. ISC Proliferation is generally thought to be regulated by the release of specific cytokines from neighboring cells. Some specific genes involved in the release of cytokines that cause ISC proliferation, such as gene p38, have only been recently discovered. There are many genes involved in damage sensing pathways in the intestines that remain unidentified.

The aim of this project was to identify which genes in the gut are responsible for sensing damage and activating cell proliferation. This was accomplished by performing RNAi gene knockdown on *Drosophila melanogaster*, stressing the midgut



via bacterial infection by *Pseudomonas entomophila* (P.e.) to increase cell proliferation, then dissecting and removing the midgut to analyze the effect gene knockdown had on cell proliferation. Of the 192 genes screened, knockdown of 59 genes led to increased cell proliferation and knockdown of 19 other genes led to decreased cell proliferation. Further studies targeting these genes of interest could lead to a deeper understanding of damage-sensing signaling pathways and to novel cancer treatments that can target specific genes.

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## **Role of CD8aa cells in Experimental Autoimmune Encephalomyelitis**

### **Annie Pugmire, University of Utah**

Faculty Mentor: Brian Evavold, University of Utah

SESSION A (9:00-10:30AM)

POSTER A75

Multiple sclerosis (MS) is a neurodegenerative disease which causes numbness, paralysis, pain and fatigue as a result of the body's immune system attacking the central nervous system (CNS). Diagnosis occurs between the ages of 20 and 50 and disproportionately affects women and people of Northern European descent. This disease affects approximately 2.8 million people worldwide, and even with treatment, shortens life expectancy by approximately seven years (Walton et al.). Many risk factors have been identified and immunotherapies developed, but no specific cure or definitive cause has been

found. The current immunotherapies used for MS target the entire immune system and can have significant immunocompromising side effects (Rafiee et al). To model MS and investigate the cells contributing to autoimmunity, we use the murine model, Experimental Autoimmune Encephalomyelitis (EAE). Per this model, following delivery of Myelin Oligodendrocyte Glycoprotein (MOG) 35-55 alongside an adjuvant, mice show the same demyelination found in MS and exhibit similar symptoms. In both MS and the EAE model, CD4 T cells have been implicated as major contributors of autoimmune disease. However, both CD8 and CD4 T cells are present in MS lesions (Konjevic et al). In this study, we look specifically at a type of CD8 T cell present in the CNS of mice induced with EAE. This T cell, CD8aa, expresses an alpha homodimer instead of the classical alpha-beta heterodimer present in conventional CD8 T cells. Proposed to have an inhibitory function, these CD8aa cells are only significantly present in sick mice. We show that CD8aa expression correlates with disease severity, that these cells have a central memory phenotype, and that their expression of NK like markers acts to dampen the autoimmune response during EAE. Investigation into these cells could have major implications for future treatment of MS, allowing the targeting of effector CD8 T cells while leaving the CD8aa cells intact.

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## **Understanding the Early Molecular Level Changes Associated with Radiation Treatment – A Preliminary RNA**

## Sequencing Study

### David Rou, University of Utah

Faculty Mentor: Sujee Jeyapalina, University of Utah

SESSION A (9:00-10:30AM)

POSTER A76

Affecting one in 8 women, breast cancer is the second most common cancer in women in the United States. In 2019, 42,280 deaths were reported as a result of breast cancer. The standard of care for treatment is surgical tumor excision with sentinel lymph node biopsy and adjuvant radiation therapy. Although this standard procedure significantly improved tumor-free survival rate, 10-12% of patient morbidity is reported due to radiation-induced tissue fibrosis (RIF). To date, very little is known about its etiologies. To bridge this knowledge gap, this study was designed to understand the differences in RNA expression between radiated and non-radiated breast tissues using RNA sequencing techniques and immunohistochemistry (IHC). Using the approved Institutional Review Board protocol (University of Utah: 00047788), those patients who elected to undergo a double mastectomy but only had radiation therapy to the affected single breast were recruited. Post-radiation therapy, tissue samples (skin, fibrous capsule, and muscle) were collected from both breasts, the total RNAs were extracted, and a complete sequencing study was performed. Post-processing, the differentially expressed genes (DEGs) were identified, and their abilities to over and under-translate the corresponding proteins were validated using IHC. The data did confirm the over- and under-translations of respective proteins. This pilot data clearly indicates the utilities of complete RNA sequencing in understanding the mechanisms of RIF.

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## **Examining the Role of Non-Canonical Wnt Signaling in Adrenal Homeostasis and Hyperplasia**

**Catherine Rousculp, University of Utah**

Faculty Mentor: Kaitlin Basham, University of Utah

SESSION A (9:00-10:30AM)

POSTER A77

The Wnt signaling pathway plays an essential role in development and tissue homeostasis and is aberrantly activated in many human cancers(1). There are two main Wnt signaling pathways, the canonical Wnt pathway, involving regulation of B-catenin, and the non-canonical Wnt pathway, which mediates signaling through other effector molecules. While canonical Wnt has been extensively researched, non-canonical Wnt remains relatively unexplored. ZNRF3, an E3 ubiquitin ligase, negatively regulates Wnt signaling and targets Frizzled (FZDs) receptors for degradation. Since FZDs can be in complex with co-receptors that mediate canonical (e.g., LRP5/6) or non-canonical Wnt (e.g., ROR1/ROR2, or RYK), ZNRF3 has the potential to regulate both pathways(2,3). To study ZNRF3 and non-canonical Wnt, we are using the adrenal gland as a model. Located above the kidneys, it produces hormones to regulate stress, metabolism, and homeostasis(4). Wnt signaling is known to be critical for adrenal development and homeostasis(5), and ZNRF3 is frequently inactivated in adrenal cancer(6). Prior work in the lab has revealed that mouse

adrenals with *Znrf3* conditionally knocked out (cKO) display significant hyperplasia at 6 weeks of age(7). While this phenotype is highly dependent on Wnt ligand availability, it remains unclear if this phenotype requires canonical or non-canonical Wnt, or perhaps both. To examine a potential role of non-canonical Wnt in ZNRF3-dependent signaling, the lab measured expression of non-canonical co-receptors in adrenal glands of *Znrf3* cKO mice. This revealed that RYK was more highly expressed as compared to the controls, suggesting it may be a ZNRF3 target and key mediator of non-canonical Wnt. To further examine the role of RYK in normal adrenal biology and in relation to ZNRF3, we generated a *Ryk* cKO mouse model, where the gene has been selectively inactivated in all adrenal cortex cells using Cre/lox technology, and a double knockout (dKO) model where both *Znrf3* and *Ryk* are simultaneously inactivated. We have found a 35% and 27% reduction in adrenal size in male and female mice, respectively, in the *Znrf3*;*Ryk* dKOs as compared to *Znrf3* cKOs. Using immunohistochemistry (IHC), we have found that while there is no significant difference in proliferation ( $p=0.55$ ), there is a significant increase in myeloid cells in the dKO as compared to the *Znrf3* cKO ( $p=0.021$ ). Prior work has shown myeloid cells phagocytose damaged adrenal cortex cells(8), suggesting loss of *Ryk* may enhance immune-mediated cell clearance. Our next step is to perform RNA sequencing to determine differences in the transcriptome of the control adrenal versus the *Ryk* cKO, and in the *Znrf3* cKO versus the *Znrf3*;*Ryk* dKO. Based on the signaling pathways that are changed, we will perform follow-up studies to functionally validate these results. We will also conduct further IHC analyses to investigate other possible explanations for the hyperplastic reduction.

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## **A feasibility trial to determine the effect of mindfulness on weight-loss maintenance**

### **Jackie Smith, University of Utah**

Faculty Mentor: Tanya Halliday, University of Utah

SESSION A (9:00-10:30AM)

POSTER A78

**PURPOSE:** Over 70% of adults in the U.S. have overweight and obesity. Weight loss is often recommended to improve overall health and risk of disease. However, weight regain following intentional weight loss is common, and diminishes initial improvements. Therefore, interventions aimed at attenuating weight regain following weight loss are of crucial importance. Mindfulness-based interventions are a promising and novel approach in mitigating weight re-gain. Therefore, the aim of this study was to investigate the effects of a mindfulness intervention to prevent weight regain in weight-reduced adults. **METHODS:** Women (age:  $40.2 \pm 10.8$ ; BMI:  $31.6 \pm 5.2$ ) who recently achieved a 7% reduction in body mass within the past 2 months were enrolled into an 8-week KORU mindfulness intervention ( $n=7$ ). The intervention consisted of a weekly 75-minute sessions involving mindfulness-meditation, plus daily meditation homework. At baseline and post-intervention body mass, dietary restraint, disinhibition, and hedonic hunger (via the Three-Factor Eating Inventory); and physical activity (via IPAQ) were evaluated. To compare change in body mass to a standard weight loss maintenance intervention (Diabetes Prevention Program [DPP] Post Core Curriculum), 8-week

weight loss data from historic controls matched on age, sex, and BMI (n=5) was utilized. RESULTS: Weight loss was maintained following the 8-week KORU intervention, and was not significantly different from the historical DPP controls (KORU:  $-0.04 \pm 1.2\%$  vs. DPP:  $0.09 \pm 0.7\%$ ). No significant changes were detected in the KORU mindfulness group from pre- to post-intervention for dietary restraint (pre:  $11.7 \pm 4.1$ ; post:  $12.7 \pm 4.5$ ;  $p=0.27$ ), disinhibition (pre:  $6.3 \pm 4.4$ ; post:  $6.6 \pm 4.8$ ;  $p=0.69$ ), or hedonic hunger (pre:  $3.7 \pm 2.6$ ; 2.9  $\pm$  3.8;  $p=0.29$ ). Additionally moderate-to-vigorous physical activity (pre:  $12114.1 \pm 8706.3$  METmins/week; post:  $7422 \pm 5842.8$  METmins/week;  $p=0.17$ ) and sedentary time (pre:  $4274.3 \pm 1544.9$  min/week; post:  $2655.7 \pm 1508.8$  min/week;  $p=0.43$ ) were also not changed following the KORU intervention. CONCLUSIONS: Mindfulness-interventions are feasible and an efficacious approach for short-term weight loss-maintenance. Future trials that include matched controls and longer term follow up are needed.

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## **Comparing Contraceptive Use Prior to and After Abortion In Utah- The Role of Rurality In Contraceptive Decision Making Maegan Thomas, University of Utah**

Faculty Mentor: Rebecca Simmons, University of Utah

SESSION A (9:00-10:30AM)

POSTER 79



Introduction/ 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 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). 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 which supports the need for additional research.

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## **Exploring Novel PI3K-AKT-MTOR Therapy Inhibition as a Treatment for BRAF-Mutant Melanoma**

**Ashley Thompson, University of Utah**

Faculty Mentor: Gennie Parkman, University of Utah

SESSION A (9:00-10:30AM)

POSTER A80

Despite emerging therapies, melanoma progression and metastasis is the leading cause of death for skin cancer patients (Liu, et al. 2014). There is a 15-20% five-year survival rate for Stage IV melanoma, proving the need for new targeted therapies. The phosphatidylinositol-3'-kinase (PI3K) and mitogen-activated protein kinase (MAPK) pathways play a significant role in cell proliferation. In the MAPK pathway, BRAF is the most commonly mutated proto-oncogene found in melanoma metastases. However, mutation of this gene alone does not lead to melanomagenesis (Parkman, et al. 2021). Melanomagenesis requires further mutational burden within other signaling pathways, such as the PI3K pathway. AKT, a downstream effector of the PI3K pathway, promotes activation of mTORC1, a protein that drives cell proliferation. SGK is highly homologous to AKT, sharing downstream effectors and promoting mTORC1 activation (Sommer, et al. 2013). Therapies

targeting BRAF have shown success in inhibiting the MAPK pathway; nevertheless, the PI3K pathway remains active and able to promote cell growth. To combat the activation of the PI3K pathway, therapeutics have been developed to inhibit AKT and PI3K. However, PI3K and AKT-targeted therapeutics have not successfully reduced melanoma metastasis and thus have not been FDA-approved. When AKT is genetically inhibited, SGK is overexpressed, rescuing the knockdown of AKT (unpublished data from the Holmen lab). Therefore, to decrease the proliferative effect of the PI3K pathway, combined inhibition of AKT and SGK remains a viable strategy. We report that inhibitors against AKT and SGK decrease melanoma cell proliferation in vitro. Furthermore, combined AKT and SGK inhibition results in decreased tumor progression and increased overall survival ( $p=0.0031$ ) in a BRAFV600E-driven immunocompetent mouse melanoma model. These findings demonstrate that dual targeting of SGK and AKT may represent a novel therapeutic strategy to abrogate melanoma growth.

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## **Childhood Opportunity Index as a Predictor of Autism Spectrum Disorder Diagnosis in Utah Zachary Tripp, University of Utah**

Faculty Mentor: Michele Villalobos, University of Utah

## SESSION A (9:00-10:30AM)

## POSTER A81

Significant research has shown that health and well-being are directly correlated to childhood poverty and socioeconomic status. Racial inequities exist when it comes to age of diagnosis and service access for kids with Autism Spectrum Disorders (ASD). This is the first study to date to examine the impact of neighborhood level resources and conditions on access to autism services using the Childhood Opportunity Index 2.0 (ChOI 2.0). The primary goal of this study is to examine whether local-level child opportunity can serve as a predictive factor for diagnosis of ASD in the state of Utah. This study included 3,500 unique children seen at the Child Development Clinic from 2018- 2022 (1,030 female; 2,469 male) 194 of whom received an ASD diagnosis and 3,306 who did not. We geocoded residential addresses obtained from families in Utah and linked each location with census tract-level ChOI data. Child Opportunity Index 2.0 is a publicly available surveillance tool that incorporates a total of twenty-nine traditional and novel attributes of neighborhood conditions split into three categories. We analyzed the distribution of ASD diagnoses across the sample. A logistic regression was performed to ascertain the effects of ChOI on the likelihood of an ASD diagnosis. This research is important because it can highlight diagnostic differences based on opportunity. Further research can be done to determine the causes for the disparities in order to develop possible interventions to promote early detection of autism in all children.

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# **Pediatric Oncology Patients'**

## **Conceptualization of Cancer Symptoms**

### **Minahil Usman, University of Utah**

Faculty Mentor: Lauri Linder, University of Utah

SESSION A (9:00-10:30AM)

POSTER A82

Background: Approximately 1 in 285 children in the U.S. are diagnosed with cancer before their 20th birthday. The short- and long-term symptoms experienced by these children disrupt their quality of life by restricting their ability to participate in daily activities, negatively affecting close relationships, as well as increasing feelings of distress and frustration. The purpose of this project is to describe how children with cancer between the ages of 6 to 12 characterize their symptoms and expressions they use in relation to these symptoms. Methods: This descriptive study involves analysis of cognitive interviews with children with cancer 6-12 years of age who participated in the Kids Instrument Development Study for Symptom Management (KIDS-SM) which is supporting the development of two instruments to measure aspects of symptom self-management among children with cancer. Transcribed interviews have been uploaded into Dedoose to support identification of statements and phrases specific to how the child describes symptoms as well actions the child describes taking in response to experiencing symptoms or to avoid experiencing symptoms. A constant comparative process will be used to develop a coding schema to identify common categories of responses. Results: Interviews have been completed with 21 children (11 girls, 10 boys; mean age: 10 years). Preliminary analysis reveal that children use a variety of

expressions to relate symptom experiences, such as feeling pain or 'hurt', going cross-eyed, etc. Children describe specific roles for their parents and clinical teams and also speak about things they do independently to self-manage their symptoms such as reading books and taking Tylenol. Discussion; Understanding how children conceptualize their symptoms is vital to track to improve children's experiences during cancer treatment. Understanding children's perceptions of these symptoms while also considering interpersonal, intrapersonal, and transpersonal relationships and environments can enable a more comprehensive, individualized, and sensitive approach to care.

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## **Characterizing SPTLC3 Polymorphisms Associated with Circulating Ceramides Alex Wiedemann, University of Utah**

Faculty Mentor: Marcus Pezzolesi, University of Utah

SESSION A (9:00-10:30AM)

POSTER A83

Introduction. Obesity roughly affects one third of adults in the United States and is often a precursor to various comorbidities, including diabetes, hypertension, and dyslipidemia. Studies have reported that ceramides, a precursor to complex sphingolipids, are increased in obese and diabetic patients and are drivers for metabolic disease. Previously published genome-wide association studies (GWAS) of circulating ceramides have identified reproducible associations

with single nucleotide polymorphisms (SNPs) near the SPTLC3 gene. However, the functional consequences of these SNPs are unclear. Here, we aim to identify variants effecting the expression of SPTLC3, which may have a role in driving dysregulated ceramide levels.

**Methods.** We focused on SNPs that were genome-wide significant ( $p \leq 5 \times 10^{-8}$ ) from the National Human Genome Research Institute – European Bioinformatics Institute (NHGRI-EBI) GWAS catalog that are associated with various circulating ceramides and are within 100 kilo-base pairs of SPTLC3. Identified SNPs were examined for association with gene expression using the Genotype Tissue Expression Project (GTEx) and annotated with functional regulatory information from the Encyclopedia of DNA Elements (ENCODE). The RegulomeDB database was also used to annotate putative regulatory potential and identify predicted transcription factor binding motifs. After characterizing these SNPs, we designed and performed luciferase-based reporter assays for each SNP to determine their consequence on reporter activity.

**Results.** We identified 7 SNPs of interest that are associated with Cer(d18:1/18:0), Cer(d18:1/22:0), Cer(d18:1/24:0), Cer(d18:1/24:1), and Cer(d18:1/26:0) species. All SNPs are strong expression quantitative trait loci (eQTLs) for liver-specific expression of SPTLC3 ( $p \leq 5.3 \times 10^{-12}$ ), though, only two SNPs fall within candidate cis-regulatory elements from ENCODE. After performing luciferase-based reporter assays, we identified one SNP, rs4814175, that demonstrates reduced luciferase activity. This SNP has a predicted binding motif for transcription factors GATA2 and ALX1 and may be functionally important in regulating SPTLC3.

**Conclusion.** We identified rs4814175 as a potential driver for decreased SPTLC3 expression seen within human gene expression data. This SNP may impact binding of two potential transcription factors and

may be a contributor to dysregulated circulating ceramides levels. Additional research is needed to fully understand the genetic drivers of ceramides.

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## **Sequence learning across memory domains**

### **Clara William, University of Utah**

Faculty Mentor: Genevieve Albouy, University of Utah

SESSION A (9:00-10:30AM)

POSTER A84

Previous research suggests that memory systems supporting declarative and motor learning are not independent, sharing common processes. However, there is no direct empirical evidence of such between-memory-domain similarities. The goal of this study was to address this knowledge gap.

We designed a new version of the serial reaction time (SRT) task, with pictures of objects as visual cues to trigger motor responses. There are three different versions of the task: an object sequence task (sequence of objects paired with random key presses), a motor sequence task (sequence of key presses paired with random objects), and a control task (random keys and objects). Thirteen healthy participants (age: 18-30, 8 female) learned the two sequence tasks 4 hours apart. Consolidation of the sequence tasks was assessed with an overnight retest. Behavioral analyses of response time indicate that participants learned object and motor sequences to the same extent (block effect [BE]:  $F(19,228)=20.29$ ,  $p<0.001$ ; condition effect [CE]:  $F(1,12)=2.87$ ,  $p=1.12$ ; condition by block



effect [CBE]:  $F(19,228)=1.19$ ,  $p=0.26$ ). Data acquired during the post-training test showed that performance plateaued similarly between conditions (BE:  $F(3,30)=1.54$ ,  $p=0.22$ ; CE:  $F(1,10)=0.54$ ,  $p=0.47$ ; CBE:  $F(3,30)=0.27$ ,  $p=0.847$ ). During the overnight retest, performance improved similarly between conditions (BE:  $F(3,30)=6.63$ ,  $p=0.001$ ; CBE:  $F(6,60)=4.19$ ,  $p=0.001$ ). Performance differed between conditions (CE:  $F(2,20)=22.04$ ,  $p<0.001$ ) such that both sequence tasks performed faster than the random task, and performance was similar across sequence tasks. These results indicate that our newly designed SRT task allows memory development from different domains in one training day. There was similar retention of the sequence-specific knowledge across memory domains during the overnight retest. Moving forward, analyses of neuro-imaging data will unravel the neural processes supporting sequence learning across memory domains.

Does an audiologist's person-centered  
discourse during a hearing aid orientation  
effect the patient's self efficacy?

Tess Crawford, Utah State University

Faculty Mentor: Brittan Barker, Utah State University

SESSION A (9:00-10:30AM)

POSTER A87

This study aimed to determine whether the manner in which  
a videoed clinician orients an individual to hearing aids

(person-centered (PC) or clinician-centered (CC)) affects their processing fluency and comprehension of the material. Furthermore, we were curious if such effects are moderated by the individual's health literacy. This study employed a between-subjects experimental design. The independent variable was delivery method (person-centered (PC), clinician-centered (CC)). The dependent variables were processing fluency rating and comprehension accuracy; health literacy served as moderator. 100 participants will be recruited via Prolific (2022), an online paid service to recruit participants and conduct behavioral studies. Participants must be 18 years or older, must communicate confidently in spoken and written English, have self-reported typical hearing, and self-reported typical cognitive functioning. During the study, each participant first completed a health literacy measure, The New Vital Sign (Weiss et al., 2005). Participants were then randomly designed to a video stimulus (PC or CC). The PC video included dialogue aspects such as, avoiding lengthy details, clearly explaining tasks with a hearing aid as a model, and refraining from the use of medical jargon. The CC video highlighted multiple pieces of information simultaneously, provide lots of details and superfluous information, and include a large amount of medical jargon. After the participant finished watching their assigned video, they completed the processing fluency survey via a 1-7 Likert scale, as well as 5 brief multiple-choice, comprehension questions about hearing aids. We are currently in the process of completing data collection. However, we plan to calculate descriptive statistics, and conduct a regression analysis to analyze our data. We predict that participants who viewed the video of an audiologist orienting the research participant in a person-centered (PC) manner will have comparatively higher comprehension

accuracy and processing fluency scores than participants viewing a similar video of an audiologist orienting their patient to hearing aids in a clinician-centered (CC) manner. Furthermore, we predict that participants' health literacy levels will moderate this relationship. Communication challenges between well-educated clinicians and their patients can result in miscommunications, and poor motivation to continue health care and interventions, which can have detrimental effects to individuals' overall health and wellbeing. In audiology, hearing aid orientations, are often standardized and clinician centered. We predict that our data will support the need for audiologist to communicate more effectively with their patients in a patient-centered manner (e.g., use minimal jargon). This may ultimately ensure that patients could put their cognitive effort into understanding how a diagnosis/treatment applies to them and their care instead of working so hard to decipher what an audiologist is sharing. Such a facilitated understanding could lead to improved hearing aid use in future patients and improved overall hearing health.

**Health and  
Medicine. Session  
A - Oral  
Presentations,  
Dumke, Alumni  
House**

**SESSION A (9:00-10:30AM)**

**Location: DUMke Room, Alumni House**

Preoperative Skin Preparation does not  
eradicate Deep-Dwelling Microflora; using two

## models to quantify bioburden from porcine skin

### Abbey Blair, University of Utah

Faculty Mentor Dustin Williams, University of Utah

SESSION A 9:00-9:15AM

### Dumke, Alumni House

### Health and Medicine

Clinical Preoperative Skin Preparation (PSPs) kits are the standard of care for skin disinfection prior to surgery and the most important method of infection prevention. However, we have discovered that the antiseptics contained in these kits do not eradicate the natural flora that live in the deep regions of the skin. FDA approved PSPs fail the 2-3 log<sub>10</sub> reduction required by the FDA when full-thickness skin samples are used on Yorkshire pigs [1]. We hypothesized that the method with which the PSP are tested is directly correlated with the log reduction result. To test this, we compared two skin sampling methods: the FDA required process, the cup scrub method, and a new procedure called the tissue blend method. The cup scrub method consists of placing a sterile cylinder on the skin that has been cleaned with antiseptic. Broth is added to the cylinder and the skin is agitated within the cup. The bacteria in the broth is then quantified. In contrast, the tissue blend method is performed by cutting out full-thickness skin samples from the backs of pigs. These tissue samples are blended, and then the homogenized tissue is quantified. We performed the cup scrub and tissue blend methods on the backs of 7 Yorkshire pigs following alternating scrubs of 4% chlorhexidine gluconate (CHG) and alcohol (n=5/pig). The cup scrub and tissue blend methods were also performed on control skin as a relative baseline (n=5/pig). With 4 treatment groups, 20 samples were

taken from each animal for a total of 140 samples. The average log reduction for the cup scrub and tissue blend methods were  $1.57 \pm 0.45$  CFU/cm<sup>2</sup> and  $0.23 \pm 0.48$  CFU/cm<sup>2</sup>, respectively. When analyzing the data, CHG appears to decrease the bioburden following PSP application when using the cup scrub method, however the tissue blend method shows that it is not killing bacteria dwelling deep in the skin, ultimately resulting in infection risk. This research is fundamental for the development of new PSP technology that eradicates deep dwelling flora.

#### References:

Duffy, H.R.; Godfrey, R.W.; Williams, D.L.; Ashton, N.N. A Porcine Model for the Development and Testing of Preoperative Skin Preparations. *Microorganisms* 2022, 10, x. <https://doi.org/10.3390/xxxxx>

## Reducing Drug Adsorption in Extracorporeal Membrane Oxygenation (ECMO) Circuits: Propofol Extraction and Analysis Oliver Hubbard, University of Utah

Faculty Mentor Hamid Ghandehari, University of Utah

SESSION A 9:20-9:35AM

Dumke, Alumni House

Health and Medicine

Background: Extracorporeal membrane oxygenation (ECMO) is a life-saving technology for many critically ill patients. Unfortunately, ECMO has a >40% mortality rate, partly due to lack of established dosing guidelines. Dosing is

different in this population due to drug interactions with the ECMO circuit. Drugs can be adsorbed by the ECMO circuit via hydrophobic and electrostatic interactions, thereby decreasing the amount of drug available to the patient. Micellar encapsulation of drugs may prevent adsorption. Methods: Two types of propofol were compared in an ECMO ex-vivo system: the clinical formulation of propofol and micelle-encapsulated propofol. The ECMO system consisted of a reservoir, pump, and oxygenator, as well as ports for drug administration and sample collection. The ECMO systems were dosed with either clinical or micellar propofol, and drug concentrations were measured over time using an optimized High Performance Liquid Chromatography (HPLC) assay. Each drug was measured in triplicate. % Recovery at each timepoint was calculated by comparing the concentration at a given timepoint with initial concentration at 1 minute. Data was reported as the mean percent recovery with 95% confidence intervals. Results: Adsorption of propofol was significantly reduced ( $P < 0.01$ ) in micellar propofol compared to clinical propofol at earlier time points where 40% of the drug was recovered in case of micellar propofol compared to only 24% in case of clinical propofol at 30-minute time point. Conclusion: Micellar encapsulation significantly reduced drug adsorption in the ECMO circuit. The clinical significance of this reduction is not clear. Additional studies to optimize micellar encapsulation and decrease adsorption are needed.

## Effects of Blueberries Supplementation on Oral Dysbiosis

## Nizhoni Porter, University of Utah

Faculty Mentor Anandh Velayutham , University of Utah

SESSION A 9:40-9:55AM

Dumke, Alumni House

Health and Medicine

The gut and oral cavity are the two most significant microbial habitats and are closely connected through the digestive pathway. Evidence indicates microbial transmission (oral-to-gut and gut-to-oral) regulates the pathogenesis of diseases such as cancer and is mediated through the oral-gut microbiome axis. An imbalance in the oral microbes (dysbiosis) is implicated in oral diseases and systemic diseases such as inflammatory bowel disease, cardiovascular disease, and Alzheimer's disease. Our lab recently showed that dietary supplementation of blueberries improves diabetes-induced gut dysbiosis. Phytochemicals such as anthocyanins in blueberries act as prebiotics and promote the growth of beneficial gut microbes. Dietary blueberries increased the abundance of commensal microbes and decreased the abundance of opportunistic microbes in diabetic mice. In the proposed study, we will evaluate whether supplementation of blueberry improves a high-fat diet and antibiotics-induced oral dysbiosis in a preclinical model. Mice will be divided into four groups: Control (C), High Fat Diet-fed (HF), High Fat Diet-fed with antibiotics (HFA), and High Fat Diet-fed with blueberry supplementation and antibiotics (HBA). The Antibiotics will be distributed to the mice in the drinking water. The oral and gut microbiomes will be analyzed using 16s rRNA amplification. 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. Our study will identify whether dietary blueberries improve oral dysbiosis by modulating the oral-gut microbiome axis.

## Supplementation of Blueberries Attenuates High-Fat-Diet and Antibiotics Induced Gut Inflammation

Keaton Rosquist, University of Utah

Faculty Mentor Anandh Velayutham, University of Utah

SESSION A 10:00-10:15AM

Dumke, Alumni House

Health and Medicine

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, allowing for higher chances of gastrointestinal disorders. Antibiotic usages interrupt gut symbiosis and further exacerbate HFD-induced complications. Evidence indicates that HFD with antibiotics increases the risk of pre-inflammatory bowel disease (IBD). Blueberries contain bioactive flavonoid compounds called anthocyanins which possess antioxidant and anti-inflammatory properties. 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 the colon using RNeasy plus mini kit, cDNA was synthesized using RT-PCR kit, and the expression of inflammatory molecules was measured with qPCR 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 blueberries significantly reduced the expression of IL-1 $\beta$ , iNOS, and MCP-1, indicating the beneficial effect of blueberries on the gut. The mRNA expression of IL-6 was similar among the groups. Our ongoing studies focus on identifying the molecular mechanisms involved in the protective effect of blueberries. Our study suggests consumption of blueberries may be a potential dietary approach to improve gut health.

**Humanities.**  
**Session A - Poster**  
**Presentations,**  
**Ballroom, Union**

**Location: Ballroom, A. Ray Olpin University**  
**Union**

**(Un)Manning Alexander: The Reception of**  
**Bagoas the Eunuch in Contemporary**  
**Narratives of Alexander the Great**  
**Annie Jensen, University of Utah**

Faculty Mentor: Mira Green, University of Utah

SESSION A (9:00-10:30AM)

POSTER A46

The increased interest in queer theory has prompted academia to re-examine popular narratives in all areas of study; the field of Classics has seen a surge of literature concerning gender, sexuality, and power. Scholarship has focused on the sexuality and gender performance of Alexander the Great, the infamous King of Macedon that expanded from the Northern Balkans to the western borders of India. Literature that supports Alexander's masculinity being tied to his sexuality often falls into two broad categories: the empowerment of Alexander and his empire due to his personal relationships, or Alexander's loss of power because of his personal relationships. Within this discourse, one of the figures closest to Alexander in his later years is also the one who has been most overlooked: Bagoas the Younger, his eunuch courtier. My research examines Bagoas and his place in the historiography and popular reception of Alexander the Great. My argument is two-pronged. First, I explore the inclusion and exclusion of Bagoas in historiographical sources to consider ancient authors' concepts of power, empire, and gender. Then, I examine the popular use of Bagoas in the popular reception of Alexander in plays, novels, and movies as expressions of constructed masculinity in post-war periods of the twentieth century. Relying on scholarship about sexuality in the ancient Mediterranean world including Foucault, Halperin, and Dover in conjunction with modern queer theorists such as Butler and Sedgwick, I argue that ancient and contemporary accounts of Alexander, Bagoas, and their relationship are affected by the systems of sexuality and gender.

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## Got Global Identity?

**Samantha Denbow, Southern Utah  
University**

**Sarah Penner, Southern Utah University**

**Tanner Shandy, Southern Utah University**

**Sterling Brown, Southern Utah University**

Faculty Mentor: Julie Johnson-Pynn, Southern Utah University

SESSION A (9:00-10:30AM)

**POSTER A47**

We will be looking at different methods of presentation regarding public health messages during the COVID-19 pandemic. Research has shown that the use of information through media formats such as images and text can affect people's opinions (ÇELİK et al., 2022). Another study showed the importance of consistent, evidence-based public health messaging (Pfattheicher, S. et al., 2020). Participants were exposed to an online survey measuring Global Identity. This online survey collected sociodemographic information from each participant, and then asked them to assess their level of Global Identity. After exposing them to either ten stock photos or ten images of health statistics relating to the COVID-19 pandemic, participants were asked once more to measure their level of Global Identity. The survey was distributed through the official Southern Utah University Portal, researcher's personal social media accounts, and to General Psychology students through SONA. Our hypothesis is that those who are exposed to images of human faces will report higher Global Identity compared to those who are exposed to images of statistical data. This is expected because human faces are more likely to elicit feelings of connectedness to the global populace. Our

study is impactful because it evaluates the efficacy of public health messaging, and suggests a way to present information that will unite the human race in the midst of a pandemic. Results are forthcoming.

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## **Cultural Models of Water in Northern Utah**

**Jacob Martin, Utah State University**

**Dorie Pardoneu, Utah State University**

**Brelle Christensen, Utah State University**

**Kayla Warren, Utah State University**

Faculty Mentor: Francois Dengah, Utah State University

SESSION A (9:00-10:30AM)

POSTER A48

Water heritage studies serve as a nexus for research and applied sciences to understand myriad roles that water functions in everyday life. The Water Heritage Anthropological Project evaluates dimensions of water, its infrastructure, and management practices through an interdisciplinary lens. We report on ethnographic work from northern Utah where we conducted semi-structured interviews with three different categories of water users: farmers, water managers, and community members. Our work identifies cultural dimensions of water identity that study participants use to describe their relationship with water. We discuss the social, economic, and

environmental implications for communities in the Mountain West.

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## **Spooks and Spanks: Unraveling Paranormal Romance's Presence on BookTok**

**Lizzy Bermudez, Utah State University**

Faculty Mentor: Joyce Kinkead, Utah State University

SESSION A (9:00-10:30AM)

POSTER A49

This research project examines the frequency at which the romance subgenre, paranormal romance, appears on the online social media subcommunity BookTok. The term paranormal romance refers to any title containing a protagonist or associate who is deemed to be unnatural or supernatural in species, ability, presence, or otherwise wherein a romance containing the supernatural character is prominently featured. Collecting data from top BookTok accounts, we found that paranormal romance appeared more often within BookTok creator content. However, surveys from BookTok users asserted that the contemporary romance subgenre dominated their "For You Pages." Interviews with BookTok creators suggest that BookTok viewers often used major romance genres as catch-all categories, grouping titles that didn't technically meet set criteria for the sake of efficiency. Overlap among top subgenres is becoming increasingly common due

to the rise of self-publishing, which forgoes the traditional publishing process that typical genre determination is associated with. As titles become increasingly harder to categorize appropriately, it seems that readers opt instead to group fiction based on loose overarching, broad categories into definitions that differ from industry standards. By analyzing BookTok and other online reading communities, we uncovered interesting information about the state of the current reader, whose interpretation of book categorization deviates from the industry and is more in tune with the cultural shifts within the reading community. These findings have the potential of offering information to the publishing industry or self-published authors on how they market their books.

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## **Revisualizing Translation: How Multimodality Can Benefit Translations of Latin Poetry**

### **Jay Paine, Utah State University**

Faculty Mentor: Frances Titchener, Utah State University

SESSION A (9:00-10:30AM)

POSTER A50

Because the grammar of Classical Latin allows for a greater freedom of word order than Modern English, translators confront a problem when adapting lines of Latin poetry containing word pictures, a poetic device that allows writers to create meaning by ordering words in artistic arrangements.



This problem begs the question: Is it possible to preserve this striking poetic device and its communicated meanings, and if so, how can translators optimize the device's effect for a modern English-speaking audience? To answer this question, I turn to the Phaethon passage found at the beginning of Book II of Ovid's *Metamorphoses*. In one instance from this section, Ovid describes vicious beasts (i.e., constellations) surrounding the character Phaethon, but Ovid does not communicate this image using traditional syntax. Instead, he arranges the noun and adjective denoting the vicious beasts to surround the adjective and verb referring to Phaethon, creating a word picture. This is possible because Latin uses case endings to indicate how a word is operating in a sentence. However, Modern English has lost its case endings, so it relies on word order for communication, restricting writers to conventional syntax. To explore how translators navigate this issue, I compared three translations of the Phaethon passage to Ovid's original, and I discovered that the translators Miller and Martin disregarded the word picture entirely, losing its meaning in translation. In contrast, Humphries was careful to communicate the meaning created by the word picture using conventional English syntax, though the effect feels mundane compared to the Latin original. Based on my comparisons, it is clear that translators who utilize written text alone will inevitably fail to preserve the vivid images and effects created by word pictures. Therefore, translators should consider adopting multimodal approaches, which are gaining popularity among literary artists. For example, some poets are pairing their poetry with animated shorts, producing video poetry. Other artists are combining their creative nonfiction with comics to create cartoonish or heroic representations of their lives. After considering the shortcomings of the three

translations and the usefulness of visual effects, I hypothesized that incorporating multimodality into the translation process would preserve the intended effects of word pictures in translations targeted toward a modern, English-speaking audience. To test this, I produced a multimodal translation of the Phaethon passage using both my own translation as standard text and concept art, which I will later transform into a short animation or comic. During this process, I discovered that although the poetic device itself cannot be preserved in full, adopting multimodal approaches can help communicate the meanings underlying many of the word pictures while simultaneously preventing translators from having to sacrifice imagery and effects for poetic English.

## **Underrepresentation of BIPOC Designers in Graphic Design History Textbooks**

**Alejandra Henriquez Roncal, Utah Tech  
University**

Faculty Mentor: Rachel Ramsay, Utah Tech University

SESSION A (9:00-10:30AM)

POSTER A88

Graphic design history textbooks used at an undergraduate level seem to focus mostly on works and movements that originated in Western Europe and the United States of America. Thus, graphic designers of color are significantly underrepresented. This project aims to focus on the

underrepresentation of non-European and non-North American designers and especially the lack of presence of Latin American designers. In order to provide a concrete insight on the current graphic design history education, the project analyzes a specific textbook titled *Graphic Style: From Victorian to Hipster* by Steven Heller and Seymour Chwast, which is used for the graphic design history class taught at Utah Tech University. This textbook includes a total of 773 pictures of which 771 display graphic work by different designers. For the analysis, each one of those images was catalogued with information regarding its date, graphic design movement, author's name, author's gender, author's nationality, and author's ethnicity. From the data collected this project aims to shed light on the percentage of works that belonged to designers of color, and specifically Latin American designers.

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**Humanities,  
Interdisciplinary,  
Social Sciences.  
Session A - Oral  
Presentations, Pano  
East, Union**

**SESSION A (9:00-10:30AM)**

**Location: Pano East, A. Ray Olpin University  
Union**

“The Goal is to Build and Strengthen the Black

## Community:” Black Faculty and Staff’s Role in Black Power Movement at the University of Utah Callie Avondet, University of Utah

Faculty Mentor Shavauna Munster, University of Utah

SESSION A 9:00-9:15AM

Pano East, Union

Humanities

The late 60s and 70s are known in the United States in part for the student protests that erupted from coast to coast. In addition to protesting the Vietnam War, college students were also active in racially backed campaigns such as the Black Power Movement. Situated just blocks east of the Church of Jesus Christ of Latter-Day Saint headquarters, which then banned Black people from holding the priesthood, the University of Utah became a unique and ideal site for the Black Power Movement to play out in Utah. Though Black Power did not hit campus until the early 70s a few years after other institutions, Black U of U students followed their peer’s examples and protested in direct ways such as by walking into the university president’s office with a list of demands and by writing letters supporting Black teachers that the university was trying to fire on minimal charges. In all their work, however, these students were backed by and/or led by Black faculty and staff at the U. Faculty and staff collaboration was an essential, but often overlooked, component to these student activists’ wins as those non-students often stayed within the campus community for longer and had more direct ties to members of leadership. Thus, Black faculty and staff at the U were the less seen, but often more targeted, front lines in the Black Power movement on campus. This project focuses on the

resistance and activism Black faculty and staff performed in the early 70s in three ways: asserting and defending space for Black faculty and students on campus, directly supporting student protests, and being the leaders in enacting organizational change that the students' visible activism started. Understanding these roles not only highlights the less seen and remembered, but equally important, work that faculty and staff did to bring changes to the U, but also provides more depth and understanding of the Black Power movement and how it played out in Utah.

## We Are What We Read: We Are What We Read: The Problem of Representation on Undergraduate Philosophy Syllabi Mykie Valenzuela, University of Utah

Faculty Mentor Carlos Santana, University of Utah

SESSION A 9:20-9:35AM

Pano East, Union

Humanities

Academic Philosophy suffers from what has been called a “demographic problem.” In 2018, only 1% of full-time philosophy professors in the US were black and women professors totaled just 17%. Progress in recruiting underrepresented groups has lagged far behind other humanities disciplines, particularly in race and gender. I hypothesize, given that undergraduate syllabi contain texts predominantly written by white and male philosophers that

students from underrepresented groups are less likely to major in philosophy. I am testing this theory using several years of syllabi records from the University of Utah Department of Philosophy. Using the Simpson's Diversity Index, based on authors of assigned readings, each syllabus is given a score that illustrates how representative it is of the different identities of philosophers and authors. For example, if a syllabus only includes authors with the same identity, this would score a 0. The study resulted in averaged scores of semesters and years to create a longitudinal comparison with undergraduate demographics in the major of philosophy at the University of Utah. Scores of the gender and race of authors of assigned readings, separately, correlate with the gender and race of undergraduates in the major. This novel research study adds to the literature that supports diversifying the philosophical canon.

## The Black Hair Project

Nnenna Eke-Ukoh, University of Utah

Faculty Mentor Andrea Baldwin, University of Utah

SESSION A 9:40-9:55AM

Pano East, Union

Interdisciplinary

Pride in one's blackness includes pride in their hair, especially for Black women. For Black women, hair discrimination is not a new phenomenon. Race based hair discrimination negatively impacts how Black girls and women define and perceive blackness. Hair discrimination is a way to hire less people of color, especially Black women, and keep

them out of professional fields and environments. Education wise, it uproots Black students from the learning environment and unnecessarily disrupts their learning. Pride in Black hair has grown significantly, but race based hair discrimination continues to negatively impact their self image/worth and how Black girls and women perceive blackness/ Black culture. Could the Would the passing of the Creating a Respectful and Open World for Natural Hair Act (CROWN Act) as a legal mechanism help alleviate race based hair discrimination particularly for Black women in the work place, institutions of higher education and in the larger social community spaces? In response to race based hair discrimination, the creation of the CROWN Act came about. The CROWN Act made it illegal to discriminate based on hair styles and textures in the work environment and schools. According to “Uneasy Lies the Head that Wears a Crown: A Critical Race Analysis of the CROWN Act” by Britney Pitts (2021), In January of 2019, the CROWN Act was introduced in California by Senator Holly J. Mitchell and “...expanded the definition of race to include hair texture and protective styling under the Fair Employment and Housing Act (FEHA) and Education Code” (pg. 720). Since the passing of the act in California in July 2019, the act gained more traction among other states. These states include: Oregon, Washington, Nevada, Alaska, Colorado, New Mexico, Nebraska, Louisiana, Illinois, Tennessee, Virginia, Maryland, Delaware, New Jersey, New York, Connecticut, Massachusetts, and Maine. There are forty plus municipalities that have passed the act as well. Despite the few states that have passed this act, more states have either dismissed the bill or have not introduced a bill the protects people from hair discrimination. Pitts argues that the passing of the CROWN Act on a federal level is a necessity that increases educational and work opportunities for Black



girls and women, as well as, “affirms their aesthetic value, self worth, or central identity,” (Versey in Pitts, 2021, pg 718). Pitt utilized real world examples to support her argument. In 2019 in the school setting, Black twin girls were expelled from extracurricular activities and banned from prom because they refused to remove their box braids. In 2019 in the work setting, a Black female newscaster was harassed by her white coworker who compared her natural hair to “throwing on a baseball cap to go to the grocery store,” (Santi in Pitts, 2021, pg 719). She later filed a report for race based discrimination, but was instead fired. There have been similar incidents all over the country since the beginning of the institution of slavery. There is more than enough evidence that clearly shows that grooming policies disproportionately affects Black people. In turn, “are forced to shed their identity and Afrocentric roots to fit American standards of beauty, professionalism, and acceptability,” both in the workplace and in educational settings (Pitts, 2021, pg. 719).

## Vanguards of Change in the ‘Georgia of the North’: Youth Activism in the Civil Rights Movement in New Jersey

### Emily Peterson, Brigham Young University

Faculty Mentor Emily Peterson, Brigham Young University

SESSION A 10:00-10:15AM

Pano East, Union

Social Sciences

In 1935, Black children were forced to play on a separate playground sectioned off with barbed wire. In 1938, white onlookers threw tomatoes at young Black children who were attempting to swim in a local pool. In 1948, the NAACP reported 27 segregated schools in 11 different counties and that Black teachers had on average three times the workload of white teachers. In 1950, Martin Luther King Jr. and his friends were run out of a restaurant due to the color of their skin. In hearing all of these accounts, one would likely assume that they had occurred in the Deep South. Yet each of these instances occurred far north of the Mason-Dixon line, in New Jersey, state NAACP workers sometimes referred to as the “Georgia of the North,” because of its particularly harsh racial discrimination. In recent years, there has been growing interest in the Civil Rights movement, with scholars looking beyond the most prominent male leaders of the national movement in the 1960s. This paper builds on the work of scholars like Martha Biondi and Tomas Sugrue who have established the significance of the Black freedom struggle in the North but have primarily focused on cities like New York City, Detroit, and Chicago. It also draws on the work of historians Rebecca de Schweinitz and Thomas Bynum, which have examined the role of youth, largely in the South, in propelling the civil rights movement beyond litigation strategies. This paper highlights the role of youth in the Black freedom struggle in urban, suburban, and rural New Jersey communities from 1935 to 1955. Drawing on NAACP youth council branch papers and local newspapers from the time it showcases youth as active organizers in advancing educational opportunities, facilitating direct action, and organizing community programs, to support local and national civil rights initiatives. Showcasing how youth activism in New Jersey advanced efforts for racial justice

in the state and facilitated regional and national collaboration, This research helps us to understand the civil rights movement of the mid-twentieth century as a national, not just a Southern struggle. It also helps uncover the role that youth played in the long, and geographically broad, struggle for civil rights.

**Humanities and  
Social Sciences.  
Session A - Oral  
Presentations,  
Parlor A, Union**

**SESSION A (9:00-10:30AM)  
Location: Parlor A, A. Ray Olpin University  
Union**

## Women not Witches

Alexis Spanevello, Utah Valley University

Faculty Mentor Lyn Bennett, Utah Valley University

SESSION A 9:00-9:15AM

Parlor A, Union

Humanities

In 1692 the world witnessed one of the most notorious cases of mass hysteria in Colonial America, known as the Salem Witch Trials. Individuals, mostly women, were accused, prosecuted, and subsequently executed for the charge of witchcraft. While the rise in popularity on this subject has opened ample opportunities for research and discussion, one core idea presents itself in every case as an indicator of proposed guilt; the threat these women, and some men who associated with them, posed to patriarchal control. Religious ideology in the Puritanical society of Salem played a significant role in how women were regarded and respected legally, politically, and in general throughout the community. The legal records make it clear that New England women were subject to men. Because of this, women who spoke out against or demonstrated qualities that did not align with Puritan or patriarchal rule (ie a system in which power is primarily held by adult men) were considered easy targets for accusation and prosecution. At this time the use of hearsay from nearly any source was considered sufficient evidence for prosecution, allowing for the coercion and manipulation of individuals to build cases against those selected. Alice Parker, Bridget Bishop, Rebecca Nurse, Sarah Good, and Susannah Martin were all women of varying backgrounds who were accused, prosecuted, and executed during this time. While patriarchal ideas were

not a new concept introduced during The Salem Witch Trials, a lack of legal precedent regarding the separation of church and state, the core Puritan values rooted in patriarchy, and the collective actions from an entire society built on these values allowed for an uproar of chaos and violence to justify the murders of the innocent. The Salem Witch Trials ended almost as quickly as they started on October 29th, 1692 when Governor Phipps dissolved the Court of Oyer and Terminer. By May 1693 Phipps had pardoned and released all those remaining in prison on charges of witchcraft, nonetheless, the patriarchal practices that fueled the trials remained rampant in the society of Salem and continue to plague our societies today. I argue that what happened in Salem has become the ultimate allegory for women who challenge authority and social structures. While we may not see accusations of witchcraft or community uproar broadcast on our news stations or highlighted in our papers, the women of today are still very much hunted and metaphorically burned for their opposition to all things patriarchal. Creating awareness of this comparison is extremely significant in addressing and correcting inequalities women continue to face in modern society.

## Police & College: University of Utah Student and Faculty Satisfaction with Campus Police Ermiya Fanaeian, University of Utah

Faculty Mentor James Curry, University of Utah

SESSION A 9:20-9:35AM

Parlor A, Union

Social Sciences

The continuous discourse revolving around policing in America has two sides, one suggesting police do not serve to stop gender-based violence, and another side that argues policing is the only way to adequately address gender-based violence. Using the situation of gender-based violence as either a defense or rejection of police. With the events that have occurred here on the University of Utah campus in regard to Lauren McCluskey, a student who was murdered by her male partner after reporting to campus police, policing on the University of Utah's campus has found itself in the center of such national debate, amongst a population (college students) that faces high levels of gender-based violence (Fisher iii). In this research, we analyze current scholarship on police satisfaction, campus gender-based violence, and police perception differences among racially oppressed people. We created a survey with a line of questioning that allows us insight into the current satisfaction of students and faculty at the University of Utah with their campus police department's handling of gender-based violence and crises. We utilized recruitment methods that involved outreach initiatives on the part of administrators from all different departments on campus to collect adequately representative data. Data for this research is still currently being collected and will close on December 16th. Complete analyzation of the data will be completed a couple of months prior to the Utah Conference on Undergraduate Research and will use a combination of bivariate and multivariate statistical analysis.

Fisher Bonnie, Francis Cullen, and Michael Turner. "The Sexual Victimization of College Women" Bureau of Justice Statistics, National Institute of Justice, December 2000, <https://www.ojp.gov/pdffiles1/nij/182369.pdf>

## Alcohol Abuse Among the Diné: Valorizing Native American Traditions within an Evidence-Based Healthcare System

Sofie Linskey, University of Utah

Faculty Mentor Brian Coddling, University of Utah

SESSION A 9:40-9:55AM

Parlor A, Union

Social Sciences

Diné on the Navajo Nation experience elevated rates of alcohol-related mental illness, fetal alcohol syndrome, and traffic fatalities. Negative stereotyping of alcohol abuse among Indigenous communities has led many to view these issues as untreatable based largely on racist, colonial beliefs and poorly conducted studies. The belief that Native drinkers metabolize alcohol differently erroneously contributes to suspicions that remission efforts are futile. Consequently, substance abuse issues remain one of the greatest public health concerns on the Navajo Nation. Census data has been implemented into GIS software to visualize the prevalence and frequency of alcohol consumption relative to proximity to behavioral health services. This spatial data coupled with data regarding the application of Evidence-Based Treatment (EBT i.e., healthcare practices supported by scientific evidence) were used to determine if targeting psychological and medicinal aspects of substance abuse aids in combating substance dependency/abuse among Diné. Cultural identity and valorization were also considered to inspire more Indigenous participation. Due to previous failures to provide substantial and effective treatment to Diné people, a continued lack of cultural recognition/



identity along with inadequate services promote an environment where alcohol abuse remains at a stable, high prevalence among all ages and genders. While EBT proves effective in decreasing alcohol abuse in this population, disregard for individual patient histories and values leads to less Indigenous participation in remission efforts. Evidence suggests that placing high priority on Native cultural values within an existing EBT system results in greater participation and effectiveness of these programs since patient identities/needs are being addressed appropriately. Balancing patient histories and values with Western medicine within a larger EBT system will prove effective in minimizing alcohol dependence among Diné.

**Nursing. Session A**  
**- Poster**  
**Presentations,**  
**Ballroom, Union**

**Location: Ballroom, A. Ray Olpin University**  
**Union**

**Usability of the Revised Color Me Healthy**  
**App for Children with Cancer**  
**Sydney Gilliland, University of Utah**

Faculty Mentor: Lauri Linder, University of Utah

## SESSION A (9:00-10:30AM)

## POSTER A85

**Background:** The gold standard for symptom reporting in healthcare is self-reporting. Verbal self-reporting is often difficult for children. Children may be more able to accurately and confidently report their symptoms using an mHealth device. The Color Me Healthy app has been developed to facilitate self-reporting in children with cancer. **Purpose:** The purpose of this project was to evaluate the usability of the revised Color Me Healthy app from the perspectives of children and their parents. **Methods:** This User Centered Design study was guided by the Technology Acceptance Model with attention to Ease of Use and Perceived Usefulness. Children (6-12 years of age) receiving cancer treatment and their parents were invited to participate in usability evaluations in which they were guided through the app and asked to complete specific tasks within the app. Children and parents participated in brief interviews, and parents also completed the Technology Acceptance Model Perceived Usefulness Scale (TAM PUS). As 5 dyads completed usability evaluations, data were summarized and shared with the developer team to guide additional refinements. **Results:** Fourteen racially, ethnically, and geographically diverse parent-child dyads participated. After 3 cycles of usability evaluations, children and parents were able to complete key tasks independently, supporting its ease of use. Children and parents also indicated their preference for using the app as a method of symptom reporting, supporting its perceived usefulness. TAM PUS scores also provided evidence that parents deemed the app useful to understand and respond to their child's symptoms. **Discussion:** mHealth devices, the Color Me Healthy app in particular, are promising methods of symptom self-reporting in children with cancer. The revised

version of the Color Me Healthy app demonstrates ease of use and perceived usefulness. Future directions include evaluation of the clinical utility of the revised app in a future study.

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## **Health Narratives of Children with Cancer Using an mHealth App**

**Hakop Kardzhyan, University of Utah**

Faculty Mentor: Lauri Linder, University of Utah

SESSION A (9:00-10:30AM)

POSTER A86

**Introduction.** The Color Me Healthy mHealth app was designed to help children with cancer communicate their symptoms. The app supports children to express their individual experiences through checklists, brief free-text questions, diary entries, and drawing features. This secondary analysis presents the narratives of two children who used the Color Me Healthy app during its initial feasibility and acceptability evaluation. **Methods.** The feasibility/acceptability study included 19 children 6-12 years of age (median 8 years) with cancer who were asked to use the app for at least 5 days between clinical visits. This secondary analysis used close reading techniques with attention to time, voice, setting, mood, perspective, and symbolism to gain a deeper understanding of each child's individual experiences and common themes across children's data. **Results.** Patient 1 is a 6-year-old boy with osteosarcoma who used the app for 3 days and reported pain, fatigue, difficulty sleeping, and decreased appetite. He

also related favorites, such as cheetahs, the color blue, and interacting with others whether playing board games or playing army. Patient 2 is a 7-year-old girl with leukemia who used the app for 9 days. Her symptoms included pain, fatigue, “a lump in my throat,” and “a cold sore.” Social interactions including spending time with grandparents and going to school were important. She also related that fatigue restricted school attendance. Conclusion. Through the Color Me Healthy app, children were given a means to relate their individual narratives, thoughts, and feelings. Although some similarities were present across children, we also saw individuality in their day-to-day experiences dealing with their illnesses. Applying this information about patients directly could help create a better patient-provider relationship and overall increase the quality of care that these children may receive throughout their treatment.

**Science. Session A -  
Poster  
Presentations,  
Ballroom, Union**

**Location: Ballroom, A. Ray Olpin University  
Union**

**Local soil conditions impact rates of  
Populus Fremontii trunk growth and leaf  
litter decomposition more so than  
variances in source population or climate  
legacy**

**Jake Berryhill, University of Utah**

Faculty Mentor: Jennifer Follstad shah, University of Utah

SESSION A (9:00-10:30AM)

POSTER 90

Riparian zones, which account for less than 1% of total land area of the western U.S., are particularly threatened by climate change. Drought, severe heat waves, and other pressures have altered riparian biotic assemblages threatening the survival of the critically important foundation species, *Populus fremontii*. We present a method to evaluate the impact of genetic differences on survivorship and growth rates of 1,024 *P. fremontii* trees sourced from 16 sites spanning 3 distinct climate zones (categorized as ‘cold’, ‘medium’, or ‘hot’). Trees were planted as cuttings in a research garden at the Bonderman Field Station in Rio Mesa – a ‘cold’ climate zone – in 2014. Additionally, we measured leaf chemistry and rates of litter decomposition for 72 trees representing individuals from 6 sites spanning 3 climate zones, as inputs and degradation of organic matter are energy and nutrient subsidies to soil invertebrate

and microbial communities within riparian corridors. Measurements of trunk diameter at the root crown and canopy collar along with observations of active foliage growth were collected and documented to measure the growth and survivorship of trees from each source population. Decomposition rates were determined by measuring mass loss of leaf litter left to decompose over the course of a year. We infer that differences in survivorship, growth, and leaf decomposition by source population or climate zone would indicate that genetic differences or climate legacies are important factors for understanding the persistence of *P. fremontii* to rapidly shifting environmental changes. Our analysis of leaf litter decomposition aims to expand on existing knowledge of the critical importance of leaf litter to the energy and nutrient cycles within riparian ecosystems. Collectively, our results aim to add to growing evidence that genetics should be considered when selecting trees for restoration projects in different climate regimes.

## **The Arduino Platform as a Cost-Effective Field Data Collection Tool**

**Jake Olvera, Southern Utah University**

Faculty Mentor: Jacqueline Grant, Southern Utah University

SESSION A (9:00-10:30AM)

POSTER A91

As conservation efforts are ramping up, the need for accurate biological field measurements becomes apparent. These measurements are usually collected using multiple specialized,



expensive devices. For example, soil characteristics (temperature, humidity, and salinity) can be measured using the Aquaterr EC-350 at a price point of \$1350. Similarly, the Kestrel 3500 Weather Meter measures humidity, pressure, temperature, wind speed, and wind direction for the price of \$200. We used readily-available sensors that communicate via I2C controlled by an Arduino Uno Rev3 development board to create a single, compact device. This device can measure pressure, altitude, temperature, humidity, soil temperature, and soil humidity for under \$100. A similar approach can be taken for other projects to create custom equipment that is accurate, cost-effective, and modular.

**Science. Session A -  
Oral Presentations.  
Sorenson, (2nd  
floor), Alumni  
House**

SESSION A (9:00-10:30AM)

Location: Sorenson (2nd floor), Alumni House

**Microtubule rigidity and associated  
stability phenomena**

**Tanner Hoole, University of Utah**

Faculty Mentor Michael Vershinin, University of Utah

SESSION A 9:00-9:15AM

Sorenson, (2nd floor), Alumni House

Microtubules (MTs) are polymers of alpha-beta tubulin dimers and are the most rigid part of the cytoskeleton in eukaryotic cells. Extreme cold and heat are known to cause MT depolymerization. Several published reports showed that MTs stabilized with slow- or non-hydrolyzable GTP analogs or aldehyde-type cross-linking declined with increasing temperature in a small range of temperatures (20-35°C). Taxol-stabilized microtubule rigidity was reportedly temperature-independent. Our lab expanded on this by (1) expanding the temperature range from 0°C to as high as 50°C and (2) by testing single MTs polymerized using three different nucleotides: GTP with Taxol, GMPPCP with Taxol, and GMPCPP. Both GMPPCP and GMPCPP are non-hydrolyzable analogs of GTP, and GMPCPP is an established promoter of MT nucleation and growth which enables MT stabilization without Taxol. We observed systematic differences between persistence lengths in these three backgrounds but only statistically insignificant variation with temperature for each background. Specifically, we find that MT persistence length is log-normally distributed which not only obscures temperature variability of rigidity in our assays but also likely makes any such variability insignificant for cell function.

## **Controlling Harmful Algal Blooms Through Biomanipulation at Utah Lake Cristina Chirvasa, Utah State University**

Faculty Mentor Timothy Walsworth, Utah State University

## SESSION A 9:20-9:35AM

Sorenson, (2nd floor), Alumni House

The alteration of food web dynamics through addition or removal of species can have major impacts on the size-structure and abundance of other species. Changes in the size-structure and abundance of zooplankton, whose rapid life-histories allow for swift responses to food web changes, can readily impact prey quality and availability for fishes. Utah Lake has been the site of intensive common carp (*Cyprinus carpio*) removal efforts since 2009, experiencing a biomass reduction of over 75% at one point. Our previous research has linked reduction in carp biomass to changes in zooplankton species composition, but the impact on size-structure of individual taxa had not been examined. Here, we analyzed the body length of five common taxa, Calanoid and Cyclopoid copepods, *Daphnia*, *Diaphanosoma*, and *Ceriodaphnia*, from 2013-2020 using zooplankton monitoring data to examine their response to carp removal in Utah Lake. We found that all five taxa increased in size during periods of low carp biomass. Additionally, all taxa except *Daphnia* demonstrated a negative trend across years, suggesting other factors (e.g. lake level, temperature) are influencing zooplankton body size. Increased size during periods of lower carp biomass suggests a release from predation pressure by carp. Since zooplankton size can have important positive effects across different trophic levels, other zooplanktivorous fishes in Utah Lake, including the endemic June sucker (*Chasmistes liorus*), will benefit from the increased availability of energy-dense, larger zooplankton. Further, larger zooplankton are generally more efficient grazers of phytoplankton and thus may help limit the severity of harmful algal blooms. Future analyses will examine the

relationship between zooplankton size and algal bloom severity in Utah Lake.

## **LiDAR Analysis of a Potential Rockfall**

### **Source Area**

### **Kieren Condie, Utah Tech University**

Faculty Mentor Alex Tye, Utah Tech University

SESSION A 9:40-9:55AM

Sorenson, (2nd floor), Alumni House

Rockfall is an important mechanism of erosion in high-relief regions. Rockfall events pose significant risk to human life and infrastructure in such areas. Although many factors have been proposed to influence rockfall, including frost weathering, daily and seasonal temperature changes, mechanisms that trigger rockfall remain enigmatic. Better understanding rockfall triggering can aid with hazard mitigation. We report new monitoring data from a potential rockfall source area in Zion National Park, where previous rockfall events have damaged roads, trails, and buildings and harmed visitors. In the Park, a precariously balanced pillar of resistant Springdale Sandstone, entirely separated from an adjacent cliff by a joint, is located upslope of several historic buildings. We used terrestrial LiDAR to construct a 3D-model of the pillar in the form of point cloud data. The 3D-model allows for analysis of the geometry of the pillar, calculation of the center of mass, and exploration of scenarios for failure of the pillar due to displacement of the center of mass. Our new analysis, together with displacement meters that have been placed for continuous monitoring of rock pillar movement, provide the basis for higher-resolution prediction of rockfall failure mode. Our

approach may be exportable to other sites that are a high priority for rockfall mitigation.

## **Assessing the effectiveness of cattle enclosures on spring ecosystems in Escalante Lauryn Crabtree, Brigham Young University**

Faculty Mentor Richard Gill, Brigham Young University

SESSION A 10:00-10:15AM

Sorenson, (2nd floor), Alumni House

Springs are endangered ecosystems providing water and life to over 80% of plants and wildlife on the Colorado Plateau. The Bureau of Land Management and U.S. Forest Service implement the use of fencing called enclosures to exclude livestock from spring sites on the Grand Staircase-Escalante National Monument in effort to restore these ecosystems from years of grazing and damage. The purpose of this study is to determine if livestock enclosures are effective in protecting and restoring previously grazed spring ecosystems. In the summer of 2021, 56 springs contained within the Escalante Watershed in the GSENM were surveyed to document and observe livestock impacts on exclosed and unexclosed springs. I analyzed these data by comparing the erosion, nonnative plant abundance, and percentage of grazing of sites with exclosures to springs without exclosures, and in areas where livestock cannot graze. My results show that exclosed springs were able to have low levels of erosion, but that nonnative plant populations and grazing percentages were comparable to areas still actively

being disturbed by cattle. These results suggest that additional management strategies need to be implemented in order to restore damaged springs back to their natural, undisturbed status.

**Science and Social  
Sciences. Session A  
- Oral  
Presentations.  
Collegiate Room,  
Union**

**SESSION A (9:00-10:30AM)  
COLLEGIATE ROOM, A. Ray Olpin University  
Union**

**Herbal Tea Affect on APEH**



Faith Luk, Weber State University

Courtney Stechelin, Weber State University

Faculty Mentor Tracy Covey, Weber State University

SESSION A 9:20-9:35AM

Collegiate, Union

Sciences

Advanced Glycation End Products (AGEs) are proteins or lipids that become glycated as a result of exposure to sugars. Glycative stress is defined as a cellular status with abnormal and accelerated accumulation of AGEs and is associated with the development of diseases such as Alzheimer's, diabetes and various types of carcinomas. In order to combat the accumulation of AGEs, mechanisms that prevent glycative stress are of interest. Acyl Peptide Enzyme Hydrolase (APEH, also called Oxidized Protein Hydrolase (OPH)) is a dual function enzyme that catalyzes the hydrolysis of N-terminal acetylated amino acids and also degrades oxidized and damaged proteins as a result of AGEs. Building off recently published work showing that tea extracts can activate APEH/OPH, we hypothesized that herbal tea extracts may reduce AGEs by enhancing APEH activity. We have tested various types of herbal tea extracts to determine effects on APEH activity and have found extracts with both activating and inhibiting effects. Next we will test if activating tea extracts have a different effect on AGEs compared to inhibiting tea extracts. If successful, this work suggests that certain herbal teas could contribute to the prevention of diseases such as Alzheimer's, diabetes and various types of carcinomas by activating APEH and reducing the accumulation of AGEs.

## Communication Between Young Adults and Family Members with Type 2 Diabetes

Inakhshmi Rashid, University of Utah

Faculty Mentor Lisa Aspinwall, University of Utah

SESSION A 9:40-9:55AM

Collegiate, Union

Social Sciences

With a staggering 34.2 million Americans diagnosed with type 2 diabetes (T2D) as of 2018, T2D has become one of the most prevalent chronic conditions in the United States. Despite the growing prevalence of (T2D) and the general understanding of its preventable nature, most people susceptible to T2D still vastly underestimate their risk. In order to combat the rapidly growing rate of T2D correcting these risk perceptions is one possible intervention to help inspire preventative behaviors within individuals. While it has been established that having some level of knowledge about family history results in more accurate risk perceptions, there is still a key component missing to answer why this discrepancy in perceived and actual risk continues to persist. It is almost completely unknown how families talk about T2D risk and prevention and how these communications are related to subsequent risk perceptions and behaviors among young adults with a family history of T2D. To help fill this gap in understanding, this study focuses on young adults with a family history of T2D and seeks to understand how they view T2D, what their experience with the illness has been, and how these experiences have shaped their own perceived risk and intended preventative health behaviors. Of particular interest is how information concerning T2D is communicated between

affected and non-affected family members and whether this can have a positive or negative influence on risk perception and T2D prevention. To gather this information both qualitative interviews and a collection of surveys were used to allow participants the freedom to discuss topics most important to them, while also collecting information through pre-established psychological tools as complementary data. Having this knowledge can inform the design of public health initiatives to encourage more effective communication within families about T2D, leading to more realistic perceptions about T2D and one's susceptibility to it. Understanding which communication methods are most effective also has the potential to improve preventative health behaviors and lower the incidence rate of T2D among members of high-risk families.

## Evolution of Visual Opsin Genes in Caddisflies (Insecta: Trichoptera)

Ashlyn Powell, Brigham Young University

Faculty Mentor Paul Frandsen, Brigham Young University

SESSION A 10:00-10:15AM

Collegiate, Union

Sciences

Insects have evolved complex and diverse visual systems controlled by light-sensing molecules, known as opsins. Insect visual opsins group into three major clades based on wavelength sensitivity. These clades are known as long wavelength (LW), short wavelength (SW), and ultraviolet wavelength (UV) visual opsins. In addition, many insect species

possess a non-visual opsin, named Rh7, whose function is not fully understood. While opsins in some insect groups have been studied well, opsins in caddisflies (Insecta: Trichoptera) have never been studied. Here, we found and used 59 caddisfly opsin sequences across 27 genomes to determine the phylogenetic relationships of opsin genes in Trichoptera. We found that there has been a loss of the SW opsin in all the species of Trichoptera in this study. In addition, a copy of the UV and Rh7 opsins were found in some, but not all, of the species. Lastly, we found great diversity in the occurrence and phylogenetic relationships in the LW opsin among different Trichoptera species. The findings of this study provide insight into the diversity of opsins in caddisflies and form a basis for further research of the evolutionary drivers and complexity of visual systems in Trichoptera.

**Social Sciences.**  
**Session A - Poster**  
**Presentations,**  
**Ballroom, Union**

**SESSION A (9:00-10:30AM)**

**Location: Ballroom, A. Ray Olpin University**  
**Union**

**Climatic Variability and Mortality in Baja**  
**California Sur, Mexico**

**Isabelle Forrest, University of Utah**

**Abby Swanson, University of Utah**

Faculty Mentor: Shane Macfarlan, University of Utah

SESSION A (9:00-10:30AM)

POSTER A51

Human health and well-being are influenced by local climates. Factors such as increasing ambient temperatures and precipitation cause increases in human mortality. However, not all communities are equally negatively impacted by these factors and for some, these changes might produce positive outcomes (if only temporarily). For example, in a hot arid desert, seasonal rains, tropical storms, and hurricanes might produce positive outcomes on human health and well-being. Here, we seek to assess how climatic factors such as ambient temperature and tropical storms/hurricanes influence mortality in Baja California Sur, Mexico over a ten-year window. To do so, we extracted data on local climate, the presence of hurricanes, and mortality events using freely available data from Mexican government archives. Our analyses suggest that 1) both within and between years, hotter ambient temperatures are positively correlated with mortality events, and 2) within years, hurricanes and tropical storms are negatively related to mortality events. While we find a strong relationship between local climate and mortality, we suggest that not all climatic events that are construed as negative have negative impacts on human mortality.

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## **Walking After Dark: Illuminance Audit of the Pedestrian Environment**

**Ian Nelson, Southern Utah University**

## **Sabrina Waite, Southern Utah University**

Faculty Mentor: Jamie Spinney, Southern Utah University

SESSION A (9:00-10:30AM)

POSTER A52

It is becoming increasingly dangerous to be a pedestrian, especially at night. The purpose of this study was to perform an audit of sidewalk illuminance in the neighborhoods immediately surrounding Southern Utah University campus in Cedar City, Utah. A digital light meter was used to measure illuminance at street intersections and at regularly spaced mid-block locations. GPS coordinates were also collected to enable mapping of the data. Results suggest the pedestrian environment does not meet national lighting standards, which pose significant safety concerns for pedestrians after dark. Results also provide the information required for targeted visibility enhancements of both sidewalks and crosswalks.

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## **Social Connection as a Protective for Individuals with ASD and Social Anxiety**

**Lizzy Smith, Brigham Young University**

**Melissa Chavez, Brigham Young  
University**

**James Blood, Brigham Young University**

**Ethan Carter, Brigham Young University**

Faculty Mentor: Jared Nielsen , Brigham Young University

SESSION A (9:00-10:30AM)

POSTER A53

There has been a significant amount of research into social support as a protective factor against suicide. This information is important because it provides a coping mechanism for those with suicidal ideation and tendencies. All of that research has conclusively stated that social support is a protective factor against suicide, however, the greater portion of the research was completed in a neurotypical population. The scientific community lacks information and research on how protective social support is for populations of neurodiverse individuals. In attempts to answer this issue, we have gathered data from a socially anxious group, autistic group, and control group about social interaction and connection over a time period ranging from 6 weeks to 9 months. The individuals from each group were asked questions about their virtual and face-to-face interactions via a Metricwire survey that they received every night for the duration that they participated in the study. The results of both in-person and digital results suggest a weak correlation in support of a possible coping mechanism that the



more social connection one has, the less suicidal they will be (representing a downward trend). Nevertheless, it was highly dependent per individual as to whether they find social support to be a protective factor. Thus, from this measure it is shown that social support is a protective factor for those within the neurodivergent population, all though a weak one. This suggests that other protective factors may be more relevant to the neurodiverse population. Further research regarding this question must be completed to come to a scientifically relevant conclusion this question.

## **Oppression in Xinjiang: Rhetorical Parallels to the Causal Mechanisms Christina Anderson, Utah State University**

Faculty Mentor: Colin Flint, Utah State University

SESSION A (9:00-10:30AM)

POSTER A54

This paper focuses on the framings of ethnic conflict compared to expectations of political science explanations of the causes of such conflict. I used the example of Uyghur Muslims and Han Chinese in Xinjiang as narrated by Chinese and U.S. news media. Framings are statements used to portray the who, what, and why of an issue through the emphasis or exclusion of information to create a specific agenda. The theoretical expectation from social science is that ethnic conflict is a result of a commitment problem, which is where the two parties in the conflict cannot credibly guarantee the protection of the other. I performed a comparative content

analysis to uncover the framings that both internal and external actors are using, the differences between them, and their congruence with universal expectations from political science analyses of ethnic conflict. Findings of incongruence help us interpret narratives surrounding issues of ethnic conflict and respond to them more effectively through policy as there may be a mismatch between the rhetoric surrounding these issues and what is at the root of the conflict.

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## **Let's Talk About Sex...**

### **Mary Cannon, Southern Utah University**

Faculty Mentor: Kirsten L. Graham, Southern Utah University

SESSION A (9:00-10:30AM)

POSTER A55

Faculty Mentors: Dr. Kirsten Graham (Mentor), and Dr. Julie Johnson-Pynn, Psychology

This study aimed to look at the correlation between previous sex education received by the participants, the actual comprehensive knowledge of each participant, and then their attitudes towards sex positivity. The participants were directed to a survey that first tested their comprehensive sex education knowledge and then their sex positivity and finally some demographic questions. By comparing the results of participants using factor analysis the implications are likely to promote a more comprehensive, inclusive, and educational sex education program. Everyone should have the right to education and knowledge that allows them to make well-informed and good decisions for their health and well-being,

this including sexual health and wellness. Preliminary results will be presented, but we predict to see a positive correlation between comprehensive sex knowledge and sex positivity.

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## **Associations Among Maternal Trauma History, Prenatal Emotion Dysregulation, and Prenatal Sleep Quality**

### **Marissa Larkin, University of Utah**

Faculty Mentor: Sheila Crowell, University of Utah

SESSION A (9:00-10:30AM)

POSTER A56

Sleep is a key yet under appreciated mechanism that has a long-term impact on mental and physical health. Consequences of poor quality of sleep can include diabetes, heart attack, depression, and anxiety. Likewise, those who have faced traumatic experiences throughout their lifetime can experience mental and physical health setbacks, including poor sleep quality. One group of individuals who are especially prone to encountering poor sleep quality are pregnant women, especially those who have experienced trauma. Understanding the relation between maternal trauma history and prenatal sleep quality is vital because of its effects on fetal development, maternal health, and later parenting outcomes. More specifically, women's experiences with trauma have been linked to their sleep quality during pregnancy; however, limited research has examined if the relation between maternal

trauma history and prenatal sleep quality varies based on levels of prenatal emotion dysregulation. For instance, it may be that traumatic life experiences negatively influence sleep quality only among women who also have difficulties regulating their emotions. For us to address this gap in the literature, we had 86 women aged 19-38 who were enrolled in a longitudinal study on sleep, emotion dysregulation, and suicide risk during the perinatal period fill out a variety of self-report measures (F31MH124275, PI Kaliush). The participants completed self-report measures pertaining to traumatic life experiences (Traumatic Experiences of Betrayal across the Lifespan [TEBL]; Kaliush et al., unpublished), emotion dysregulation (Difficulties in Emotion Regulation Scale [DERS]; Gratz & Roemer, 2004), and subjective sleep quality (Consensus Sleep Diary [CSD]; Carney et al., 2012). We ran correlational analyses to investigate overall associations among the variables of interest. Hierarchical linear regression was used to test emotion dysregulation as a moderator of the predictive association between maternal trauma history and prenatal sleep quality. We hypothesized a negative correlation between emotion dysregulation and prenatal sleep quality, and a positive correlation between maternal trauma history and the mother's emotion dysregulation. We also hypothesized the relation between maternal trauma history and prenatal sleep quality would vary based on levels of prenatal emotion dysregulation. We hypothesized that high accumulation of trauma would be associated with poor sleep quality only among women who also experienced high emotion dysregulation. Similarly, we hypothesized that regardless of trauma history, women with high emotion dysregulation would have poor sleep quality. Understanding the relation between women's trauma history and prenatal sleep quality-and how this relation may differ

based on women's difficulties with emotion regulation-can inform intervention efforts that promote long-term maternal, child, and family health outcomes. Keywords: emotion dysregulation, pregnancy, sleep quality, trauma

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## **The Willingness to Pay for a Carbon Tax in Utah**

**Katie Tenney, Weber State University**

Faculty Mentor: Therese Grijalva, Weber State University

SESSION A (9:00-10:30AM)

POSTER A57

The purpose of this study is to estimate public acceptability in Utah of a carbon tax (CT) program to mitigate carbon emissions. In 2019, the Clean the Darn Air campaign proposed a ballot measure that would create a CT of \$12 per metric ton of CO<sub>2</sub> in Utah. Upon failing to gather enough signatures for the 2020 election, they have relaunched the campaign for a 2024 ballot initiative. A CT is a market-based solution promoted by economists to correct for a market failure that arises when the full costs of production and consumption (such as air pollution and climate change) are not reflected in market prices. A discrete choice experiment (CE) survey method is used to elicit preferences and acceptability of a CT program with alternative revenue use proposals that would address the regressive nature of the tax and environmental program funding, as well as estimating the dollar amount that, on average, a Utah resident

would be willing-to-pay (WTP) in the form of a CT imposed as a per gallon tax at the gas pump. Socio-demographic, economic, and environmental questions are included to identify how individual characteristics affect preferences. The survey was administered using Prolific, an online research platform. Other studies have used CEs to investigate CT preferences in individual countries, such as Australia, Turkey, and the U.S., but this is the first study focused on Utah, and thus is an important contribution to the literature and local policymakers. The survey data is analyzed using a multinomial conditional logit model to provide the probability of a Utah resident supporting a CT given its attributes and the individual's characteristics. On average, the results show that individuals would be WTP a per gallon CT of \$0.64, \$0.54 and \$0.46, if revenues are used to reduce grocery sales tax, cleaning local air pollution, and clean energy development, respectively. The results are quantitatively similar to what others have found in the literature.

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# **Impact of trauma exposure and posttraumatic stress symptoms on baseline self-reported safety behaviors versus observer-rated safety behaviors during the trauma film paradigm**

**Caleb Woolston, University of Utah**

Faculty Mentor: Anu Asnaani, University of Utah

SESSION A (9:00-10:30AM)

POSTER A58

Background: Post-traumatic stress disorder (PTSD) is a high-burden disorder marked by the tendency to engage in safety behaviors (SB) to avoid distress when an individual is facing fearful situations, which published literature suggests maintains their symptoms. However, work in other disorders (e.g., obsessive-compulsive disorder and generalized anxiety disorder) suggests there exists a discrepancy between observer-measured SB and patients' self-reported SB, creating a need to examine if this is also the case for PTSD, and whether this discrepancy exists in those who have simply had a traumatic exposure or is observed primarily in those with the presence of significant PTSD symptoms. We expect that the presence of increasing PTSD symptoms will be correlated with greater SBs in general and that those with PTSD symptoms will have a greater discrepancy between these two types of SBs. Methods: We used a between-subject design to examine an observer-rated measure of safety behaviors performed by participants exposed to distressing trauma-related videos compared to a self-reported measure of SB (Safety Behaviors Assessment

Form; SBAF) for three groups: individuals with no trauma exposure ( $n = 77$ ), those with trauma exposure but minimal PTSD symptoms ( $n = 50$ ) and those with trauma exposure and probable PTSD ( $n = 24$ ), (PTSD symptoms were measured via the Primary Care PTSD Screen-5; PC-PTSD-5). Results: Correlational analysis revealed probable PTSD is correlated to higher self-reported SB ( $r = .27$ ,  $p < .001$ ), but not observer-rated SB ( $r = -.04$ ,  $p = .69$ ). An analysis-of-variance revealed a significant discrepancy between self-reported and observer-rated SBs for those with probable PTSD compared to the other two groups, who did not show significant discrepancy in type of SBs ( $F(2,101) = 3.53$ ,  $p = .033$ ), such that those with probable PTSD reported greater self-reported SBs. Conclusions: Consistent with expectations, we found that individuals with probable PTSD showed greater discrepancies in types of SBs. Such a finding suggests SB may be more covert and internalized for individuals with PTSD, and therefore harder for observers to catch and report, underscoring the need for clinicians and researchers to ensure that they are utilizing adequate and validated self-report measures to capture SBs in individuals with PTSD.

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# **Elucidating the Mechanisms of Amygdala-Mediated Memory Enhancement**

**Carson Miller, University of Utah**

Faculty Mentor: Cory Inman, University of Utah

SESSION A (9:00-10:30AM)

POSTER A59

Emotional events are often better remembered than neutral events. Research suggests this is due, at least in part, to the amygdala and its interactions with other brain regions in the medial temporal lobe (MTL). Although there is broad support for the role of the amygdala and MTL in memory, little is known about how the amygdala differentially modulates recall vs. recognition memory. Prior work shows that direct electrical stimulation of the human amygdala enhances recognition memory and increases neuronal oscillations between the amygdala and downstream MTL regions. However, the effects of amygdala stimulation on recall memory and subsequent amygdala-MTL interactions is unknown. We are interested in examining the neural correlates of recall memory in the context of amygdala-mediated memory enhancement. This research aims to use previously collected data from experiments using depth electrodes to directly stimulate the amygdala in human patients to investigate whether brief electrical stimulation enhances recall memory and influences amygdala-MTL interactions (see Figure 1 in Supplement for task design). More specifically, this study explores the interactions between the amygdala and hippocampus and how these interactions may facilitate recall memory. To extract

behavioral data, each individual patient's free recall list of remembered images was examined, and it was determined whether the image they recalled was one they actually saw during the encoding phase and whether the image was associated with amygdala stimulation. Data analysis determined the ratio of images recalled that were associated with amygdala stimulation during encoding (see Figure 2 in Supplement), whether a clustering effect occurred, and the percentile of the stimulated images in the recall list. Finally, an analysis script incorporated permutation testing in Python on the original dataset to test the null hypothesis. For the uncompleted aspects of this project, the neural correlates of amygdala-mediated recall memory enhancement within the amygdala and hippocampus will be analyzed by examining the neural data for each patient's recall-memory trials and calculating the difference between the oscillatory activity for remembered images in the BLA stimulation condition vs. the non-stimulation condition. Additionally, the subsequent memory effects will be investigated to determine the neural states during encoding that predict successful recall during retrieval. Finally, the neural correlates of correctly recalled vs. incorrectly recalled items will be studied by examining the neuronal oscillations between the BLA and hippocampus during recall of an image that the patient saw during encoding vs. false recall of an image that the patient never saw during encoding. Together, the results of this project will clarify the involvement of the amygdala and amygdala-hippocampal interactions in recall memory, opening a path to future therapies for episodic memory loss.

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# **An In-Depth Analysis Of The Court System's Response To A Child's Psychological Well-being in Domestic Violence Custody Hearings.**

## **Ximena Franco, University of Utah**

Faculty Mentor: Annie Fukushima, University of Utah

SESSION A (9:00-10:30AM)

POSTER A60

In a child custody hearing where domestic violence is present in the household, court appointed evaluators are tasked to investigate the nature of the alleged domestic abuse, the offender and victims, and the threat of ongoing violence after the separation. Preceding research outlines both the court's tendency to assign joint custody and the psychological resources that are offered to the separating parents. If there exists the risk of domestic violence continuing or evolving after the separation, children who remain in joint custody situations are at risk of continued exposure to violence. The psychological burden that domestic violence may have on a child is of serious concern. Exposure to domestic abuse, in all its forms, negatively impacts the cognitive, social, and attachment development of children. Regarding hearing the victims' narratives and receiving psychological intervention, children remain to be an underrepresented demographic. An in-depth analysis of public court records and transcribed interviews with domestic abuse survivors were conducted to identify if the court system takes the child's psychological well-being into consideration, and if any form of counseling or intervention was court mandated to protect those children. Keywords:

domestic violence, child custody, psychological intervention,  
joint custody

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## **Test Retest Study of Multisensory Cue-Combination**

### **Jensen Koff, University of Utah**

Faculty Mentor: Sarah Creem-Regehr, University of Utah

SESSION A (9:00-10:30AM)

POSTER 61

It is known that our everyday senses, such as vision, hearing, self-motion, and others help us navigate everyday tasks, such as crossing the street. For example, we combine the sound of cars zooming past us with the visual cues of car lights to ensure that it is safe. But what happens when one of those senses is taken away? Are we less accurate in our navigation? Our research study aims to compare vision and self-motion cues and see what happens when one of those cues is taken away, leaving participants with one or the other to navigate. It also compares accuracy and reliability within and across participants, having them come back for a retest of data. This specific research is important, because it shows us how stable our metric is of cue combination, as well as improving the foundation of the field of multi sensory integration. Once we can answer that question and determine if this metric is stable, we can then ask further questions, such as how do people

combine, or weight, their senses during an orientation/navigation task?

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## **Exploring Associations Between Maternal Rejection and Insensitivity and Attachment Behaviors in Infancy**

**Caroline Martin, University of Utah**

Faculty Mentor: Elisabeth Conradt, University of Utah

SESSION A (9:00-10:30AM)

POSTER A62

Infants require high caregiver sensitivity to develop healthy socio-emotional skills. A mother's ability to be sensitive toward her infant's needs and cues is significantly influenced by the amount of sensitivity or rejection she receives from her own caregivers. Mothers who have experienced childhood adversity are more likely to misinterpret their baby's biological cues as signs of rejection of their care. This encourages the child's development of abnormal coping mechanisms so that they may better survive on their own, creating a loop of insecure attachment persisting across generations. In the absence of a trustworthy caregiver, infants may develop insecure attachment styles, such as avoidant or anxious attachment, through coping mechanisms to offset their lack of received caregiver sensitivity. Down the line, these children might perform poorly in school, abuse drugs and alcohol, and even choose peer groups with shared insecurities and trauma. It

is absolutely essential to understand how early caregiver relationships affect the development of an infant's socio-emotional skills since the trajectory of a child's life is highly impacted by these earliest attachments. Comparatively, Utah has the highest rate of mental illness in the US, according to SAMHSA's 2019-2020 National Survey On Drug Use And Health. There is a crucial need within our state to evaluate emotion dysregulation in order to halt this intergenerational cycle of hereditary psychopathology and poor developmental outcomes. My research sheds light on how the cycle of transmitted insecure attachment can be interrupted. This impacts current mothers, but it also impacts Utah's future generations. I aim to specifically examine sensitivity levels among mothers with high levels of emotion dysregulation to understand better the perceptions mothers develop towards their babies' behaviors depending on how much neglect they receive for themselves.

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## **Examining the Contributions of Social Neglect and Parental Sensitivity on Internationally Adopted Children's Behavior Problems**

### **Rose McLaughlin, University of Utah**

Faculty Mentor: Lee Raby, University of Utah

## SESSION A (9:00-10:30AM)

## POSTER A63

Children adopted internationally often encounter adverse environments prior to adoption that can potentially harm their development. For example, many internationally adopted children experience social neglect while living in institutional settings because there are not enough (Dozier et al., 2012). Social neglect, in particular, has been linked to high rates of behavior problems among internationally adopted children (Gunnar et al., 2007). The present research project tested the hypothesis that high levels of parental sensitivity act as a buffer and lower behavior problems among adopted children who experienced social neglect prior to adoption, while low levels of parental sensitivity exacerbate behavior problems among children with pre-adoption experiences of social neglect. The sample included 106 children (52% female) who were adopted internationally by families living in the United States. The children were primarily adopted from countries in Asia (68%), Eastern Europe/Russia (18%), and Africa (13%) when they were between 4.8 months and 37.8 months old. The results of the linear regression analyses indicated that children who experienced social neglect prior to adoption exhibited more behavior problems at Time 2, even after controlling for initial behavior problems at Time 1. However, there was not a significant association between social neglect and later behavior problems after controlling for parental sensitivity. In contrast, parental sensitivity was negatively associated with adopted children's behavior problems at Time 2 before and after controlling for social neglect prior to adoption. Contrary to our hypothesis, the association between parental sensitivity and later behavior problems was not moderated by whether the child experienced social neglect. These findings may help

inform the ways in which adoption agencies and service providers assist current and prospective adoptive parents prepare to care for their children.

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## **Increasing science self-efficacy and identity through participation in the Native American Summer Research Internship Program**

### **Nura Mostaghimi, University of Utah**

Faculty Mentor: Akiko Kamimura, University of Utah

SESSION A (9:00-10:30AM)

POSTER A64

The purpose of this study is to determine how participation in the Native American Summer Research Internship Program (NARI) at the University of Utah can increase science self-efficacy and identity among participants who are college students and of Native American heritage. Across the nation, individuals of American Indian and Alaska Native (AI/AN) descent represent a minority in health science professions. Their limited presence in these occupations has negative implications for the health of the greater Native American population. In order for health trends to improve amongst this population, the NARI program aims at increasing the number of AI/AN physicians, nurses, researchers, pharmacists, technicians, and additional bioscience professionals by



providing summer undergraduate research opportunities. The data for this project was collected as part of surveys given to participants of NARI. During the 2019 and 2022 program summers, two surveys were distributed prior to and following the NARI program to assess participants' knowledge and confidence with engaging in lab work, subject areas such as patient screening, data collection, and working with patients in clinical settings. There were 47 participants in total. The preliminary results indicate, participants developed a preference towards working with patients in a clinical setting, gained confidence in skills essential to clinical, translational and basic research and a vision of a career path they can pursue. Overall, this study is critical to understanding how undergraduate research opportunities such as NARI can empower cohorts of Native American undergraduate students to pursue professions in the biosciences and fill the gap in these careers such that the health disparities experienced by AI/AN individuals may be alleviated over time.

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## **Play Profiles in Toddlers at-risk for Autism across the Second Year of Life**

### **Jada Voth, University of Utah**

Faculty Mentor: Stacy Shumway Manwaring, University of Utah

SESSION A (9:00-10:30AM)

POSTER A65

**Background:** Early play skills are linked with several critical areas such as cognition, social communication, and language. Preschool-aged children with developmental delays often show differences or delays in their play development, including play that is less elaborative and less varied than their typically developing peers. However, less is known about play in the toddler years for children with or at-risk for developmental delays. This study examines the play of toddlers at 18- and 24-months of age with increased likelihood of autism due to significant language delays. **Methods:** Toddlers with language delay (LD; n=30) or typical development (TD; n=61) were drawn from longitudinal studies of early LD. Toddlers with LD were classified as ASD (LD-ASD; n=11) or non-ASD (LD-NonASD; n=19) after an evaluation at 36-months. A coding scheme was used to code play from a video-recorded 15-minute parent-child interaction with a standard set of toys obtained at 18 and 24 months. The variables examined included: total number of play actions, proportion of actions across four levels of play (indiscriminate, discriminate, functional/conventional, and symbolic), and diversity of play (number of different play actions and number of different toys played with). **Results:** Table 1 provides a summary of descriptive statistics of play at 18 and 24 months. In general, toddlers in the LD-ASD group engaged in fewer total play actions compared with toddlers with LD-NonASD and TD at both 18 and 24 months. Examination of the proportions of play actions across the four levels of play revealed that the LD-ASD group engaged in more Indiscriminate play (Level 1) compared to the LD-NonASD and TD groups. In contrast, toddlers in the LD-Non-ASD and TD groups showed proportionally more Discriminate and Functional/Conventional play. In relation to play diversity, toddlers in the LD-ASD group engaged in fewer different play

actions than toddlers in the LD-NonASD and TD groups at 18 and 24 months. Conclusion: Preliminary findings from this study suggest that toddlers with LD and particularly those with ASD outcomes engaged in less sophisticated and less diverse play compared to TD toddlers at 18 months, with this play profile persisting at 24 months. Although significant variability was observed, toddlers in the LD-NonASD group showed similar frequency and diversity of play to TD, a surprising result given the relationship between language and play development reported in the literature. Regardless of group, toddlers engaged in less indiscriminate play and more functional/conventional play from 18 to 24 months. Continuing to follow this LD sample over time to examine how play develops with age along with language and social communication will be important in informing a more complete picture of the play of toddlers with delays, with the goal of informing more targeted interventions.

## **The role of colonizers in 17th century fire regime and vegetation composition in South Africa's fynbos biome**

### **Topher Roller, University of Utah**

Faculty Mentor: Stella Mosher, University of Utah

SESSION A (9:00-10:30AM)

POSTER A89

South Africa's fire-adapted fynbos biome is one of the most biodiverse in the world, covering 90,000 km<sup>2</sup> along South Africa's western and southern coasts, and containing nearly

9,000 plant species- of which about 70% are endemic (Goldblatt & Manning 2002). For millennia, climate conditions and natural variability have controlled fire activity in South Africa's fynbos biome. However, the interpretation of these causes driving fire activity today has largely faded, favoring anthropogenic drivers. Aside from less dominant influence from early pastoralists, the entry of Dutch settlers to this area initiates a regimen of change onto Fynbos fire activity through a variety of mechanisms, including fire suppression, agricultural use, and the introduction of alien and invasive species to the existing extremely biodiverse landscape. The research proposed has the intention to explore the ecological indicators of these changes that colonizers brought to the area by investigating fire activity and vegetation change. To achieve this goal, I will focus on a coastal lake along the Southern Cape coast, Eilandvlei, by reconstructing fire history using macrocharcoal and analytical tools such as Char-Analysis, quantifying charcoal morphotypes based on physical appearance, or morphotype, and synthesizing existing pollen data from Eilandvlei and other nearby fynbos sites. I expect that changes in Fynbos vegetation during this time, with the introduction of species like *Pinus* and *Acacia* and the buildup of fuel from fire suppression, had a large influence on fire activity in the aftermath of Dutch settlement after 1652 CE. Furthermore, the frequency and intensity of fires in the area as a result from this change are important for understanding the impacts that humans had on the environment in general and are also relevant to modern day issues revolving around fire and land management. As such, reconstructing fire history is important in a broad sense because of the many ways it informs our understanding of past activities and future management operations. This project is currently ongoing, and though it is still not close enough

to attribute to colonialism, there are evident shifts in charcoal counts that give insight into the health of the system's fires before Dutch arrival. This research is projected to extend another semester, so it may not be entirely complete before UCUR, but is anticipated to be able to give some preliminary information to the research question, which is: how did colonization influence fire activity in the coastal fynbos system and how has fynbos vegetation changed because of anthropogenic pressures? Currently I hypothesize that periods of low fire activity (indicated by low counts of macrocharcoal and reduced charcoal influx) juxtaposed with a large and intense fire (indicated by high counts of microcharcoal and elevated charcoal influx) afterward will indicate the use of fire suppression techniques from the Dutch. I hope to be able to use my poster to convey changes in charcoal activity that reflect these possible techniques, and also provide a digestible description of the ins and outs of this research. I will also discuss morphotyping and hope to have enough of my own data to make some preliminary explanations about the vegetation changes.

**Social Sciences.  
Session A - Oral  
Presentations,  
Room 312, Union**

**SESSION A (9:00-10:30AM)  
Location: Room 312, A. Ray Olpin University  
Union**

# Out Like a Light? Maternal Attachment and Sleep Procrastination

Grace Carsey, Utah Tech University

Faculty Mentor Dannelle Larsen-Rife, Utah Tech University

SESSION A 9:00-9:15AM

Room 312, Union

Social Sciences

Sleep is foundational to mental and physical health across the lifespan. Poor sleep contributes to major health complications such as obesity, type-2 diabetes, heart disease, and depression in adulthood. Adult sleep behaviors may be shaped by early childhood relationships, especially attachment developed in infancy. Parental responsiveness around infant sleep practices influences attachment and sleep patterns (Sagie et al., 1994). Secure attachment forms when parents are consistently responsive to infants' needs, especially for safety and security. Infants who experience inconsistent or unresponsive parenting develop regulatory patterns that are anxious or avoidant, respectively, dimensions that underlie attachment. Attachment avoidance and anxiety are associated with clinically significant sleep disorders in infants (McNamara et al., 2003). While there is abundant research on the effects of insufficient sleep, there is relatively little known about the causes of sleep procrastination which is when individuals avoid or delay sleep. Attachment anxiety and avoidance, especially around sleep may be associated with avoiding and delaying sleep in adulthood. This study analyzed adults' attachment avoidance and anxiety and bedtime procrastination. Participants (N = 145) completed the Relationship Structures questionnaire to assess attachment with their mother or

mother-like figure while they were growing up and living at home, The Bedtime Procrastination questionnaire, and the While-in-Bed Procrastination questionnaire. Attachment avoidance and anxiety were significantly correlated with procrastination while-in-bed. Results suggest attachment avoidance and anxiety may be important for prevention and intervention efforts for sleep insufficiency and sleep procrastination and the associated mental and physical health.

## Enduring and Endearing Bonds: Maternal Personality and Child Attachment Tara Ciplin, Utah Tech University

Faculty Mentor Dannelle Larsen-Rife, Utah Tech University

SESSION A 9:20-9:35AM

Room 312, Union

Social Sciences

A child's attachment to their mothers can greatly impact many areas of development, and can significantly affect many outcomes throughout the lifespan (Rees, 2007). If an individual develops insecure attachment with their primary caregivers, it has been strongly associated to decrease academic performance (Arend, 1979) and to increase the likelihood of the child engaging in risky life behaviors through adolescence (Young, 2013). There is abundant research on the influence of maternal attachment on the development of attachment with their children (van IJzendoorn & Bakermans-Kranenburg, 1997), and there are many factors that influence how children develop attachment styles. The types of interactions children have with



their primary caregivers are especially important for the development of attachment. These interactions are determined by the parenting cognitions and practices which are a common formulation within parenting science, and are largely influenced by the personality of the parent (Bornstein, 2011). Attachment style development is dependent on the types of interactions the primary caregiver responds with to the infant's needs, so as the parent is more sensitive and responsive to the infant's cries the child will be more likely to develop a secure attachment style (Bowlby, 1979). Therefore, the relationship between maternal personality and child-mother attachment can help increase understanding on the development of secure attachment from children to their mothers, which is significantly related to a child's cognitive, social, and emotional development. Maternal personality is the emphasis of this study because the levels of particular personality traits that lead to a parent being more open, comforting, and increase the likelihood of the parent to be sensitive to infant cues of distress is what will influence the types of cognitions, practices and interactions that will develop the child-parent attachment style. Additionally, little is known about how maternal personality affects parent-child attachment within non-clinical participants. This study will review the literature on the development of attachment, and the effects of maternal personality traits on maternal-child attachment, and outcomes in children using the DSM-oriented scales. A target of 450 mothers with children who are three to five years old will be recruited for the Early Experience Study. Mothers will complete the Mini International Personality Item Pool (Mini-IPIP; Donnellan et al., 2006) to assess Big 5 personality traits: Extraversion, Agreeableness, Neuroticism, Openness, and Conscientiousness. Participants will also complete the

attachment Q-Sort (Waters & Deane, 1985; Vaughn & Waters, 1990) to assess mother-child attachment, and child outcome. It is anticipated mothers with lower extraversion, lower agreeableness, higher neuroticism, and less conscientiousness will have lower rates of mother-child secure attachment. Results from this study may be an important contributor in helping to understand how maternal personality influences the early parent-child relationship which is essential to improving child health and well-being.

## Infant Attachment Security as a Predictor of Academic Outcomes Among Children Who Experienced Early Adversity: A Mediation Analysis Examining Executive Functioning and Language Skills During Early Childhood

Caton Weinberger, University of Utah

Faculty Mentor Lee Raby, University of Utah

SESSION A 9:40-9:55AM

Room 312, Union

Social Sciences

Identifying predictors of classroom success is critical for supporting children's education. The first aim of the study was to examine whether infant attachment security positively predicts four cognitive outcomes among a high-risk sample of children: language skills, executive function, academic achievement, and cognitive ability. The second was to examine whether language skills and executive function in early

childhood mediate the association between infant attachment and both academic achievement and cognitive ability in middle childhood. The study is relevant to a debate concerning whether cognitive outcomes can be predicted by early attachment security (e.g., Sroufe, 1988; Van IJzendoorn et al., 1995). Work showing an association between attachment and both language skills and executive function (e.g., Bernier et al., 2015; Van IJzendoorn et al., 1995) which have been shown to predict academic success (Duncan et al., 2007) provides the rationale for our predictions. The body of research examining infant attachment security as a predictor of cognitive outcomes has almost exclusively focused on low-risk samples. To address this, our sample included 149 mother-child dyads referred to Child Protective Services due to allegations of maltreatment. Attachment was measured at 24 months using the Strange Situation Paradigm (Ainsworth et al., 1978). Receptive language and executive function were assessed at approximately 48 months using the Peabody Picture Vocabulary Test (Dunn & Dunn, 1981) and the Dimensional Change Card Sort (Beck et al., 2011), respectively. Academic achievement and cognitive ability were measured using the Woodcock-Johnson III test battery at 9 years (Mather & Greg, 2001). Attachment security did not significantly predict any of the proposed outcomes. These results carry implications for the direction of future attachment research. Receptive language and executive function predicted both academic achievement and cognitive ability five years later. This carries implications for programs designed to support the education of at-risk children.

## Sleep Quality & Early Life War Exposure:

# Insomnia Among Vietnamese Older Adults Using Data from the Vietnam Health and Aging Study (VHAS) Sierra Young, University of Utah

Faculty Mentor Kim Korinek, University of Utah

SESSION A 10:00-10:15AM

Room 312, Union

Social Sciences

“In peace and war, the lack of sleep works like termites in a house: below the surface, gnawing quietly and unseen to produce gradual weakening which can lead to sudden and unexpected collapse.”

-Major General Aubrey Newman (Follow Me, 1981, p. 279)

We aim to explore the associations between insomnia, early-life war-related stressors, recent life events, other environmental factors, and health outcomes in a sample of 2,447 older Vietnamese adults derived from the 2018 Vietnam Health and Aging Study (VHAS). Insomnia is one of the main symptoms of a variety of adverse health outcomes and sleep disorders but there is a knowledge gap in Low- to Middle-Income Countries (LMICs) like Vietnam. We find that most respondents report moderate to severe insomnia. In ordered logistic regression analyses we find that respondents who served in the military, and who experienced high levels of wartime violence stressors and wartime malevolent conditions experience more severe insomnia in late adulthood. These associations are mediated by the experience of recent severe PTSD and physical pain. This research makes valuable steps

toward understanding war's enduring scars and global efforts to understand, prevent, and treat sleep problems.



# Guided Tour I:

## 10:30AM - 11:30AM

Utah Museum of Fine Arts

Join us for a guided tour at the Utah Museum of Fine Arts. Share in conversation as you explore the UMFA's global collection that spans 5000 years of creativity. You'll also spend time with *Many Wests: Artists Shape an American Idea*, a special exhibition featuring contemporary work from five museums that highlights many voices—including Black, Indigenous, Asian American, Latinx, and LGBTQ+—who stake a claim in the American West.

*Registered Participants are able to sign up for the tours. Missed*

*the registration deadline and want to join a tour? Contact our@utah.edu by February 12, 2022.*



**Demystifying  
Graduate School  
10:45AM - 12:15PM**



# **Demystifying Graduate School and Tips to Conquering Imposter Syndrome**

Location: Alumni House Ballroom

In order for students to be successful in the Graduate School application process, they must understand the “hidden curriculum of academia” (Estein et. Al., 2022) including, what skills are needed for a competitive application, and where to find funding for research assistantships and fellowships. This workshop provides important information for demystifying the application process. In addition, the presentation seeks to acknowledge how intersectionality, first generation and other identities can impact feelings of imposter syndrome and affect

students' journey. Lastly, the presentation will address institutional supports that can support academic success and a successful transition to Graduate School.

Presented by Dr. Tiffany Baffour, Associate Professor, College of Social Work; Associate Dean, Graduate Equity, Diversity & Inclusion, The Graduate School

# **Session B: 10:45AM - 12:15PM**



**Architecture, Arts,  
and Humanities.  
Session B - Oral  
Presentations.  
Boyer Conference  
(2nd floor), Alumni  
House**

**SESSION B (10:45AM-12:15PM)**

**Location: Boyer Conference (2nd floor),  
Alumni House**

## **The Influence of Traditional Architectural Design on the Subconscious – An Analysis On Disneyland Using 3M-VAS Software**

**Cassidy Johnson, Utah Valley University**

Faculty Mentor Brandon Ro, Utah Valley University

SESSION B 10:45-11:00AM

Boyer Conference (2nd floor), Alumni House

Architecture

The purpose of this project is to explore the relationship between time and architecture. More specifically, how buildings constructed using the principles of classical architecture generally withstand the ever-changing trends and fads of the current era. To understand this phenomenon, we will compare buildings that were designed using classical and modernist theories of design. The purpose behind this comparison is that these two principles are diametrically opposed in their consideration of time as an influence on design. To illustrate how classical and modernism differ in how they view the past, present, and future we will look at one of the most popular theme-parks in the world as a case study; Disneyland. Within Disneyland there are examples of classical architecture, like the Magic Kingdom Castle, and examples of modernism like Tomorrowland. Using these structures along with biometric tracking tools, like 3M-VAS (Visual Attention Software), this study will explore how the use of sacred geometry, precedents, and cultural experiences influences how these structures withstand the passing of time. The VAS. will illustrate how classical architecture creates a more unified experience from the viewer's perspective. As individuals look



at images of Magic Kingdom's Castle this can help explain the hypothesis VAS will detect similar patterns of eye movement and individuals will spend more time viewing similar structures comparative to when they view images of Tomorrowland. Classical design principles create a more unified experience across viewers and elicits a stronger emotional response. This explains why classical design remains relevant over time compared to modernism. This occurs because the Magic Kingdom's castle is based on proper aesthetic principles and the castle elicits strong emotional response in humans, a phenomenon discovered by Vitruvius. Thus, it could be said that the castle of Disneyland is what brings the 'magic' into the Magic Kingdom.

## **The Effects of High School Design on Student Success**

**Charity Wardle, Utah State University**

Faculty Mentor Holly Murdock, Utah State University

SESSION B 11:05-11:20AM

**Boyer Conference (2nd floor), Alumni House  
Arts**

The central purpose of this research was to explore the effects that high school design had on student success. Society is starting to value mental health just as much as physical health, especially in our younger generations. It is important to consider the physical aspects of school design, but it just might be even more beneficial to focus on the impact of design on the mental health of students. Every student should feel valued by

society, but instead many students are being stigmatized by the physical state of their high school and community. The goals of this research are to help define student success, recognize the impact that thoughtful interior architecture and design can have on those occupying a space, gain perspective from high school administration and faculty, and bring awareness to the public about the importance of investing time and money into high school design. This research focuses primarily on three high schools in Utah from varying districts that have either a remodel or renovation in the past five to fifteen years. The literature review for this project played a large part in proving the significance and need for this kind of research dealing with educational design. The methodology for the research is categorized into two parts, online data, and physical data. The online data consisted of researching the statistics of each school before and after the remodel or renovation. The statistics dealt with quantitative data such as enrollment and graduation rates, test scores, and overall school ranking in the state. The online data also provided images of schools both before and after the remodel/renovations to give a visual that otherwise would be difficult to describe in words alone. The physical data consisted of interviews with administration members from each school. The interviews and images of the schools provide qualitative data, which in the field of interior architecture and design can arguably have more importance than quantitative data alone. Their interviews gave important insight into how the interior design and architecture of a building affect students as a whole. The outcomes of this research project yielded the following; the definition of student success is shifting from solely academics to a goal of helping students feel prepared for real-life challenges. There was little to no difference in the statistics from each school before and after the remodel/

renovation. There is always room for improvement in school design. There is little to no collaboration between faculty and administration during the design process involving schools. The new designs don't affect faculty motivation to come to school, as their motivation comes from helping students. Students take more pride in their schools when they are beautiful, unique, and innovative. Well-designed high schools provide greater opportunities for flexibility, collaboration, and socialization.

## **Shards of History: Piecing together the Early Qur'an Garrett Maxwell, Brigham Young University**

Faculty Mentor Kevin Blankinship, Brigham Young University

SESSION B 11:25-11:40AM

Boyer Conference (2nd floor), Alumni House

Humanities

The background of the earliest layer of the Quranic corpus remains shrouded on account of its laconic style and exegetical opacity. One of the most recent scholarly attempts to bring some measure of clarity is the Corpus Koranicum project that seeks to establish a chronology of Quranic surahs by quantitative means, and in doing so, provide a scaffolding on which to construct a linear narrative of the Quran's literary and theological development. Following the lead of scholars such as Nicolai Sinai, my research focuses exclusively on the very earliest group of surahs identified, known as the 'Early Meccan Group I,' comprising fifteen brief surahs that are

notoriously difficult to decipher. By resorting back to the most fundamental levels of analysis such as grammatical address, I have attempted to delineate a cogent sub-chronology of this earliest group of surahs, as well as identify and decipher any plausible hints as to the historical or biographical context of these revelations. Sinai has called for as much, acknowledging that the chronological ordering of the text based on quantitative considerations needs to be done in parallel with “the reconstruction of a plausible theological and literary trajectory” (Sinai, 2017). In this paper, I will lay out my findings. By attending to formal features of Quranic stylization and intratextual resonances, I will offer several possibilities for sketching in broad strokes the prophetological arc of the early Quran in a logically efficient manner. I will also propose that Q 102 evidences a rupture from the rhetorical style of the earliest layer of recitations, and triggers developments in charismatic prophecy that begin to emerge in Q 81, which build on the incipient prophetology of what I argue are the earliest accounts of prophetic commission in the corpus, namely Q 93, 94, and 108. Lastly, I will highlight the thorny questions that this study has raised which demand further attention.

**Engineering.  
Session B - Poster  
Presentations,  
Ballroom, Union**

SESSION B (10:45AM-12:15PM)

**Location: Ballroom, A. Ray Olpin University  
Union**

**Biomarker Discovery with GC-MS  
Emily Lym, University of Utah**

Faculty Mentor: Swomitra Mohanty, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B1

Tuberculosis (TB) is classified as a global health emergency that primarily appears in developing countries. For people in these countries, traveling to a medical clinic multiple times for diagnosis and treatment is often not feasible. Point-of-care diagnostics are necessary in order to appropriately respond to TB in these often impoverished communities. However, current diagnostic methods, including sputum microscopy, are time consuming and expensive. Notably, TB in children is especially difficult to diagnose and treat. Recent studies have identified several breath-based compounds, including methyl nicotinate, that could potentially serve as biomarkers for *Mycobacterium tuberculosis*. In an effort to verify and expand on these studies, breath samples from potential TB patients in Uganda have been analyzed using GC-MS techniques, including dual-column verification, standardized tests, and mass spectra interpretation. In a preliminary analysis of the data, we have found evidence supporting the correlation between methyl nicotinate and *M. tuberculosis* for adult patients but reveals no such relationship in child patients.

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## **Artificial micro-swimming at low Reynolds number**

**Ruba Alraqibah, University of Utah**

Faculty Mentor: Yong Lin Kong, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B2

Recent advances in microrobots have shown great promise

for a wide range of biomedical applications with the potential of enabling new aspects of medicine ranging from targeted drug delivery to minimally invasive surgery. However, locomotion represents a significant challenge for robots at the microscale. Swimming at the microscale is challenging due to differences in the fundamental physics between the microscale and macroscale. At the microscale, fluid dynamics are characterized by a low Reynolds number ( $Re < 0.1$ ) where motions are dominated by viscous forces rather than the inertial forces that dominate macroscale fluid dynamics. In nature, microorganisms have evolved swimming strategies to achieve locomotion in their low  $Re$  environment. Extensive development has focused on artificial biomimetic microswimming techniques such as the corkscrew and flexible oar methods. The flexible oar method is advantageous because of its simple design and actuation scheme – consisting of a flexible appendage whose oscillation produces propulsion. Here we explore the flexible oar approach of micro-swimmer designs at low Reynolds number. The work investigates propulsive characteristics of the micro-swimmer by experimentally evaluating the swimming of novel designs in a centimeter-scale setup in high viscosity oil that replicates the low  $Re$  environment. Experimental objectives include altering swimmer geometry to enhance locomotion characteristics, such as enabling reconfiguration in confined spaces and simplified actuation schemes, which could enable promising applications and technologies in healthcare. Ultimately, we anticipate that the development of low  $Re$  locomotion techniques for microrobots will have a significant impact in the field of medicine by enabling robots to navigate through highly confined and complex regions of the human body to perform medical tasks that address unmet clinical needs.

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## **Applying Statistical Distance Metrics for Dimensionality Reduction**

**Anna Bell, University of Utah**

Faculty Mentor: Jeff Phillips, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B3

At the University of Utah's Department of Chemistry, the Sigman Lab is searching for "hotspots," from experiments involving organic compounds and hundreds machine-learning generated descriptors of these compounds. A "hotspot" may be described as densely concentrated target reactions resulting from experimental asymmetric catalysis. In this project, we attempt to identify meaningful 2-dimensional feature spaces containing these hotspots. Using density measures, we score the "clustering" of highly reactive outcomes and their variance from all other outcomes within each pairwise combination of descriptors. The meaningfulness of the score is then determined using a permutation method which calculates whether a hotspot's distribution differs significantly from the overall distribution of outcomes in its respective 2-dimensional feature space.

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## **Statistical Shape Modeling of Sex-Based Pelvic Morphology**



## Bergen Braun, University of Utah

Faculty Mentor: Andrew Anderson, University of Utah

SESSION B (10:45AM-12:15PM)

### POSTER B4

Statistical Shape Modeling of Sex-Based Pelvic Morphology

Bergen Braun, Andrew Anderson, PhD, Penny Atkins, PhD

Hip disease affects many individuals and is detrimental to quality of life. It is generally understood that sex-based differences in hip shape may predispose individuals to certain hip diseases. Specifically, females are more likely to develop acetabular dysplasia, while males are more likely to develop acetabular retroversion and FAI. Further, there is a high prevalence of hip disease related morphology in male and female athletes, especially, acetabular dysplasia and FAI. However, many of these athletes do not have any pain or motion-related symptoms, which indicates that pathological morphology is not well defined. Previously, hip shape and morphology has been evaluated using 2D radiographic measurements, however, the pelvis is a complex shape and cannot be fully represented in 2D. We believe that 3D analysis of the pelvis shape will help us to gain a better insight into shape variation of the pelvis between males and females. Herein, we used 3D statistical shape modeling to determine the variation in male and female pelvis shape for a cohort including patients with hip disease, athletes, and control subjects. The mean male and female pelvic shapes will be used to evaluate the morphological variation of the pelvis and to identify the less obvious anatomical differences between male and female pelvis. Imaging data from fifty-five computed topography (CT) scans and 10 double echo steady state (DESS) magnetic resonance (MR) scans were acquired after obtaining informed

consent. The subjects were separated into five cohorts, based on diagnosis or level of activity. These groups included three patient groups based on diagnosis of dysplasia, retroversion or cam FAI, a control group, and a group of collegiate athletes. Each of these groups contained a mix of male and female participants (38 males, 25 females overall). The images were segmented to isolate the pelvic bone based on voxel intensities in the images, using Corview and Amira. Here, all three planes of the images were segmented, and a 3D reconstruction of each pelvis was generated, smoothed, and decimated. The 3D reconstructions of the pelvis were then used to create a statistical shape model using ShapeWorks. ShapeWorks provides methods to automatically place and optimize correspondence particle locations over subject-specific surfaces which provides correspondence across a population of shapes. From the particle locations, the mean shapes were generated for the entire cohort, as well as for all males and females and then for each group. The statistical shape model of the pelvis is still being finalized, but preliminary comparisons between males and females show large shape differences in superolateral iliac crest and posterolateral ischium (Figure 1), which aligns with previously described sex-based differences in pelvic morphology. Results will be finalized within the next few weeks and the analysis expanded to evaluate the five groups.

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# **IMU-based Reconstruction and 3D Visualization of Shoulder Movement**

## **Joey Brignone, University of Utah**

Faculty Mentor: Edoardo Battaglia, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B5

Proprioception is the perception of the movement and position of one's own body [1]. The purpose of this study is to improve the proprioception of the shoulder for stroke patients who have lost this sense. Sensory information that allows proprioception comes from Golgi tendon organs, joint and skin stretch receptors, and muscle spindles [2]. Proprioception deficits in the upper extremity are present in about 30% to 48% of stroke patients [1]. This proposed system in this study will measure shoulder movement through Inertial Measurement Units (IMUs) and visualize the movement in real-time. One of these sensors will be placed on the top of the shoulder and the other will be placed near the top of the upper arm, close to the shoulder. The two sensors contain gyroscopes inside of them to measure the rotation of the arm, as well as accelerometers that measure the force of gravity on the sensor. With the rotation angles and speed as the input, these sensors will determine the position and orientation of the arm. The data from this system will later be transferred from the receiving microcontroller to a haptic device to convey these movements to the patient. Before the device is designed, the position and orientation data of the shoulder will be visualized in a 3D model of a mannequin with the inertial sensors attached using Unity 3D. The accuracy of the model will confirm that the data are correct, and the sensors are appropriately capturing

the rotations and speed of the shoulder movement. As many patients who lose this sense are unable to regain complete control over their arms, haptic feedback could allow the user to at least partially restore this sense that was lost. This restoration of proprioception should lead patients to more accurate control over their movements. This system would create practical technology for those whose proprioception has been lost or debilitated, as the system should result in a low-cost solution. Proprioception restoration has been researched most commonly for hand movement, and some additional studies have been done on the lower extremity. Since the shoulder has not been the focus of many upper extremity proprioceptive studies, this will enrich the field of study for those creating an extensive system for aiding proprioception. While this research plan focuses on stroke patients, there are other diseases that cause proprioception loss including multiple sclerosis (MS), amyotrophic lateral sclerosis (ALS)/Lou Gehrig's disease, joint injuries, Parkinson's disease, and Huntington's disease. Medical research is the primary focus of this study, but other robotic applications may be pursued in the future, such as teleoperation or drones.

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  - [2] E. Battaglia, J. P. Clark, M. Bianchi, M. G. Catalano, A. Bicchi and M. K. O'Malley, "Skin Stretch Haptic Feedback to Convey Closure Information in Anthropomorphic, Under-Actuated Upper Limb Soft Prostheses," in *IEEE Transactions on Haptics*, vol. 12, no. 4, pp. 508-520, 1 Oct.-Dec. 2019, doi: 10.1109/TOH.2019.2915075.
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## **Enabling Entrained Flow Gasification of Blends of Coal, Biomass and Waste Plastic**

**Natalie Fink, University of Utah**

Faculty Mentor: Kevin Whitty, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B6

Gasification has been a successful technology used to convert coal to synthesis gas to produce hydrogen, fuels, and chemicals. The approach of using mixtures of coal, biomass, and plastic in high-pressure, entrain flow gasification (EFG) is a promising method to generate hydrogen through beneficial feedstocks with the potential for net negative carbon dioxide emissions. Despite EFG being a well-researched technology, further investigation is necessary to achieve reliable feed and operation of such mixtures as there are no established means to do so. The objective of this work is to evaluate the feasibility of coal-biomass-plastic slurries for high-pressure EFG. To assess flowability and separation patterns, the mixtures are evaluated for viscosity and phase behavior. A rotational viscometer was used to evaluate viscosity as a function of shear rate and temperature. Shear thinning behavior was apparent in all mixtures with the viscosity being heavily correlated to the coal concentration when above 25 wt%. In addition, viscosity decreased with an increasing shear rate but also with time at a constant shear rate. Increasing plastic oil decreased the viscosity by up to 20%. However, phase separation was present with plastic oil concentrations over 20wt%. Regardless of composition, the viscosity as a function of temperature

followed an Arrhenius-type relationship. Thermogravimetric analysis of the blended slurries is used to determine the moisture content, volatiles, and fixed carbon with ash as the residual. Additionally, it is a means to quantify the degree of mixture separation as the composition of separated phases. The favorable mixtures were successfully fed at roughly one ton per day with a progressive cavity pump at pressures greater than 300 psi for four hours. If separation and mixture instability during pumping is prevented, continuous high pressure of coal-biomass-plastic mixtures has been demonstrated.

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## **Association between Preoperative Venous Medial Collagen Fiber Configuration and Arteriovenous Fistula Development**

**Gabrielle Hadinger, University of Utah**

Faculty Mentor: Yan-Ting Shiu, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B7

Background: Arteriovenous fistula (AVF) is the preferred vascular access for hemodialysis but often fails to mature. AVF maturation requires venous dilation to allow increases in blood flow. The required venous dilation is likely affected by its microstructure. We hypothesized that the preoperative collagen fiber configuration index for the venous medial layer may determine venous dilation and hence AVF maturation. Methods: Veins were harvested from 84 kidney failure patients undergoing AVF creation Surgery at the University of Alabama

at Birmingham. These vein samples were obtained from near the anastomosis, where the vein and artery were surgically connected. They were formalin fixed, paraffin embedded, and sectioned into 5 $\mu$ m thin sections. The second harmonic generation (SHG) signals in these sections were acquired and analyzed for anisotropy index (AI) and orientation angle (OA). AI ranged from 0 (random fiber network) to 1 (completely aligned fiber network). OA ranged from 0 $^{\circ}$  (parallel to lumen) to 90 $^{\circ}$  (perpendicular to lumen). The fiber configuration index (FCI) was defined as the product of AI and sin(OA). AVF duplex ultrasound was performed post-op at 6weeks. Maturation was defined as the ability for dialysis at blood flow  $\geq$  300 ml/min for at least 6 dialysis sessions in 1 month and within 6 months post-op. Results: AVF maturation failure occurred in 15.5 % of these patients. The 6-week AVF blood flow was positively associated with the FCI (per 0.1 unit difference in FCI:  $\Delta$  blood flow = 131 ml/min; 95% CI, 8 to 254 ml/min;  $p=0.038$ ). The FCI of clinically matured AVFs was significantly higher than that of non-matured AVFs ( $0.13\pm0.07$  vs.  $0.08\pm0.05$ ,  $p=0.02$ ). Conclusions: Using the novel fiber configuration index, we have characterized venous medial collagen fiber organization in kidney failure patients. The FCI values appear to be associated with the likelihood of AVF maturation.

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## Effectiveness of Ski Wax Treatments in Sintered Ski Bases Using Different Temperatures and Application Methods of

## **Ski Wax**

**Lindi Hopkins, University of Utah**

Faculty Mentor: Jeffrey Bates, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B8

This project has focused on application temperatures and methods on sintered ski bases. It is believed that sintered bases have a higher porosity, allowing for better absorption of ski wax. There is a tradeoff with this method as it is more expensive to produce than extruded bases, sintered bases are generally reserved for higher performance skis, such as those used by alpine racers and heavily experienced hobbyists. Ski waxes have been formulated for different conditions of snow primarily cold, warm, and all-temperature waxes. While there has been extensive testing of these waxes' characteristics, there has not been extensive research on varying application methods and subsequent temperatures. This project delved into application methods and characterization of ski base samples using tribology, hardness, and contact angle testing to obtain data that can be translated into a more effective wax for consumers. Tribology measures the coefficient of friction between the base of the ski and the snow. Results from tribology testing can determine mechanical and thermal stability of the base, this testing could be enhanced by the use of a rheometer that tests coefficient of friction as a function of temperature. Hardness testing, specifically Shore A hardness, tests hardness as a function of temperature which can give insight into how ski wax hardens onto the base. Contact angle can be obtained using the Sessile drop technique, this can help describe the friction factor snow has on sliding velocity, surface



roughness, and surface pattern. There are many types of ski wax, recently a large number of brands have stopped producing fluorinated wax as there has been recent environmental concerns revolving around PFOA found in fluorinated waxes. This project utilizes waxes without PFOA to stay relevant with the current transition. In addition, there are many waxing techniques, which can vary from application temperature to the process in base treatment before and after waxing.

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## **The Effects of Transfection on the Differentiation of Stem Cells**

**Kaylen Lee, University of Utah**

Faculty Mentor: Tara Deans, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B9

Novel Genetic Circuit for the Differentiation of Pluripotent Stem Cells into Megakaryocytes. The lineage of all cell types begins with pluripotent stem cells. Pluripotent stem cells may differentiate into hematopoietic stem cells (HSC), which is the start of the blood cell lineage. One of the types of blood cells that derives from HSCs are megakaryocytes (MKs), from which platelets are derived. Platelets are anucleate cells that have important roles in clot formation and inflammation. This makes platelets an ideal vehicle for therapy, as none of the genetic engineering that is done to the precursor stem cells is transmitted to the engineered platelet product. By controlling iPSC differentiation, we can modify MKs to produce engineered platelets. The aim of this project was to design and build a

novel genetic circuit that directs mouse embryonic stem (ES) cells to differentiate into megakaryocytes (MKs). The genetic circuit was created by first amplifying the gene for HoxB4, a transcription factor, using PCR. The desired band of the amplified HoxB4 gene was inserted into a DNA vector containing Gata-1 through cloning. The genetic circuit controls the expression of HoxB4 and Gata-1 according to the cell state, allowing control of the cell's differentiation. The genetic circuit has not been successful, due to incorrect enzyme cutting and failed ligation. Success in the integration of a novel circuit into stem cells would allow for better understanding of how to direct stem cell differentiation, and therefore cell function. This leads to the ability to modify MKs to produce engineered platelets to sense or diagnose thrombosis.

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## **Design of a Low-Profile Arm-Swing Assistance Device**

**Jesse Prime, University of Utah**

Faculty Mentor: Edoardo Battaglia, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B10

Arm movement, specifically swinging, is an integral part of walking and movement for humans. Due to injuries and complex diseases, some people lose their ability to swing their arms correctly or entirely. Incorrect swinging movement or a lack of movement can negatively impact these people's lives and correlates to a high risk of fall and deteriorated gait

patterns. Research has shown that providing assistance to restore the movement of the arms closer to baseline conditions can facilitate better gait recovery. To address this need, a design is proposed of a sleeve-like device that can lift the arm and then release it to mimic the version of the arm-swing movement generated while walking. This would be achieved with a system of cables and pulleys that would be actuated by an electric motor. Additionally, the frequency of the generated arm-swing will be a function of the frequency of the movement of the legs, based on a transfer function relating baseline arm movement to walking patterns obtained from previous research. The design should demonstrate the arm-swing movement at a variety of frequencies while operating on a mannequin. This will display how the device can work at multiple walking speeds to swing an actual arm. Additionally, figures and data will be generated to show the device's performance and flaws. The data should demonstrate the device's ability to perform in situations comparable to real-life walking.

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## **A Reliable and Understandable PCB for Underfoot Loading Sensor Array Sampling and Bluetooth Data Transmission**

### **Grange Simpson, University of Utah**

Faculty Mentor: Kylee North, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B11

Despite lower extremity fractures being common injuries,

little is known about how patient weight-bearing behavior during rehabilitation contributes to long-term outcomes. Monitoring patient weight-bearing behavior using wearable sensors would allow clinicians to develop data-driven rehabilitation protocols. The objective of this study was to categorize gait parameters based on their ability to differentiate between patients with excellent and average long-term outcomes using Fuzzy Inferences System (FIS). Methods: Patients with closed tibial or bimalleolar ankle fractures were recruited in this 3 year observational study. An insole load sensor continuously monitored patient weight-bearing during rehabilitation. Longitudinal data was reduced to 93 gait parameters. Using the 1 year physical function outcome score patients were divided into two groups; Excellent Outcomes, and Average Outcomes. A FIS classified gait parameters based on their ability to differentiate between the two outcomes. Results: Of the 42 patients enrolled, 17 had both 1 year physical function outcome score (9 Average, 8 Excellent) and complete insole data (33.7+14.5 y/o, 60% female). The FIS revealed that gait parameters related to step count and active walking time best differentiated the two outcome groups. Weight-bearing magnitude moderately differentiated the two groups, and cadence and static loading variables did not have strong differentiation. All metrics with strong FIS classification had statistically significant two-tailed T-test results ( $P$ -value  $< 0.03$ ), while weak FIS differentiated groups did not. Conclusion: FIS proved to be a powerful tool for automated gait parameter classification due to its ease of implementation, adaptability, and intuitive graphical inputs. Although the data came from a pilot study with small patient size, FIS implementation indicated what gait patterns to focus on when designing

higher-powered future clinical trials to produce data-driven protocols.

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## **Timing Cues Enhance Intensity Discrimination at Low Electrocutaneous Frequencies**

### **Rebecca Urban, University of Utah**

Faculty Mentor: Jacob George, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B12

The long-term goal of this research is to create a prosthetic hand capable of restoring a sense of touch to users. In the United States alone, 1.2 million people suffer from limb loss [1], [2]. The current standard of care for individuals with limb loss is unsatisfactory; upwards of 50% of individuals abandon their prostheses citing a lack of sensory feedback from the prosthetic hand as a principal reason [3]. Electrocutaneous stimulation of the residual arm nerves can be used to provide sensory feedback to individuals with limb loss. A higher stimulation frequency results in a more intense sensation. We measured the Weber fraction — the minimum percent change in stimulation frequency that can be identified correctly 75% of the time — to describe how well electrocutaneous stimulation can convey the magnitude of tactile stimuli. We previously showed that the Weber fraction is much smaller at lower stimulation frequencies (17% change needed at 50 Hz vs 42% change needed at 100 Hz), which means that electrocutaneous stimulation

is more discriminable at lower stimulation frequencies [4]. Here, we show that this enhanced discriminability is due to supplemental temporal cues present at lower frequencies only. When stimulation intensity is decoupled from stimulation frequency, participants were still able to discriminate stimulation frequency at 50 Hz (when there is at least a 30% change) but were not able to discriminate stimulation frequency at 100 Hz. The ability to discriminate stimulation frequency based strictly on temporal cues only at 50 Hz implies that these tactile cues enhance discriminability selectively at lower frequencies. These results help deepen the understanding of the neural basis of tactile perception and can aid the development of sensitized prosthetic hands.

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# **A Low-Cost, Multiarticulate, Upper-Limb Exoskeleton**

**Nathan Wallace, University of Utah**

Faculty Mentor: Jacob George, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B13

The long-term goal of this research is to develop a low-cost upper-limb exoskeleton to aid individuals with neuromuscular impairments in underserved communities. About 800,000 people suffer from stroke each year, and up to 80% of them lose mobility or strength of one half of their body, including their arm. Commercial wearable exoskeletons can aid stroke recovery, but the high cost and the limited number of actuated degrees of freedom (DOFs) of these devices prevent widespread use. Here we present the design and development of a low-cost 3D-printed exoskeleton with five actuated DOFs. 3D-printed parts, digital servos, and a low-cost signal processing unit, are used to keep the overall cost below \$1,000. The exoskeleton design provides five actuated DOFs, including tripod and power grasps, wrist flexion, wrist pronation/supination, and elbow flexion. In contrast, commercially available exoskeletons provide only two actuated DOFs, tripod grasp and elbow flexion, at a cost of approximately \$30,000. This project provides proof of concept that upper-limb exoskeleton devices can be designed to have increased DOFs and a lower price. After further design validation for comfort and torque, this exoskeleton device could treat a variety of neuromuscular deficiencies in underserved communities.

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## **Analysis of the Effects of Moisture on the Electrochemistry of Molten Calcium Chloride**

**Marah Cragun, Brigham Young University**

**Rankin Shum, Brigham Young University**

Faculty Mentor: Devin Rappleye, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B14

Molten chloride salts have application in carbon capture and utilization, thermal energy storage, solar and nuclear energy production, liquid metal batteries, critical metal (e.g., Mg, Li) production, and other areas. Although these salts have great potential to aid in climate control as well as the long term energy crisis, there is still significant developmental work required within certain applications. One of the main issues with molten chloride salts is that impurities such as oxygen and moisture have a notable impact on the physical qualities of the salt, such as corrosion, melting point, and viscosity. Furthermore, moisture analysis within molten chloride salt systems is an unproven process with little precedent up to this point. This work explores analytical techniques for quantifying the moisture content in molten chloride salts. Electrochemical techniques, such as cyclic voltammetry, square wave voltammetry, and chronoamperometry, are performed to identify and analyze signals relating to hydrogen ions in molten  $\text{CaCl}_2$ . To correlate the hydrogen ion content to electrochemical response, different additions of  $\text{CaH}_2$  are made



within various samples of  $\text{CaCl}_2$ . Electrochemical signals from these experiments are investigated as a possible in-situ method of moisture determination.

## **The role of environmental factors in the deterioration of electrical properties in conductive nano-composites**

**Emma Bowden, Brigham Young University**

Faculty Mentor: David Fullwood, Brigham Young University  
SESSION B (10:45AM-12:15PM)

POSTER B15

Authors: Emma E. Bowden, Jacob D. Carter, Anton E. Bowden, David T. Fullwood. Wearable nanocomposite stretch sensors are an exciting new development in biomechanical motion-tracking technology, with applications in low back pain, knee rehabilitation, fetal movement tracking and other fields. When pulled under a strain (for example when applied to the skin of the lower back and stretched by a patient completing physical therapy exercises), the sensors exhibit a measurable electrical response, which can be used to analyze human motion cheaply and accurately. However, current sensor technologies have exhibited rapid deterioration in the form of increased electrical resistance if left stored in normal room conditions. The purpose of the present work was to evaluate the influence of several proposed environmental factors that could impact the deterioration of electrical properties of these sensors, including temperature, humidity, oxygen exposure, and light exposure. The electromechanical

performance of sensors stored under each condition were compared against control sensors over a period of weeks. Our results showed that the presence of oxygen and humidity in the environment where the sensors are stored is the primary cause of the deteriorating electrical properties of the sensors. Sensors that are kept in de-oxygenated or desiccated environments do not deteriorate over time. This understanding allows for long-term storage of the sensors, and assists in gaining a greater understanding of the internal processes at work within the nanoparticle-polymer matrix, particularly as they relate to the interface between conductive particles and the polymer.

## **Using Focused Ultrasound to activate**

### **Shape Memory Alloy**

#### **Aldo Chipana, Brigham Young University**

Faculty Mentor: Christopher Dillon, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B16

Nitinol is a shape memory alloy that demonstrates ideal characteristics suitable for the Biomedical Engineering Field. The rise in popularity of Nitinol has opened exploration in research for its use in medical procedures. This research will focus mainly on the use of focused and unfocused ultrasound waves commonly used in medical applications in junction with nitinol wire to noninvasively insert inside the human body and heat the wire above the activation energy threshold without causing any damage to the surrounding human tissue. The qualities that Nitinol exhibits are ideal because of its biocompatibility, corrosion resistance, and “shape memory”

properties. The challenge that arises while using Nitinol wire has been heating the wire above 46.0 degrees Celsius without causing damage to surrounding human tissue. By incorporating MRgFUS (Magnetic Resonance-guided focused ultrasound surgery) to precisely and noninvasively heat the alloy to above its memory temperature threshold. To show the memory effect of the wire, first it must be strained at room temperature (25 degrees Celsius), wrapped tightly around a rod in a coil shape in order to be inserted into a ballistic gelatin that mimics human tissue. Using the focused ultrasound transducer (with frequencies from 500 kHz to 1.8 MHz) the wire is heated inside of the ballistic gelatin recipient until it returns to its conditioned shape memory state. Thermocouples will measure the temperature of the gelatin to verify that it is within safe temperatures for human tissue. The experiment will run multiple lengths and diameters of Nitinol wire ranging from 1.0mm to 3.0mm for diameter that have activation temperatures between 30-50 degrees Celsius. Additional data will be collected using a commercially available, non-focused ultrasound transducer (frequency range= 1.3 MHz) which generates a more diffused heat region.

## **Characterizing Temperature-Dependent Tissue Properties for Focused Ultrasound Modeling**

**Caio Farias, Brigham Young University**

**Isaac Doddridge, Brigham Young**

## University

Faculty Mentor: Christopher Dillon, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B17

Background: High intensity focused ultrasound (HIFU) is a non-invasive, therapeutic technique used to ablate tumors. HIFU uses concentrated ultrasound waves that are absorbed by human tissue, increasing the local temperature and destroying the tissue. A successful HIFU treatment requires a patient-specific treatment plan that is generated before the therapy by clinicians. Computer modeling can assist clinicians by simulating HIFU treatments and predicting treatment outcomes. However, accurate computer simulations are currently limited due to unknown temperature-dependent properties. An assessment of these properties will make treatments safer and more efficacious. Purpose: Our research aims to experimentally determine temperature-dependent acoustic and thermal properties of porcine muscle tissue for more accurate HIFU simulations. Methods: Thermal properties we investigate include thermal diffusivity [ $\text{mm}^2/\text{s}$ ], thermal conductivity [ $\text{W/mK}$ ], and specific heat capacity [ $\text{J/kgK}$ ], Acoustic properties include the attenuation coefficient [ $\text{np/cm}$ ], and tissue speed of sound [ $\text{m/s}$ ]. To determine how each property varies with respect to temperature, tissue samples are immersed and allowed to equilibrate in a temperature-controlled water bath prior to measurements. The insertion-loss through-transmission technique is used to calculate the speed of sound and attenuation. Radiation force balance also calculates the tissue's attenuation coefficient. The thermal properties of each sample are measured with commercially

available thermal sensors (METER Group TEMPOS Thermal Property Analyzer and TA Instruments MCDSC) to analyze its change in temperature over time). Preliminary Results: Both acoustic and thermal properties have shown temperature-dependent variation in pork muscle, which has properties similar to human muscle tissue. We have found that attenuation, speed of sound, and specific heat capacity increase as the temperature increases. Current results with the temperature-dependence of thermal conductivity and diffusivity are inconclusive. Conclusion: The temperature-dependent thermal and acoustic properties we are measuring have the potential to improve simulations for HIFU treatment plans.

## **Design of a Thick Origami Flasher for Deployable Optical Space Arrays**

### **Jared Hunter, Brigham Young University**

Faculty Mentor: Larry Howell, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER 18

Purpose. LiDAR telescopes serve a variety of purposes in the scientific, agricultural, and defense industries. It is desirable for the telescope lens to be large in order to maximize the amount of light collected. However, the satellite must concurrently be compact enough for launch. Origami patterns show promise for application to achieve this duality, but panel thickness and structural stability require special modifications to the origami pattern. The purpose of this research is to determine if thick

origami patterns can be used for deployable optical elements in space telescopes. Can an origami-based mechanism be designed to create LiDAR satellites with sufficiently coplanar optical elements and a compact geometry which deploys to a larger diameter? Methodology. The research methodology for this project includes evaluating candidates, selecting an origami pattern, and implementing novel thickness accommodation techniques. The pattern selection process was guided by the work of Bolanos<sup>1</sup>. Project design constraints suggested the m5-h2-r1 flasher pattern (Figure 1) is the best candidate. The tapered panel thickness accommodation technique is used to overcome the challenges that arise when paper-thin origami patterns are applied to load-bearing mechanical systems. Angled features were placed between adjacent panels to create a coplanar surface (Figure 2). A one-meter prototype was made to validate the design and to test the mechanism's complex deployment kinematics. Significance. Our optimized origami flasher pattern provides a mode to achieve large deployed-surface-area-to-stowed-volume ratios. The mechanism deploys 0.559 m<sup>2</sup> of a thin sheet to a flat state with minor angular deviation (Figure 3). Thick origami mechanisms open the door for small satellites to collect the same amount of light as larger, fixed lens telescopes. Hence, the telescope performance remains constant while the satellite volume and weight are minimized.

1 Bolanos, D., Varela, K., Sargent, B., Stephen, M., Howell, L. L., & Magleby, S. P. (2022). Selecting and optimizing origami flasher pattern configurations for finite-thickness deployable space arrays. *Journal of Mechanical Design*, 1-11. <https://doi.org/10.1115/1.4055900>

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# **Interpreting the Clinical Significance of Movement Phenotypes among Patients with cLBP**

**Tyler Hutchinson, Brigham Young University**

**Spencer Baker, Brigham Young University**

Faculty Mentor: David Fullwood, Brigham Young University  
SESSION B (10:45AM-12:15PM)

POSTER 25

Lower back pain (LBP) is a serious condition with a lifetime prevalence as high as 39% . The objective of this study is to identify dominant spinal movement patterns (i.e., phenotypes) among chronic lower back pain (cLBP) patients and interpret their significance for clinical applications. We hypothesize the findings from this study will provide clinicians with important information which will facilitate more personalized treatment paradigms and result in improved efficacy of treatment paradigms. Data were collected from a group of 36 subjects with cLBP using an array of 16 viscoelastic sensors placed on each subject's lower back to detect skin stretch and spinal motion. Subjects were then instructed to perform 6 repetitions of 14 distinct spinal motions. Data were processed to detect the maximum change of resistance, a feature analogous to spinal range of motion. The subjects were then clustered into phenotypes using a k-means clustering algorithm. The clustering algorithm divided the subjects into 3 phenotype groups for each exercise. These phenotypes were then tested for statistically significant differences among patient-reported

outcomes, specifically using Oswestry Disability Index (ODI) scores, using one-way ANOVA and Student T-Tests. This research shows that subjects suffering from cLBP can be clustered into distinct movement phenotypes. Cluster 1 patients demonstrated reduced right lumbar flexion and left lumbar extension ranges of motion (ROM); Cluster 2 demonstrated reduced upper right extension; and Cluster 3 were typified by slightly below average lower right flexion. Subjects in the phenotype clusters 1 and 2 exhibited higher ODI scores than subjects in cluster 3. These observations confirm that cLBP patients have different motion characteristics, and that these differences may result from different sources or mechanisms of cLBP, or from different coping mechanisms, which also influence the patients ODI scores. The study is an important first step to providing clinicians with the tools to improve prescribed treatment paradigms through greater personalization and tailoring.



# **A Device for the Automated Measurement of Maize Stalk Stiffness and Strength**

**Jacob Chase, Brigham Young University**

**Jarom Harris, Brigham Young University**

**Samuel McKinnon, Brigham Young**

**University**

**Suzanna Gilbert, Brigham Young**

**University**

Faculty Mentor: Ken Hardman, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B20

Modern, high-yielding grain crops can be susceptible to wind-induced failure of the stalk. The development of grain crops that are both high-yielding and structurally robust requires automated testing of stalk strength. Stalk stiffness (flexural rigidity) has been shown to be highly correlated with stalk strength, and thus provides an excellent proxy for strength measurements (which are destructive). Flexural stiffness measurements enable strength to be estimated without causing damage, thus preserving the crop and enabling longitudinal studies. We present a new device that will autonomously collect stalk stiffness data at a rate of 1 second per stalk. Existing devices require manual manipulation and take approximately 24 seconds per stalk, which is much too slow for modern breeding and genetics studies [1]. The new device will displace grain stalks with a load cell; by measuring force and displacement, flexural stiffness can be calculated. The

device will be mountable to a vehicle that moves through the field. The automation of these measurements will enable many advances in the structural performance and development of crops. [1] Cook, D. D., de la Chapelle, W., Lin, T.-C., Lee, S. Y., Sun, W., & Robertson, D. J. (2019). Darling: A device for assessing resistance to lodging in grain crops. *Plant Methods*, 15(1). <https://doi.org/10.1186/s13007-019-0488-7>

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## **The Effect of Political Orientation on Self-Reported Electric Vehicle Adoption**

### **Intent in the United States**

**Jacob Huff, Utah State University**

Faculty Mentor: Antje Graul, Utah State University

SESSION B (10:45AM-12:15PM)

POSTER B21

This study collected representative US data (n=525) to fill the gaps in the existing research on consumer perceptions of light duty electric vehicles (EVs). Research questions regarding what affects consumer EV perceptions and adoption are explored. Specifically, which marketing appeals are most effective at influencing consumer perceptions? What role does charging price and parking convenience play when choosing charging parking spots? What barriers are most influential to potential customers? Is there a difference between owners and non-owners/ other demographics? What are current attitudes, perceptions, and knowledge/ knowledge gaps regarding charging innovations? How can light duty EV adoption be

predicted for the next 5, 10, and 15 years? These research questions are intended to fill the gaps in consumer EV research that have yet to address wireless charging, the effects of marketing messaging on EV perceptions, EV preferences, political orientation, and consumers' perception of the importance of EV characteristics. Prior research hasn't provided representative samples of the general US population, which this survey has done. This study also integrates novel moderators and mediators to extend prior findings that used closely related constructs.

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## **Selectively Stiffened Integrated Composite Hinge**

**Philip Klocke, Brigham Young University**

Faculty Mentor: Larry Howell, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER 22

The purpose of this research is to develop a method to create carbon fiber composites for use in origami-based antennae design through the selective stiffening of carbon fibers. Carbon fiber composites have often been used in manufacturing due to their light weight, yet high stiffness and tensile strength. Typically, this is achieved by reinforcing dry carbon fibers with epoxy, creating stiff, customized, complex surfaces. The use of carbon fiber composites in antenna design is encouraging for the same reasons, though with the added benefit of being non-

conductive and antiferromagnetic. In origami-based antennae, a primary drawback of using carbon fiber panels is that their high stiffness makes it difficult to fold without cutting and using rigid body hinges. This research seeks to understand the following question: How can epoxy be selectively applied to dry carbon fibers to create an integrated carbon fiber composite that exhibits both flexibility along hinge lines and stiffness across panel surfaces? Methods produced from this research utilize the flexibility of a dry carbon fiber mesh to create hinges. These hinges have been integrated into the antenna panels by applying epoxy everywhere except along the specified hinge lines of the dry carbon fibers. Two methods have been developed for the selective application of epoxy. In the first method, wax is applied along hinge lines to obstruct the flow of epoxy during compression and curing. The wax is later melted out. In the second method, epoxy is applied and compressed everywhere but along the hinge lines. By using a thin enough layer of epoxy, the epoxy does not flow into the hinge area and only cures in panel locations. Both methods demonstrate the feasibility of using carbon fiber composites in antenna design.

## **Reducing Uncertainty in Speed of Sound and Attenuation Measurements**

**Leanna Badger, Brigham Young University**

**Kaeli Monahan, Brigham Young University**

Faculty Mentor: Christopher Dillon, Brigham Young University

## SESSION B (10:45AM-12:15PM)

## POSTER B23

**Background:** High-intensity focused ultrasound (HIFU) is a non-invasive treatment that destroys tumors through thermal ablation. Unfortunately, HIFU waves are easily distorted by human anatomy, which causes the focus of the ultrasound to be blurred or misplaced. The tissue properties of speed of sound and attenuation are used to predict where the focus is. By minimizing uncertainty in speed of sound and attenuation measurements, focus predictions will be more accurate and help prevent healthy tissue from being destroyed. **Purpose:** In our study, we aim to isolate factors that impact speed of sound and attenuation measurements. Experimental factors include sample thickness, sample position, apparatus position, and water quality. Careful evaluation of these factors will help minimize experimental bias and error in HIFU predictions. Through-transmission experiments allow us to find the speed of sound through gelatin samples, which have properties like human tissue. Using an ultrasound transducer and hydrophone, we can measure the time delay in the pressure waves through water and gelatin. The difference in these time delays is used to find the gelatin's speed of sound and attenuation. Through analyzing which factors affect these property measurements and which do not, we hope to diminish the epistemic uncertainty in HIFU focus predictions. This will ultimately make HIFU more reliable and trusted for clinical applications. **Preliminary Results:** Initial testing suggests that factors contributing to measurement error consist of movement of the apparatus, the size of the specimen, and variation of gelatin sample composition. Adjusting the distance between the transducer and hydrophone also had an impact on measuring speed of sound. More accurate measurements of the length of

each gelatin sample produced more accurate speed of sound results. When comparing multiple measurements in several gelatin samples, speed of sound measurements varied from sample to sample, where some were consistently higher and others lower. This suggests a difference in the material itself, even for samples made from the same gelatin batch. Conclusion: HIFU is a revolutionary, minimally invasive treatment. However, our understanding of acoustic properties that help predict HIFU heating still has a lot of uncertainty. As we reduce variability in our experimental setup, we expect our results to show that uncertainty in acoustic property measurements is dominated by tissue heterogeneity. As error in speeds of sound and attenuation property measurements decrease, we hope that HIFU will become safer due to a decrease in collateral damage caused by this treatment.

## **Characterizing the Power Spectral Density of Essential Tremor**

**Noah Francom, Brigham Young University**

Faculty Mentor: Steven Charles, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B24

Introduction. Tremor is the most common movement disorder, and current treatment options are not satisfactory to many patients [1,2]. Whether tremor is caused by out-of-phase activity in a pair of antagonist muscles or by rhythmic activity in a single agonist is unknown. To answer this question, we

first had to characterize the spectral distribution of tremor power within the tremor band (4-8 Hz). The purpose of our research is to characterize the shape of tremor within the tremor band to better understand the muscle activity that causes tremor using experimental data from Essential Tremor patients. Methods. Surface electromyography (sEMG) signals were recently collected by Pigg et al. from the 15 major superficial muscles of the upper limb in 25 Essential Tremor patients as they held various postures representing common activities [3]. We calculated the power spectral density of each muscle's sEMG in each posture using Matlab's pwelch function. From these power spectral densities, we identified the most prominent peaks, determined their widths, and integrated over those widths to determine what percentage of tremor-band power was contained within the peaks. We identified for each instance the number of peaks, the width of each peak, the percentage of power contained in each peak, and the total percentage of tremor band power contained in all the peaks. Results and Discussion. The initial findings show that patients with severe tremor tend to have distinct peaks within the tremor band. Patients with less severe tremor have a greater number of instances where significant peaks are present in the tremor band. Many factors could cause this, one being that the power spectra of patients with less severe tremor tends to be of a broad-band nature. This suggests that tremor stems from a high concentration of muscular power at a frequency within the range of 4-8 Hz. Significance. This research aims to determine the spectral distribution of tremor in patients with Essential Tremor. From this characterization, we can analyze the power and phase differences between muscles. To determine the mechanical source of tremor, we can then find to what extent tremorogenic activity is represented by significant

out of phase tremor-band activity in antagonist muscles verses significant tremor-band activity in only one muscle. Understanding the source of tremor will allow us to better identify which muscles are most responsible for it and therefore where is best to intervene with tremor suppression techniques. Acknowledgements: This research was supported by NIH grant R15 NS087447-02.

#### References

- [1] Bhatia, K. P., et al. 2018. *Mov. Disord.*, 33(1).
- [2] Anouti, A., et al. 1995. *West. J. Med.*, 162(6)
- [3] Pigg, A. C., et al. 2020. *Clin. Neurophysiol.*, 131.

## **Robotic Harvesting of Cotton**

**Carson Townsend, Brigham Young**

**University**

**Josh Chapman, Brigham Young University**

Faculty Mentor: Douglas Cook, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B25

Authors: Spencer Stowell, Carson Townsend, Jeffrey Taylor, Jacob Swartz, Joshua Chapman, Carter Noh, Douglas Cook. Cotton bolls ripen and open at different times and there are currently limited options to autonomously harvest open cotton bolls without harming the un-opened ones. We are designing and creating a to-scale robot aimed at addressing this harvesting problem in a simplified model of a cotton field. We have analyzed and evaluated commercial cotton harvesting



methods and hand-held cotton harvesting tools to design and prototype a small scale, vacuum tube claw that can be used to target individual, ripe bolls. This end effector is mounted on an arm with two degrees of freedom, which allows for vertical motion up and down the plant as well as horizontal motion to select individual open bolls without damaging unopened bolls not yet ready for harvest. The arm is attached to a mobile platform to enable movement between plants. Cameras, a variety of sensors, and computer vision with OpenCV are used for navigating and identifying ripe cotton bolls. To design this robot, we created and tested prototypes for each subsystem in the model cotton field and then optimized and refined these prototypes based on our testing, resulting in at least two versions of each subsystem. The concept selection process, final concept, and the final prototype performance in the model cotton field will be presented.

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## **A Qualitative and Quantitative Description of Maize Stem Failure Initiation and Progression**

**Cole Dunn, Brigham Young University**

Faculty Mentor: Douglas Cook, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B26

Maize stalk failure often typically involves Brazier buckling, but the initiation of failure is poorly understood. In hollow

tubes, buckling is controlled entirely by cross-sectional ovalization, but the septated, pith-filled stems of maize stalk are more complex. To study the initiation and progression of the stem failure, we created a measurement system consisting of a camera integrated with a universal testing machine to simulate and document a 3-point bending test on individual stalks. The camera moves in parallel with the loading anvil, thus preserving a consistent viewing perspective. The universal testing machine triggers the camera and records the time stamp of individual photographs. This system collects force, deformation, and image data during the test. Custom software was used to track landmarks on the stem, thus allowing a consistent cross-section to be analyzed during testing, even if substantial rotation of the stalk occurs during bending. Results revealed two failure mechanisms. First, localized buckling of the stem increased mechanical stresses, which caused tissue failure and collapse. Second, tissue failure sometimes occurred spontaneously, which tended to initiate buckling behavior. Thus, whichever mode is weakest in a particular stalk will happen first, and the remaining mode will appear as part of the structural collapse process. This information provides a more complete understanding of maize stalk failure.



## **A novel sensor that provides simultaneous measurement of force, deformation, and location of force**

**Jordan Porter, Brigham Young University**

Faculty Mentor: Douglas Cook, Brigham Young University

## SESSION B (10:45AM-12:15PM)

## POSTER B27

At this conference we will present a novel sensor consisting of a cantilever beam with mounted strain gauges. Our patent-pending sensor can simultaneously measure the magnitude of an applied force, the location of the force, and the deformation of the beam caused by the force. The sensor uses a minimum of two strain gauges attached at different longitudinal locations along the beam. Additional strain gauges provide more sensitivity but do not affect the core functionality of the sensor. As a force is pressed on the beam, each strain gauge outputs a voltage proportional to strain, which we read into a data acquisition system. The beam requires initial calibration by hanging known weights at precise locations and recording the voltages from the strain gauges. The beam's dimensions and material properties, as well as the location of the strain gauges are required to make these calculations. Once the beam has been calibrated, it can measure a force, location, and displacement at any location along the beam. We will demonstrate the performance of the sensor and discuss challenges and future work.

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**Identification of Anomalous PurpleAir****Particulate Matter Sensors****Nathan Searle, University of Utah**

Faculty Mentor: Kerry Kelly, University of Utah

## SESSION B (10:45AM-12:15PM)

## POSTER B28

Particulate matter (PM) is a common air quality metric, as it can lead to a number of adverse health effects including asthma, heart attacks, and premature death. PM measurements are classified by particle size, and different size classes indicate different contaminants, such as dust and smoke. The PurpleAir low-cost PM sensors use a fan to draw air past a laser, and particles that pass the laser scatter light. The sensor then measures scattered light, which correlates to PM counts and mass concentrations. A fraction of the PurpleAir sensors installed since June 2021 appear to report different PM concentrations compared to sensors installed prior to June 2021. We identified potentially anomalous sensors by comparing the measurements of these new sensors with the measurements of sensors installed prior to June 2021. Each sensor installed after June 2021 was paired with an older sensor installed in the same geographic location to understand whether localized PM readings were consistent. Historical PM concentration readings from the summer of 2022 were collected from each pair of sensors and used to determine the likelihood of the new sensor reporting anomalous values. This process also identified a threshold for which a newly installed sensor could be flagged if PM counts differed significantly from the previously installed sensor in the region. Our preliminary results suggest hundreds of PurpleAir sensors that measured significantly higher PM counts for the smallest particle sizes (less than or equal to 0.3 microns in diameter), while simultaneously reading significantly lower counts for large particle sizes (greater than 1.0 microns in diameter). These differences also suggest that these new sensors may require different PM correction factors than those not exhibiting this

anomalous behavior. More research is needed to determine appropriate correction factors and the long-term prevalence of these newer PurpleAir PM sensors.

**Health and  
Medicine. Session  
B - Oral  
Presentations,  
Saltair, Union**

**SESSION B (10:45AM – 12:15PM)  
Location: Saltair, A. Ray Olpin University  
Union**

# Varying Mechanisms of Apoptosis Caused by Vpr Polymorphisms in HIV-1

Amanda Carlson, Brigham Young University

Faculty Mentor Brad Berges, Brigham Young University

SESSION B 10:45-11:00AM

Saltair, Union

Health and Medicine

Human Immunodeficiency Virus (HIV) is a virus that causes Acquired Immunodeficiency Syndrome (AIDS). Although it is one of the most studied viruses, no completely effective treatment or vaccine exists. Viral protein R (Vpr) is a multifunctional accessory protein that plays an important role in pathogenesis and replication in HIV, and it is believed to be a potential target for therapeutic intervention. Polymorphisms of Vpr have been shown to relate to dramatic variations in the development rate of AIDS. The Vpr mutants R36W and R77Q are associated with Rapid Progressor (RP) and Long Term Non Progressor (LTNP) phenotypes, respectively. Regular AIDS onset is 5-7 years for wild type (WT) virus, 3-5 years for patients with the RP Vpr mutant, and 10 or more years for the LTNP mutant. We have successfully shown that R36W enhances the ability for HIV to replicate, and it primarily relies on necrotic, highly inflammatory pathways for cell death. R77Q activates G2 cell cycle arrest more efficiently followed by apoptosis, a death mechanism with less inflammation. While the molecular mechanism of Vpr-induced apoptosis is known, it is not yet determined why point mutations in Vpr are changing apoptosis levels. HIV progresses into AIDS by depleting CD4+ helper T cells via chronic immune activation and inflammation, so we started investigating the mechanisms

by which the Vpr mutants change apoptosis levels by looking at release of inflammatory cytokines. We choose to quantify levels of IL-6, IL-10, IL-1 $\beta$ , TNF- $\alpha$ , and Type 1 IFN- $\alpha$  through a cytometric bead array. We saw that R77Q under-expresses pro-inflammatory cytokines, such as IL-6 and TNF- $\alpha$ , compared to WT and R36W. We also saw that R77Q has significantly higher expression of IL-10, an anti-inflammatory cytokine, compared to R36W. These results match our predictions and show that Vpr polymorphisms are related to inflammatory cytokines and immune activation. Functions of Vpr come from binding and modifying cellular proteins and enzymes. We will continue researching what molecular interactions change between Vpr mutants to better understand shifts in apoptosis levels. Vpr can be found intracellularly in the nucleus, cytoplasm, and mitochondria and extracellularly in secreted proteins and within virions. We plan to execute an experiment determining where Vpr is most concentrated by isolating these intracellular and extracellular components individually and using Western Blots to analyze the proteins contained in the samples. We hypothesize that differences in Vpr concentrations exist among Vpr mutants both intracellularly and extracellularly. Since bystander cells not infected by HIV were also found to be apoptotic, we also hypothesize that extracellular, secreted Vpr could be inducing this phenomenon. Through these experiments, we aim to discover more about the role Vpr plays in cell death by apoptosis and contribute to the existing literature exploring the importance of Vpr.

## The Effects of Probiotics on Group B Streptococcus (GBS) Rates in Pregnant Women



Tennessee Reed, Utah Valley University

Jake Reed, Utah Valley University

Robert Taylor Eakins, Utah Valley University

Faculty Mentor Michaela Gazdik Stofer, Utah Valley University

SESSION B 11:05-11:20AM

Saltair, Union

Health and Medicine

Group B Streptococcus (GBS) is a bacterial species commonly found in the vaginal tract of ~40% of pregnant women (Ho et al., 2016). GBS positive women are not sick, but can pass the bacteria to the infant during birth leading to possible complications for the child. GBS infection in the infant can lead to an increased risk of the infant developing sepsis, pneumonia, meningitis, and in some cases death (Ho et al., 2016). Pregnant women are tested for GBS using a vaginal swab when they are 36 weeks pregnant. According to CDC guidelines, patients who are GBS positive will be administered antibiotics 4 hours prior to delivery. Pre- and intrapartum antibiotics can adversely affect the development of the infant's immune system resulting in an increased risk for allergies, asthma, obesity, and eczema (Lamont et al., 2020). A hypothesized solution to combat GBS colonization in pregnant women is the use of taking probiotics prophylactically to prevent GBS from colonizing, and/or eliminating GBS after it has infected the vaginal tract. There have been few

(<7) clinical trials done on the effects of probiotics on GBS, with only two taking place in the United States (Aziz et al., 2018; Hanson et al., 2014). We hypothesize that if pregnant women take a probiotic every day beginning at week 28, they will have a decreased likelihood of contracting GBS. We have currently enrolled 9 pregnant women to participate in our study and are actively collecting data to address our hypothesis. Participants take a vaginal swab at week 28 to test for the presence of GBS. At that point probiotics are given to participants and one capsule will be taken daily until the end of their pregnancy. At 36/37 weeks of pregnancy, the patient's provider will perform another vaginal swab to test for GBS.

## Knowledge, attitudes, and practices of college athletes regarding pain management in sports injuries

Maren Clark, Utah Valley University

Faculty Mentor Heather Thiesset, Utah Valley University

SESSION B 11:25-11:40AM

Saltair, Union

### Health and Medicine

Misuse of opioids has reached epidemic proportions nationwide. Opioids can be essential when treating pain and

helpful when administered by a doctor in small doses for a short amount of time. A lack of following these criteria can lead to opioid dependence, addiction and often overdose. Utah has continually held the title for the highest index category for opioid usage for over a decade. While rates of alcohol, tobacco, and other illicit drug use are historically low, opioid misuse in Utah is becoming increasingly alarming. Despite official efforts to create interventions, campaigns, anti-opioid marketing, and prescription take back programs, the numbers continue to rise. Our study at Utah Valley University was a descriptive cross-sectional survey. The purpose was to assess attitudes, perceptions and self-reported practices of pain management following injuries incurred as an athlete. The Likert scale questionnaire given to student athletes asked questions regarding student's mental health in addition to their use of opioids to manage pain. Descriptive statistics were calculated on categorical variables, results from the survey compared differences in attitudes, perceptions, and practices by sex, age, and student status. Students often lacked information on alternatives to opioids in their pain management needs. Furthermore, survey results showed that there is room for educational interventions to ensure that injuries sustained in their athletic careers do not become life-long catalysts for chronic pain and addiction.

## Infertility in POMC Deficient Mice

Andrew Geddes, Utah Valley University

Faculty Mentor Zoe Thompson, Utah Valley University

## SESSION B 11:45-12:00PM

Saltair, Union

Health and Medicine

The pro-opiomelanocortin (POMC) gene is expressed in the hypothalamus and pituitary and its product is cleaved into several peptides including the melanocyte stimulating hormones ( $\alpha$ ,  $\beta$ , or  $\gamma$ -MSH), adrenocorticotrophic hormone (ACTH), and beta-endorphin. Alpha-MSH is involved in regulating appetite, sexual behavior, and melanin, while ACTH regulates secretion of glucocorticoids from the adrenal cortex. Humans who have a POMC mutation either produce an abnormally short version of POMC or are missing the protein completely and therefore lack these hormones. This has biological consequences including red hair and fair skin, early-onset obesity (due to severe hyperphagia), hypothyroidism, hypogonadism, and potentially infertility. We are interested in studying the infertility through a mouse model of hypothalamic POMC-deficiency. These mice also experience early-onset obesity and infertility. The testes and epididymides of these mice have been sliced and stained with hematoxylin and eosin, and then fixed to a slide. These slides will be placed under a microscope and imaged at 4x, 10x and 40x to determine the amount and condition of germ cells, somatic cells, and sperm. Some potential issues that could be identified through histology are tubular degeneration or atrophy, which causes shrinkage of the testis and loss of germ cells due to reduced testosterone and sperm levels. There may also be a disrupted blood-testes barrier due to obesity, which decreases the motility of the sperm. The results from this study will help us understand the causes of infertility in POMC-deficient mice, which may also lead to greater understanding on how to treat humans with infertility due to a POMC mutation.

**Health, Medicine,  
and Social  
Sciences. Session B  
- Oral  
Presentations.  
Sorenson, (2nd  
floor), Alumni  
House**

**SESSION B (10:45AM-12:15PM)**

**Location: Sorenson (2nd floor), Alumni House**

## Effects of Written and Verbal Gratitude on Nursing burnout

Taylor Crook, Brigham Young University

Hazel Ticas, Brigham Young University

Faculty Mentor Cody Reeves, Brigham Young University

### Health and Medicine

SESSION B 10:45-11:00AM

Sorenson, (2nd floor), Alumni House

Burnout among nurses is a worldwide issue, particularly in the wake of COVID-19 (Raso et al. 2021). Typically underpaid and over-scheduled, nursing professionals experience burnout-which often leads to lower job performances and even leaving the profession-at a very high rate. Much of this may be attributed to the stressful environment in which nurses work, forcing them to reckon with endless unpredictability, overcrowding, multitasking, and grief. Despite measures implemented to reduce nursing burnout, it remains a widespread problem. Studies reveal that 34.1% of nurses experience emotional exhaustion, 12.6% undergo depersonalization, and 15.2% feel a lack of personal accomplishment (Galanis et al. 2020). Past studies on professional burnout have identified tools to analyze aspects that lead to burnout and how to identify burnout symptoms. One such model is the Job Demand Resource Model (JDRM) developed by Bakker and Demerouti (2007) which outlines factors within the workplace that are either a “demand” or a “resource” for employees. Having both high demands and low resources-common in the nursing workplace-leads to higher symptoms of job burnout: depersonalization, disengagement,

and exhaustion. These burnout symptoms are already measurable among nursing professionals at concerning rates (Galanis et al. 2020). To solve this issue, healthcare institutions are implementing strategies such as authentic leadership; professional development opportunities; and most prevalently, support groups to teach nurses how to cope with burnout symptoms (Converso et al. 2015). While there is a consensus that positive and healthy environments are most effective against nursing burnout (Fitzpatrick et al. 2019), none of the current strategies involve the patient-a key component of a nurse's professional environment-as a possible solution to the problem. This study focuses on the impact of patient gratitude on nurses' burnout levels, alongside the perception of depersonalization.

## **Modeling Stress Levels in Complex Scenarios through Random Behavioral Patterns**

**Victoria Smith, Utah Tech University**

**Jacob Atkinson, Utah Tech University**

Faculty Mentor Vinodh Chellamuthu, Utah Tech University  
Social Sciences

SESSION B 11:05-11:20AM

Sorenson, (2nd floor), Alumni House

The way in which humans experience stress differs across different situations and schedules. When given a group of people working together to solve a problem, accumulated stress can affect their overall productivity in completing their work.

We seek to understand how to use differential equations and various models to show how stress affects the overall productivity of two groups of astronauts. We use a modified Reservoir model, as well as a Job Demand – Resources model to quantify the impact accumulated stress has over time. Our simulation results will help display the importance of measuring stress levels using different complex scenarios.

## **Back in Person: Attachment to Campus, Social Isolation, and Loneliness as a Result of COVID-19**

**Kennedi Childs, Southern Utah University**

**Angelica Jaegle, Southern Utah University**

Faculty Mentor Britton Mace, Southern Utah University

Social Sciences

SESSION B 11:25-11:40AM

Sorenson, (2nd floor), Alumni House

As the world rebounds from what is considered one of the most isolating pandemics in human history, it is crucial now more than ever to investigate how this isolation has impacted people (Marazziti & Stahl, 2020). Research has indicated a predominant factor in preventing depression or anxiety is feeling a sense of belonging (Mellor et al., 2008). Research also indicates that attachment to a place can impact feelings of belonging (Escalera-Reyes, 2020). Relationships exist between subjective characteristics of the environment and an individual's attitudes and actions in relation to that environment. These characteristics are linked to an



individual's satisfaction, behavior, and performance within that specific environment (Carlopio & Gardner, 1992). The purpose of the present research is to assess the relationship between place attachment and perceived social isolation in students returning to campus at Southern Utah University. Approximately 200 lower and upper division students taking a psychology course completed Likert-type scales measuring perceived social isolation (Cornwall and Waite, 2009), and place attachment measures assessing affective commitment (Meyer and Allen, 1997), satisfaction (Hackman & Oldham, 1975), intentions to leave (Cropanzano et al., 1993), and the scenic beauty of the campus (Elias, et al., 2013). It is hypothesized there is a relationship between social isolation and aesthetic ratings of campus (scenic beauty), leading to greater or lesser satisfaction with the university. Satisfaction also mediates the relationships between affective commitment to the university and intention to leave/remain. In essence, social isolation and scenic beauty are expected to have an indirect effect on commitment and turnover intentions through satisfaction with the university. Descriptive, correlational, and reliability results will be presented as well as SEQ goodness of fit statistics assessing the hypothesized model. Perceived social isolation is related to how attached one feels to their university and has implications for student satisfaction and retention. Keywords: Perceived isolation, COVID-19, place attachment

## **A phenomenological inquiry of the applicability of Neurologic Music Therapy training for a student music therapist**

## **Katie Fairbourn, Utah State University**

Faculty Mentor Allison Fox, Utah State University

Social Sciences

SESSION B 11:45-12:00PM

Sorenson, (2nd floor), Alumni House

Neurologic Music Therapy (NMT) is a popular training available for various disciplines that teaches how the manipulation of different musical elements can achieve specific neurologic functions. There is a strong body of research proving NMT's effectiveness, but there is a lack of information when it comes to the value of the training for a music therapist. This makes it difficult for music therapy students and professionals who are trying to decide if the NMT training is a right fit for them personally. My phenomenological inquiry of NMT's applicability for music therapy will address this question by providing personal clinical experiences in which NMT was used, and a comparison of my own therapeutic practice before and after taking the training. Although my focus is specifically on NMT's applicability within music therapy, I will also emphasize throughout my presentation the many other different clinical settings (physical, occupational, speech, and other therapies) that the NMT training is available for. Through my presentation, participants of various different disciplines will gain a personal understanding of NMT, along with a greater knowledge of the capabilities of using music in a clinical setting and the vast applications of music therapy.

**Humanities.**  
**Session B - Oral**  
**Presentations,**  
**Room 312, Union**

**SESSION B (10:45AM – 12:15PM)**  
**Location: Room 312, A. Ray Olpin University**  
**Union**

## Lost in Translation: The Complexities of Translation Theory and Colonialism in *Inés del alma mía*

Saydi Anderson, Westminster College

Faculty Mentor Chris LeCluyse, Westminster College

SESSION B 10:45-11:00AM

Room 312, Union

Humanities

This past summer, under the sponsorship of an Honors College Independent Summer Research Grant, I explored the relationship between English and Spanish in *Ines Del Alma Mia*. My textual analysis builds upon a close-reading of the text in the two language, and is grounded in translation theory – the deliberate yet culturally influenced decisions that translators must make when translating. I argue that although *Inés del alma mía* might be new to readers, its plotline is one that has been passed down historically for generations: the story of conquest and colonization. This shared social knowledge simplifies the translation process, allowing a literal translation of the original text. Even further, I illustrate how we cannot create what we cannot first imagine, and what we can imagine comes from our backgrounds and social context; the deliberate decisions made in the translation process merely magnify the all too familiar and accepted glorification of the conquest of native tribes.

## A Solution to Kripke's Puzzle about Belief

## Lexi Andrist, Southern Utah University

Faculty Mentor Gretchen Ellefson, Southern Utah University

SESSION B 11:05-11:20AM

Room 312, Union

Humanities

In the philosophy of language, a widely discussed problem is that of reference. Although there are many problems that arise when speaking of reference, the one I will be discussing is a problem that arises when a speaker is utilizing a word and its translation (in a different language) in the same sentence, which leads to seemingly referencing multiple objects but in actuality the individual is only referring to one object, which can lead an individual to hold contradictory beliefs. In “A Puzzle About Belief,” Kripke proposed a puzzle in which a person named Pierre believes that the city of London is ugly, but that the city Londres (the French translation of London) is pretty. This is a problem, because London and Londres are the same city, and both names are denoting the same city; which leads to the problem of contradictory belief. One of Pierre’s beliefs must be false, and Kripke holds we cannot know the answer of which is false and cannot solve the puzzle. I will argue that this puzzle can be solved through the utilization of individual’s idiolects (individual dialects). I argue that by utilizing idiolects one can create a framework in which belief should be based; this framework being that how we theorize one’s belief of things should be based *de dicto* (on the word used to present the object) rather than purely *de re* (the object itself). Following the establishment of how one’s belief should be based, I will disprove the principle of translation (which states that if a statement is true in one language, it should also be true in another language) through the use of idiolects; as

all individuals use words differently, which makes the *de dicto* meaning of the words change, thus circumventing the problem that Kripke is posing. Finally, I will address some potential objections to my solution. These objections will be regarding the use of idiolects being considered insignificant, as well as contexts in which is the principle of translation can and should be utilized.

## **A History of Spanish Language Congregations in the LDS Church Paul Guajardo, Brigham Young University**

Faculty Mentor Ignacio Garcia, Brigham Young University

SESSION B 11:25-11:40AM

Room 312, Union

Humanities

Guillermo Balderas is a key figure in Latter-day Saint history who is virtually unknown. He was a Mexican, refugee, bishop, and missionary. While he faced racism, he remained faithful to the LDS Church and worked throughout his life to change a hegemonically white institution to better serve Latino saints. My work examines Balderas in context and argues that his life is exceptional and will expand historians' understanding of Latino leadership in the early-modern LDS Church. This research answers the question: how should we write about the roles that people of color played in the 20th century?

This project examines why important people of color ("the other") are not discussed in American religious history. Traditionally, the space has been occupied by "great men." This idea has rightly been challenged by modern schools of thought;

indigenous studies, women's studies, and queer studies are examples that challenge the traditional narrative. I argue the problem historians face is not one of exceptionalism but rather of scope. There are many great people who have been forgotten for not fitting a certain profile. Guillermo Balderas' contributions to his community and church make him an exemplary individual, and important in the historiography of Latino leaders in American religious movements. This project places will consider how we write about the expansion of the LDS Church into Latino communities, how historians write about Latino Christians in the United States, and the impact that Guillermo and other Latinos had on the LDS Church. My research and presentation draw from several primary sources, namely his papers and unpublished autobiography, as well as secondary sources from historians such as Elisa Pulido, Aron Sanchez, Jorge Iber, and Ignacio Garcia. Ultimately, it provides the audience with an example of a non-white hero and expands Mormon historiography by examining "the other" in history.

## Tool-Assisted Induction of MITSL Languages

Jacob Johnson, University of Utah

Faculty Mentor Aniello De Santo, University of Utah

SESSION B 11:45-12:00PM

Room 312, Union

Humanities

Model-theoretic phonology seeks to formally model natural language as a mathematical system. This approach allows for theoretical arguments about the learnability of natural language patterns, addressing questions of how much input

is needed, and whether models can be constructed from unlabeled, mostly positive examples (Heinz et al, 2011). The formal language theory behind model-theoretic phonology has also enabled grammatical inference algorithms, which derive grammars from a sample by making assumptions about the complexity class of the language represented (De la Higuera, 2010). Recent work in this subfield of computational linguistics has revealed that phonotactics, among other natural-language phenomena, can be characterized by subclasses of regular languages. In particular, De Santo & Graf (2019) propose a subregular class of Multiple Input-sensitive Tier-based Strictly Local (MITSL) languages for phonotactics, combining the strengths of sensitivity to local structure when projecting to tiers with the ability to encode multiple tiers of constraints. De Santo & Aksënova (2021) propose an algorithm to learn a MITSL grammar from positive language data. Here, considerations regarding the implementation and use of this MITSL algorithm are presented. The algorithm is evaluated on a series of test languages, including simplified corpus data (Aksënova 2020): the learned grammars are used to generate new members of the learned language, and these are classified as to whether they belong to the target language. Importantly, generated strings that do not belong in the target language are directly traceable to particular subsequences missing in the sample. These results show that the proposed algorithm functions as theoretically predicted, demonstrating the learnability of phonotactic constraints from positive data. The implementation of the learner is furthermore valuable to researchers interested in experimenting with MITSL grammars.



**Humanities.**  
**Session B - Oral**  
**Presentations,**  
**Conference Room,**  
**Sill Center**

**SESSION B (10:45AM – 12:15PM)**  
**Location: Conference Room, Sill Center**

## “A bird with a broken wing”: Disability and Normality in Kate Chopin’s *The Awakening*

Maren Archibald, Utah State University

Faculty Mentor Jared Colton, Utah State University

SESSION B 10:45-11:00AM

Sill Center

Humanities

Kate Chopin’s “*The Awakening*” depicts Edna Pontellier, a married woman attempting to cast off the disciplinary shackles of the nineteenth century through a personal rebirth. As theorized by the French philosopher Michel Foucault, discipline is more than controlling behavior; it is about optimization of the body. The three pillars of discipline – hierarchical observation, normalizing judgement, and examination – contribute to the view of the body as “a site of normalization.” Lennard J. Davis, a renowned disability studies specialist, theorizes that in any novel can be found “a kind of surveying of the terrain of the body, an attention to difference.” In *The Awakening*, Chopin often describes Edna’s bodily experiences, from exhaustion to passion to boredom, creating a view of Edna as a disabled body. Disability metaphors, as Davis states, are used to “represent limitations on normal morals.” The language surrounding Edna’s awakening is marked by disability metaphors that function to polarize her from the moral norm. In addition, the observation Edna is subject to characterizes her struggle as one against control and examination, not just expectation. Applying Foucault’s three pillars of discipline and Davis’ reflections on normality and disability, I argue that Edna’s position outside the norm is exaggerated by the disability-coded language used to describe

her body and behavior, and that it is not the societal expectations themselves against which Edna rebels, but rather the suffocating rules of discipline and normality that surround them. Audience takeaways will include an increased awareness of the subtle presence of disability metaphors in early feminist literature and an understanding of how disability perpetuates standards of normality.

## A Comparative Analysis of Barefoot Gen

Taylor Rae Connor , Utah Tech University

Faculty Mentor Brooke Hotez , Utah Tech University

SESSION B 11:05-11:20AM

Sill Center

Humanities

This research presentation will provide a comparative analysis of the animated movie Barefoot Gen and its eponymous graphic novel by Keiji Nakazawa. Barefoot Gen is a story loosely based on Nakazawa's personal, first hand experience during World War 2 and the aftermath of the atomic bomb on Hiroshima. Nakazawa's story is significant because it illustrates a monumental historical event that ought to never be repeated. The discussion about nuclear war is especially interesting because Americans often view the United States as the "world police" or the protective big brother country despite this devastating event. This comparative analysis will examine the unique differences between these two versions of Nakazawa's tale, specifically focusing on the portrayal of the

father, Mr. Nakaoka, and his protest against the war, and the depiction of violence, horror, and suffering.

“Legend Still Holds Secret the Key:” Animism  
and Dialogic Witnessing in Véronique Tadjo’s  
Queen Pokou and Toni Morrison’s Beloved  
Holden d’Evegne, Brigham Young University

Faculty Mentor Aaron Eastley, Brigham Young University

SESSION B 11:25-11:40AM

Sill Center

Humanities

Many critics have observed how African novels use elements such as mythology, rhetorical questions, dialects, etc. in their texts to recreate elements from oral legends, but this neglects to take into account how animist literature changes a reader’s engagement with a text. Animist literature invites readers to renegotiate the meaning of old stories by becoming a story’s custodian-guarding it for a future performance. In this paper, I argue that the novels *Queen Pokou: A Concerto for a Sacrifice* by Veronique Tadjo and *Beloved* by Toni Morrison use animism as a literary paradigm to recreate the experience of participating in oral literature. Tadjo’s and Morrison’s novels restructure founding stories from their communities’ pasts to create fluid texts that resist overly historical interpretation. Animism is what gives African oral literature a unique ability to fluctuate and modify itself according to each generation. This fluidity preserves the continuity of a community’s identity. In this way, both works of the authors deconstruct history and

writing to provide an African form of interrogating the past and shaping the present. This form of interrogation is what I call dialogic witnessing: the act of participating in the past as a witness and the responsibility to become a storyteller for the future. As examples of Animist written literature, *Queen Pokou* and *Beloved* bridge the gap between the Western novel and African oral traditions by restructuring the audience's engagement with texts and the past. They use animism to recreate the performative, communal nature of oral traditions in a written medium.

## Rod Serling: A Look at his life, minorities, and his fight with golden age television

### Madison King, Brigham Young University

Faculty Mentor Paul Kerry, Brigham Young University

SESSION B 11:45-12:00PM

Sill Center

This paper is meant to answer the question as to how the *Twilight Zone* represented minorities as well as show the writer's, Rod Serling, own experience with being a minority. Rod Serling is Jewish and dealt with Anti-Semitism despite being a well-known writer. The main focus was on prejudice and how that played into how minorities were seen at the time *The Twilight Zone* was written. How the research was conducted by looking at separate episodes of *The Twilight Zone* and analyzing them for how minorities would have been represented or how Rod Serling fought against television and human prejudice. There were three episodes analyzed, namely

'Eye of the Beholder,' 'He is Alive' and 'I am the Night-Color me Black.' These episodes proved that much of *The Twilight Zone* was written to prove a point and that point was that prejudice is a great evil and we should learn to be open-minded and accepting of those around us. The paper also goes into depth with Rod Serling. From interviews with the daughter and other anecdotes of his life, Serling shows that he has no patience for those who will not accept the different and condemn the ostracized. The research was conducted by looking at books written about *The Twilight Zone* and its influence on society as well as the meaning behind the episodes. There were books on the political thinking in the Zone. Others talked about how the episodes were written which brought light to either the writers' thoughts or the episodes' tone. *The Twilight Zone* showed how prejudice was ruining society in the 1960s and much of what was talked about then can be applied to the events occurring today, such as trying to fit into a society that only values one look, or way of thinking, or how we keep up alive the things that scared us in the past with bigotry and hatred. *The Twilight Zone* and its meaning should not be forgotten. Rod Serling's lessons still apply no matter how the world has changed or has not.

**Humanities and  
Social Sciences.  
Session B - Oral  
Presentations,  
Parlor A, Union**

**SESSION B (10:45AM – 12:15PM)**

**Location: Parlor A, A. Ray Olpin University  
Union**

Rhetorics of Erasure: Critiquing the Role of the  
U.S. Educational System in Indigenous Cultural

## Genocide

Alisen Allen Setoki, Southern Utah University

Faculty Mentor Nicole Dib, Southern Utah University

SESSION B 10:45-11:00AM

Parlor A, Union

Humanities

Indigenous communities in the United States have faced a debilitating history of erasure and violence, a history we can trace through policy and rhetoric. This history includes criminalizing the use of Indigenous languages and dances, boarding schools that aimed to “kill the Indian,” and the unethical seizure of Native lands. Yet despite the immensity of these events, most non-Indigenous Americans remain ignorant of these historical injustices. This presentation will examine the role that educational systems played-and still play-in the cultural genocide and erasure of Indigenous peoples. My presentation will first examine the United States’ removal of Native American children in the mid-1800s from their communities in order to immerse them in a westernized education which resulted in a devastating loss of culture and language. I will also examine this history in light of rhetorics such as the infamous slogan “Kill the Indian, save the man,” Richard Henry Pratt’s formulation for justifying the violent goals of institutions like the Carlisle Boarding School. This presentation will then examine how cultural genocide has been carried out through the erasure and whitewashing of Native history taught in public educational systems. I will articulate how the study of Indigenous people is often approached through an abstract lens rather than by studying the voices of those with lived experience. For example, Indigenous



communities are further erased through the misrepresentation of their culture with mascots that purport to “celebrate” Indigenous communities, and through the insidious use of racial slurs in school marketing, such as the “Redmen.” My presentation will close with an analysis of how Indigenous scholars have faced attempted academic suppression in higher education when engaging with difficult history and topics. Higher education-with its attention to history and rhetoric-can be a space to change the conversation around Indigenous communities and representation.

## The Influence of Education of Police Officer Performance

Jun Hanvey, Southern Utah University

Faculty Mentor Joshua Price, Southern Utah University

SESSION B 11:05-11:20AM

Parlor A, Union

Humanities

The United States is an incredibly diverse place, in terms of geography, people, and politics. It’s no secret that political views can be incredibly divisive. But how is an individual’s political ideology formed? Some suggest that people’s beliefs regarding individual policies are primarily formed through a partisan lens. (Borick & Rabe 2010) However, others have found that there are subconscious factors that can influence a person’s beliefs. Oxley’s research shows that a person’s sensitivity to sudden noises and threatening images can be an indicator of their support of policies. (Oxley et al., 2010) And

of course, social factors play a part. Research has found that the more “red” or “blue” a state is influences how the residents of said state interpret terms like “liberal” or “conservative.” (Feinberg et al., 2017) I intend to examine the influence of geographical factors on political ideologies. Political leaning (in the United States) is correlated with the region in which one lives. For example, southern states which are generally hotter tend to have more conservative citizens. It has also been theorized that people living in states that are more likely to experience natural disasters are more supportive of traditionally conservative policies. (Conway et al., 2017) As certain geographical features imply different living styles and communities, it is reasonable to assume that people may subconsciously derive their support of certain ideas and policies from the physical environment they live in. Assessing the magnitude of this effect (if any) allows for a deeper analysis of the psychology that underlies political affiliation. We are living in a time and place where differences in political ideology threaten relationships, jobs, and communication. Gaining a deeper understanding of the origin of these differences could potentially mend some of the intense division we see between people of different political ideologies.

## Paying Attention: What Graphic Novels Can Teach Us About Human Rights

Ethan Morin, Utah Tech University

Faculty Mentor Brooke Hotez, Utah Tech University  
SESSION B 11:25-11:40AM

Parlor A, Union

Humanities

In 1946, Miné Okubo published *Citizen 13660*, a graphic narrative of her life in the internment camps that Americans of Japanese descent and Japanese immigrants were sent during WWII. Okubo was an artist, so she illustrated life in the camps. This analysis of *Citizen 13660* draws on Michael Galchinsky's paper "The Problem With Human Rights Culture" which deals with the relationship between art and human rights. It examines conventions and devices of the graphic novel genre according to theorists Scott McCloud, Will Eisner, and Rachel Rys, using their work to understand how graphic novels operate within a "theory of comics." How does Okubo's work conform to this theory, and how does it distinguish itself? This essay also looks at *Citizen 13660* as a work of human rights art, representing the graphic novel genre as a whole and how it might contribute to human rights. This paper explores the role of human rights literature in allowing readers to understand and interpret history through the lens of the lived experience of individuals as opposed to the lens that is provided by institutions, which may be incomplete, lack nuance, or be actively harmful to specific communities. *Citizen 13660* represents the way that graphic novels allow readers to interpret history through the experiences of people who lived it, therefore contributing to a culture that is more aware of human rights and more empathetic to ways in which they are threatened or infringed upon.

An Objective Empirical Evaluation Of the  
performance International Regimes

## Hugh Kerry, Brigham Young University

Faculty Mentor Samuel Otterstrom, Brigham Young University  
SESSION B 11:45-12:00PM

Parlor A, Union

Social Sciences

Historically, analysis of political leadership has largely been evaluated by philosophical and journalistic means. The political science and analysis that exists in this area consists largely of attempts to probe public opinion as opposed to the evaluation of the direct effects of a regime's policies' effects on its population's well-being. Although the evaluation of individual policies' effect on well-being persists, there has yet to be a thorough analysis of the effects of international and historic regime types on several measures of well-being simultaneously. As a way to attempt to evaluate political leadership independently I have produced two databases containing a series of variables which are indicators of and or surrogates for well-being. Using Leadership as the unit of an Index I have evaluated the change in and value of these Social, Economic, and Political indicators of well-being which include empirical measures of:

- 1 – Corruption
- 2 – Human Rights (Incidence of Torture and Killings per capita)
- 3 – Crime (Murder Rates)
- 4 – Mental Health (Suicide Rates)
- 5 – Wealth (income per capita)
- 6 – Health (Early Deaths per capita)
- 7 – Productivity
- 8 – Opportunity (Surrogates for social mobility)
- 9 – Consistency of economic growth
- 10 – Family Health (Teen birth rates)

The average of these ten indicators creates the Leadership Index, which is intended to evaluate the quality of governance in a country in the same way the Human Development Index and World Happiness Report measure the quality of life in a country. The findings of this study show several clusters of leaders which are often considered to follow certain ideological governance styles which perform differently. One example of this is the comparatively high scores of Western Liberal Democracies like the UK or Sweden in the consistency, Human rights and corruption categories while scoring relatively poorly in the Wealth, Productivity and Mental Health categories. Another finding was that the highest scoring region overall was Eastern Asia between 1960 and 2010, this was especially the case of the three of the Four Asian Tigers measured: South Korea, Taiwan, and Singapore which had exceptionally high scores. This could mean that the regimes in charge in eastern Asia Governed more effectively during this period, and it could also mean that Eastern Asia was the most lucky for circumstantial reasons.

**Interdisciplinary.  
Session B - Poster  
Presentations,  
Ballroom, Union**

**SESSION B (10:45AM-12:15PM)**

**Location: Ballroom, A. Ray Olpin University  
Union**

**Alternative, Ergonomic Music Keyboard  
Designs Suit More People  
Christine Schmidt, Salt Lake Community  
College**

**Anita Riddle, Salt Lake Community  
College**

**Sierra Schmidt, Salt Lake Community  
College**

**Karson Spencer, Salt Lake Community  
College**

Faculty Mentor: Nick Safai, Salt Lake Community College

SESSION B (10:45AM-12:15PM)

POSTER B91

Undergraduate students are creating innovative designs for electronic music keyboards that suit more people and offer better ergonomics. This collaborative project, originally contrived and led by a music student, motivated engineering students to contribute to designs, marketing, and presentations. This is one of two unrelated projects by this undergraduate student research group. A standard piano keyboard has 88 keys laid out in a flat plane. Many pianists practice hours per day and suffer from repetitive stress injuries, such as carpal tunnel syndrome. Additionally, some compositions are unplayable for some people if their hands are too small. Just as with computer keyboards, alternative shapes of keyboards could help musicians who suffer from carpal tunnel. Alternative sizes of keyboards have been produced; however, they are simply a scaling down of the current keyboard design. In this project, students worked together to design alternative geometry of musical keyboards to fit more human hands and to provide better ergonomics. Students first studied keyboards details of

Yamaha digital pianos. Digital piano sounds do not come from a hammer hitting a long string, as they do from conventional or “acoustic” pianos. Digital piano sounds result from sophisticated music sampling and computer modeling. Because a digital piano has no hammers nor strings, there are fewer restrictions on the design of the input device. New keyboard designs in this project include angled and semi-spherical shaped input devices to play a digital piano, MIDI controller, or synthesizer.

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**Medicine, Science  
and Engineering,  
Session B - Oral  
Presentations, Pano  
East, Union**

**SESSION B (10:45AM-12:15PM)**

**Location: Pano East, A. Ray Olpin University  
Union**

## Engineering and Characterization of Antibodies Against Cancer Biomarker Thymidine Kinase 1

Joshua Bennett, Brigham Young University

Faculty Mentor Scott Weber, Brigham Young University

SESSION B 10:45-11:00AM

Pano East, Union

Medicine

Engineered antibodies used in immunotherapies have been increasingly successful due to their ability to uniquely target cell expressing specific cancer antigens. Thymidine Kinase 1 (TK1) is a DNA salvage enzyme typically found in the cytosol. However, in certain types of cancer, TK1 is surface expressed, making it a unique cancer biomarker. By identifying antibodies with a high binding affinity for TK1, we can target cancer cells expressing TK1 on their surface. Using cell sorting and a yeast display library expressing 109 human single chain antibody fragments, we have isolated ten unique single-chain antibodies (scFvs) that bind to TK1. Flow cytometry affinity characterization of the 10 clones revealed strong binding affinity in the low nM range. Sequencing of the scFvs showed they all had unique complementarity-determining regions (CDRs) with some similarities among the clones. The scFvs were cloned into constructs containing an antibody constant domain and they will be cultured with cancer cell lines expressing TK1 and evaluated for antibody-dependent cellular cytotoxicity. This research has the potential to target TK1+ cancers and maximize cancer cell death while minimizing harm to healthy cells.

## rHsGal-1: A Novel Protein Therapy for LGMD2B

Parker Nelson, Brigham Young University

Faculty Mentor Pam Van Ry, Brigham Young University

SESSION B 11:05-11:20AM

Pano East, Union

Science and Technology

Limb-girdle muscular dystrophy type 2b (LGMD2B) is an autosomal recessive disease caused by a mutation in *dysf* gene, the gene responsible for the key membrane repair protein called dysferlin. Unlike similar degenerative diseases, there is no viable treatment for LGMD2B. In the Van Ry Lab, our research is focused on understanding whether recombinant human Galectin-1 (rHsGal-1) could serve as a viable therapeutic option based on previous studies published evidencing its efficacy in treating Duchesne Muscular Dystrophy. A six-month study was conducted in dysferlin-deficient (BLA/J) mice under which time various assays and experiments were conducted, including monthly blood serum analyses and functional movements tests. Further tests were conducted to elucidate the effects of rHsGal-1 in the murine model, such as a laser injury assay of myofibers and histological examinations to study muscle morphology. Results from tests conducted demonstrated a statistically significant difference between treated and non-treated mice. Membrane repair, muscle morphology, and overall muscular health were improved in treated mice over a six-month period. Continued understanding of the role rHsGal-1 plays in membrane repair will help the thousands of individuals affected by LGMD2B worldwide.

## Grallator Tracks as a Window to Growth Strategies of Small-Bodied Early Theropods Karrah Spendlove, University of Utah

Faculty Mentor Randall Irmis, University of Utah

SESSION B 11:25-11:40AM

Pano East, Union

Science and Technology

Fossil tracks are far more abundant than skeletal remains and record both locomotory information and impressions of the soft tissues that covered the feet. Thus, they have large sample sizes and can act as proxies for determining growth regimes among living dinosaur feet. The St. George Dinosaur Discovery Site at Johnson Farm (SGDS) in St. George, Utah, USA, has a wealth of tridactyl *Grallator* tracks, likely made by early, small theropods, preserved on closely-spaced bedding planes. Therefore, the site is as close to population sampling as possible. Tracks were measured using eleven linear metrics, which were used to determine whether these early theropods experienced allometric or isometric growth of their feet. Analysis of track metrics using bivariate plots and regressions suggests weak, negative allometric linear relationships between the width of the track and the length of digits III and IV. Photographs of tracks were utilized in 2D geometric morphometrics, which removes the effect of size by establishing common landmarks on specimen photographs and normalizing all specimens to a single size. This increases understanding of possible allometric growth in ways

traditional linear measurements cannot. Both linear measurements and geometric morphometrics suggest a single continuous sample, suggesting the tracks were likely made by a single species or closely related species having similar foot morphologies. These data suggest that as early small theropods increased in size, growth in toe length was slower than growth in foot width. This could indicate that growth progressed to convey larger theropods greater stability to support their increased mass.

## Evaluation of the ability of naturally derived oils and disinfectants to inactivate SARS CoV-2

Elizabeth Wagstaff, Brigham Young University

Faculty Mentor Richard Robison, Brigham Young University

SESSION B 11:45-12:00PM

Pano East, Union

Science and Technology

Throughout human history, people have been using plants and plant-derived products for a variety of medical applications. Recently, essential oils have received increased attention for diverse applications, many of which have not been validated by peer-reviewed research. However, some essential oils have been shown to have antibacterial and antiviral properties. Fueled by the recent pandemic, there is an increased need for disinfectants effective against SARS CoV-2. This aims of this project were to determine the ability

of essential oils and oil-infused disinfectants to inactivate SARS CoV-2 on surfaces. This knowledge can provide insight into how these products might inactivate SARS CoV-2 and potentially other viruses as well.

To be considered effective, high-level disinfectants must be able to effect a four log reduction of a virus dried onto a surface within a stated contact time. Three essential oils and three oil-infused disinfectants were tested for their ability to inactivate SARS-CoV-2 using a disc-based quantitative carrier test. An effective neutralizer was developed to inactivate each product after a specified contact time. These time points were chosen to create an inactivation regression line for each disinfectant, and predict the time required to cause a four -log reduction of viable viral particles. The results for each disinfectant were replicated three times, in each of three test days.

Preliminary results indicate that four disinfectants were able to effect a four-log reduction between 30 seconds and 4 minutes. Two oils showed only about a one log reduction after fifteen minutes of exposure to the virus. Further trials are being performed to more accurately predict the four -log reduction times. Future research will focus on identifying the exact mechanisms of inactivation, in order to develop more effective antiviral disinfectants.

**Science. Session B -  
Poster  
Presentations,  
Ballroom, Union**

**SESSION B (10:45AM-12:15PM)**

**Location: Ballroom, A. Ray Olpin University  
Union**

**A Planned Device for Solar Powered Water  
Purification for Disaster Relief  
Evelyn Fuentes, Utah Tech University  
Thomas Keate, Utah Tech University**

## **Christian Riordan, Utah Tech University**

Faculty Mentor: Aaron Davis, Utah Tech University

SESSION B (10:45AM-12:15PM)

POSTER B29

Studies predict that extreme weather events, due to climate change, are expected to increase in frequency and magnitude. Specifically, the flooding impacts from a hurricane may lead to the loss of necessary infrastructure like water treatment plants. This is especially concerning due to the loss of drinkable water available. In response we, as a multidisciplinary team, plan to develop a purification device that is able to effectively filter waste and sewage-contaminated water to allow communities and families, without available infrastructure, to receive drinkable water. We will be testing different processes of filtration to find the most efficient and cheapest method. This process of filtration would be possible due to a foldable solar array that would power a pump to push water through a filtration system. The solar array would supplement other disaster relief options due to its ability to be used without constant supervision, and it would be capable of continuous, reliable use. This would allow for the production of drinkable water in the event that water purification infrastructure was down, but contaminated water was available. The solar array and water purification device would be portable for fast deployment, with options of building a larger device, as part of a disaster relief preparedness package. If successful, this device has the potential to increase disaster preparedness and save lives through providing clean water.

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# **Isolation and Identification of Soil Fungal Species Associated with Juniperus**

**osteosperma**

**Hailey Sermersheim, Utah Valley**

**University**

**Tyler Shaver, Utah Valley University**

**Kylee Larsen, Utah Valley University**

Faculty Mentor: Olga Kopp, Utah Valley University

SESSION B (10:45AM-12:15PM)

## **POSTER B30**

Juniperus osteosperma, known locally as Utah Juniper, is one of the most abundant trees in the Utah desert and commonly found in higher montane areas. Endemic to Utah and surrounding western states, J. osteosperma is a monoecious perennial evergreen characterized by its bushy appearance, rounded crown, small scale-like leaves, and berry-like cones. J. osteosperma provides important habitat and forage for many native plants and animals, with several bird species depending on the cones for forage during fall and winter months. The identification and cataloging of native plants such as J. osteosperma and their associates is of utmost importance for proper rangeland management. Understanding how the sum of individual factors within an environment affect one another leads to informed decisions on land use and species management. Fungal associates, particularly root mycorrhizae, are a severely understudied environmental factor and have been shown to play an important role in the health of their associated plants and the surrounding environment. The

purpose of this research was to isolate and identify soil fungal species associated with *J. osteosperma* in order to determine similarities of fungal associates between several *J. osteosperma* individuals; as well as the overall richness of fungi associated with *J. osteosperma* compared to its surrounding environment. The identification of fungal species associated with *J. osteosperma* will give insight into the richness and species of mycorrhizae required by *J. osteosperma* in order to thrive in its environment. Soil collections were obtained from inside and outside the rhizosphere of three *J. osteosperma* individuals. The fungus was isolated and colonized on antibacterial agar plates and identified through PCR sequencing. The isolation and identification are ongoing, at its completion this abstract will be finalized with a list of found associates.

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## **Comparative transcriptomic assay of ectomycorrhizal fungi isolates to identify the genetic responses of environmental stress**

**Tiffany Do, University of Utah**

Faculty Mentor: Bryn Dentinger, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B31

Ectomycorrhizal fungi (EMF) are a diverse group of soil organisms that play an essential role in ecosystems by forming mutualistic relationships with trees. These fungi provide

nutrients, such as nitrogen and phosphorus, in exchange for photosynthetically derived carbon sugars. There is little understanding of how EMF responds to environmental conditions and what genetic mechanisms are utilized to thrive under those conditions. One way EMF interact with their environment is through the breakdown of soil organic matter to acquire nutrients for their host (Frey, 2019). Previous work has suggested that EMF have a reduced capacity to decompose soil organic material compared to their saprotrophic ancestors, represented by the consistent loss of saprotrophic enzymes to decompose lignocellulose (Kohler et al., 2015). However, not all saprotrophic enzymes are lost, with the number of enzymes retained varying dramatically between species (Kohler et al., 2015). It is unknown whether EMF utilize the same genetic pathways to degrade soil organic matter as saprotrophs or if they use novel genes. In addition, it is unknown whether the remaining saprotrophic enzymes represent a diverse array of decomposition behaviors. To identify this, I conducted a transcriptomic assay of cultures of seven EMF species grown on varying types of media to distinguish genes used in degrading carbon and whether they vary in decomposition behavior. Mimicking environmental stressors and using transcriptomic analysis can allow a better understanding of how different EMF responds to climate-related stimuli. I extracted and sequenced mRNA from flash-frozen cultures to identify the genes that are differentially expressed in the presence or absence of an ecological stressor. Through comparative transcriptomics, I expect to identify contrasting patterns of gene regulation in response to stressors. Through these analyses, we will gain a better understanding of gene regulation and behavior in response to environmental

conditions, which are essential for understanding why EMF are so diverse.

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## **Conservation of the Endemic Coral Pink Sand Dunes Tiger Beetle, *Cicindela albissima***

**Kate Ehlert, Southern Utah University**

Faculty Mentor: Fredric Govedich, Southern Utah University  
SESSION B (10:45AM-12:15PM)

POSTER B32

Coral Pink Sand Dunes, located in southwestern Utah (Figure 1), is a unique desert dune system that has a number of endemic species including the Coral Pink Sand Dunes Tiger Beetle, *Cicindela albissima* (Rumpp, 1962) (Figure 2). This species of tiger beetle has adapted to the unique conditions found in this dune environment. Geographical separation between this system and other similar systems has resulted in the speciation of this tiger beetle, but it has also meant that this species is potentially sensitive to any changes in its environment. Anthropogenic impacts such as recreation and climate change have resulted in fluctuations in the number of individuals of *C. albissima*. This study has focused on monitoring the population of adults and larvae of this sensitive species to ensure its continued survival. This project is supported by the BLM, Utah DNR, US Fish and Wildlife, University of Utah and Southern Utah University.

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# **Longitudinal analysis of Anatoxin-a in Utah Lake**

**Tyler Hill, Utah Valley University**

Faculty Mentor: Emily Heider, Utah Valley University

SESSION B (10:45AM-12:15PM)

POSTER B33

In the summer of 2022, 13 of Utah's 18 freshwater bodies that are monitored by the Department of Environmental Quality (DEQ) were issued health advisory conditions due to the presence of harmful algal blooms (HAB). With limited resources, DWQ reports the cyanobacteria cell counts relative to the warning advisory threshold of 100,000 cells/mL and health advisories are issued annually for Utah Lake due to exceeding the danger advisory threshold of 10,000,000 cells/mL. In addition to the eutrophic conditions resulting from the presence and decay of these algae, the toxic products they produce pose a hazard. The Utah Division of Water Quality (DWQ) monitors the liver toxin microcystin, which is produced by blue-green algae. Concentrations of other toxins such as anatoxin-a have not been regularly reported by DWQ due to the cost and complexity of the analysis. This research conducted a longitudinal (2-year) 2021-2022 analysis of the concentrations anatoxin-a in Utah Lake. The concentration profile shows increasing anatoxin-a in the warm summer months with a decline in late fall. All measured concentrations exceeded the amount last measured by Utah DEQ in 2019, 0.2 ppb. Although the United States doesn't have a regulatory limit for anatoxin-a, all measured anatoxin concentrations were below the New Zealand limit of 6.0 ppb. Such analysis is crucial to detecting and intervening in the rampant increase of

neurotoxins in fresh-water bodies. This analysis will be valuable particularly since exposure to such neurotoxins has been indicated in neurodegenerative diseases such as Parkinson's disease and Alzheimer's disease.

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## **Is there a link between male gonopodium size and mating strategies amongst fish in the family Poeciliidae?**

**Ryen Hunsaker, Brigham Young University**

Faculty Mentor: Jerald Johnson, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B34

The association between distinct male mating strategies and gonopodium size in the Poeciliidae family is a topic that has been suggested in several scientific papers and studies. However, many of these works merely acknowledge that there is likely a relationship between these factors, without having collected data across species as evidence. The purpose of our study is to provide physical and conclusive data testing the connection, or lack thereof, between male reproductive traits and behavioral modes of reproduction. We will take measurements of gonopodium size using collections of Poeciliid fish species. We will then test for an association between gonopodium traits and mating strategies using several species. The main reproductive modes that we will be using to categorize each species being studied are mating attempts by means of coercive force copulations, courtship display, or both.

Following the analysis of our findings, we hope to be able to come to a conclusion if there is statistically significant evidence that supports the correlation between male gonopodium size and mating strategies. By doing so, this study will provide key insights into the behavioral ecology and evolutionary adaptations of male fish within the Poecillidae family.

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## **High wind impacts on the Wasatch Front – Saratoga Springs Jennifer Jentzsch, Utah Valley University**

Faculty Mentor: Anne Arendt, Utah Valley University

SESSION B (10:45AM-12:15PM)

POSTER B35

The Wasatch Front Range has experienced major windstorms causing Utah citizens to be concerned about how future events could affect them. In our research project, we concentrated on the city of Saratoga Springs, Utah. The methods we used for gauging wind event impact involved researching statewide weather information utilizing local news and historical weather information with a focus on Saratoga Springs. Our goal was to develop information on what the public could do to prepare for a wind event and what to do during the event. We then compiled an informational document that could be potentially used on a web-based platform. After additional research and recommendations from future cohorts of students with a focus on other cities along the Wasatch front. These findings could then be consolidated and offered for use to different emergency sites, which currently

have no materials that are specific to wind events such as BeReady Utah. (<https://beready.utah.gov/>)

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## **Raptors in the City: Site Occupancy and Abundance of a Top Predator Inhabiting Urban Green Spaces Within a Megacity**

**Elias Johnson, Brigham Young University**

Faculty Mentor: Byron Adams, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B36

How organisms persist under extreme conditions has received a lot of attention in ecology. Some extreme environments are natural and pristine (e.g., open lands and wilderness), while others are highly impacted (e.g., large cities). Unfortunately, we know little about the ecology of species that live in urban environments relative to those in pristine environments. My research focuses on population ecology of birds in Mexico City, one of the largest urban landscapes in the world. Specifically, I study how birds utilize green spaces across Mexico City. Previous work suggests that parks are occupied by dozens of different species, including top-predator raptors. I will spend two months in Mexico City surveying birds at 101 parks to determine how native and exotic species interact to shape population dynamics of these species. I use occupancy models to determine how birds utilize urban habitats, how they interact with each other, and if some species facilitate or limit the persistence of other species.

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# **Phylogenomics of Baetidae: A Comparison in Classification**

**Avery Larsen, Utah Valley University**

Faculty Mentor: Heath Ogden, Utah Valley University

SESSION B (10:45AM-12:15PM)

POSTER B37

This study focused on the evolutionary relationships of the family Baetidae, one of the three largest families in Ephemeroptera. Baetidae is of phylogenetic interest because of its somewhat basal position in the order and its diverse and varied life histories and morphological characteristics. This analysis was carried out using Anchored Hybrid Enrichment from over 450 protein coding loci from 45 baetid ingroup taxa and 5 outgroup taxa. The data was analyzed as DNA (1st and 2nd positions in the codons) and as translated amino acid sequences in both maximum likelihood and Bayesian methodological frameworks. The results are compared to the recognized clades and classifications seen in previous phylogenetic proposals (Cruz et al. 2021) and suggest monophyly within subgroup Cloeoninae. Central Research questions: 1) What can anchored hybrid enrichment analyses show about the relationships and supposed subgroups of the Baetidae family? 2) Are the main lineages (subfamilies) supported as monophyletic with all combined data? Keywords: Ephemeroptera, Phylogenetics, Anchored hybrid enrichment, Baetidae

References

CRUZ, P. V. et al. A cladistic insight into the higher level

classification of Baetidae (Insecta: Ephemeroptera). Systematic entomology, [s. l.], v. 46, n. 1, p. 55-44, 2021. DOI 10.1111/syen.12446. Disponível em: <https://discovery.ebsco.com/linkprocessor/plink?id=5d85bd40-1821-39d9-971d-2641e9db98c9>. Acesso em: 10 out. 2022.

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## **Effects of Varying pH on *Pisum sativum***

### **Scott Morreall, Utah Valley University**

Faculty Mentor: Olga Kopp, Utah Valley University

SESSION B (10:45AM-12:15PM)

POSTER 38

Authors: C. Monsen, S. Morreall, S. Smith, R. Motte. (Utah Valley University – Botany Research / Dr. Kopp). The effects of soil pH on plants is a very well documented and researched idea. Soil pH is a vital part of plant growth and health. Soil pH controls the solubility, mobility, and bioavailability of trace elements, which determines their translocation in plants. Feed crop plants or plants for phytoremediation efforts will have an optimum pH soil value associated with optimal growth. Alterations in soil pH can influence the availability of essential plant nutrients and therefore affect the quality and composition of a plant. When amending soil with any manufactured fertilizers, crop rotation strategy or natural soil additives, the soil's pH must be closely monitored and the plant's health evaluated. For our research project we evaluated the fitness of Pea Plants (*Pisum sativum*) grown in varied pH soils. We used Soil Acidifier and Lime mixed at different concentrations

with topsoil and compost to modify the soil pH values. With supervision of Dr. Kopp we mixed soils with varied pH values ranging from 5-8 and created 3 categories of soil (Acid -Neutral and Basic). We made 4 pots for each pH category and planted 5-6 individual pea plants in each pot. The soil pH and the plant's fitness was evaluated and monitored regularly. In discovering the correlation between nutrient absorption efficiency and soil or root environment pH levels, we demonstrate the critical need to perform such evaluations on a large variety of essential plants. We investigated the correlation between soil pH and plant height, stem width, branching, and stem color in *Pisum sativum* for all three different soil compositions. Our research indicates that further research should be done on the distribution of pH throughout the soil and the underlying mechanism for the neutralization of acidic soil.

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## **A Comparative Study on Breast Cancer Prediction**

**Rosemary Mwithiga, Utah Tech University**

Faculty Mentor: Md Sazib Hasan, Utah Tech University

SESSION B (10:45AM-12:15PM)

POSTER B39

Breast cancer is one of the most recurrent types of cancer. Each year the number of deaths due to breast cancer increases significantly. It is estimated that the number of people who will be diagnosed with cancer will be higher in the near future. Detecting, diagnosing and preventing breast cancer became

a necessity. Developments and progress made to predict and diagnose breast cancer are vital in treatment and care plans for patients. Researchers around the world are working on how to detect breast cancer in the most efficient way. Our project is to study breast cancer detection based on the different characteristics of the diagnosed cancer cell. Applied statistical and machine learning techniques will be applied to accurately detect the possibility of breast cancer. Comparative studies for different techniques will be made.

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## **Discovering Trichome Development and Genetics in the Genus *Gilia***

### **Bryce Nielson, Brigham Young University**

Faculty Mentor: Clint Whipple, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B40

Trichomes are hairlike structures on the surface of many plant species. They are used to protect plants and store important compounds for plants. They are also important targets in many industries including the pharmaceutical industry as these compounds can be extracted and purified. Despite the possible monetary gains in understanding genetic factors in trichome development, there has yet to be a research focus specifically on loci of genes that influence trichome type. *Gilia capitata* and *Gilia yorkii* are organisms of interest for this research due to their fast growth, ability to hybridize, and different trichome morphologies. *G. capitata* has villous trichomes that are long and wispy. *G. yorkii* has glandular

trichomes that have a large sphere at the tip. When these organisms hybridize, they form an F1 generation that has both villous and glandular trichomes. After the creation of an F1 generation, the plants can be further backcrossed to produce a fertile backcross population that also exhibits the glandular and villous trichome combination. When the backcross population is scored with a simple count comparing glandular to villous trichomes, the ratio ranges from 50% of each type of trichome to nearly 100% glandular trichomes. Using an analysis of over 200 individuals from this backcross population, we determine that trichome development in *Gilia* is likely polygenic due to a unimodal curve of the trichome distribution. Using a QTL analysis, we show that genes for trichome development are most likely present on chromosome 8 of the *G. yorkii* and *G. capitata* genomes.

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## **Comparing highly heterochromatic cactophilic *Drosophila* genome assemblies**

### **Marissa Ohran, Utah Valley University**

Faculty Mentor: Carl Hjelman, Utah Valley University

SESSION B (10:45AM-12:15PM)

POSTER B41

Insect genomes vary extensively in size, chromatin structure, and chromosome number, but tend not to vary in gene number. Therefore, larger genomes tend to have more gene-poor heterochromatic regions. Previous work on cactophilic *Drosophila* in the nannoptera species group found that these

specialist dipterans had highly heterochromatic chromosomes, suggesting they had large genomes. However, follow up work on genome size found that while these genomes are highly heterochromatic, they do not have a larger genome size than would be expected for most *Drosophila* species. Therefore, we are asking what types of rearrangements in the genome allow for such compaction and where do these heterochromatic sequences occur. In order to address this problem, we performed long-read sequencing with Oxford Nanopore Technology on males and females of *D. acanthoptera* and *D. bromeliae*, with subsequent Illumina sequencing. *Drosophila acanthoptera* is from the cactophilic nannoptera group, while *D. bromeliae* is sister to this group, and does not have a highly heterochromatic genome. As preliminary assemblies of *D. acanthoptera* have been found to be difficult due to repetitive heterochromatic content (genomes assembling smaller than estimated sizes), we assembled the genomes using multiple parameter configurations from three commonly used long-read genome assembly programs (Canu, Flye, and NextDenovo). We then performed BUSCO analysis to determine the completeness of these assemblies. Here we are presenting comparisons of the assembly statistics and BUSCO scores for male and female genomes for both species.

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## **The Arduino Platform as a Cost-Effective Field Data Collection Tool**

**Jake Olvera, Southern Utah University**

**Madeline Wilkerson, Southern Utah**

## University

Faculty Mentor: Jacqueline Grant, Southern Utah University

SESSION B (10:45AM-12:15PM)

POSTER B42

As conservation efforts are ramping up, the need for accurate biological field measurements becomes apparent. These measurements are usually collected using multiple specialized, expensive devices. For example, soil characteristics (temperature, humidity, and salinity) can be measured using the Aquaterr EC-350 at a price point of \$1350. Similarly, the Kestrel 3500 Weather Meter measures humidity, pressure, temperature, wind speed, and wind direction for the price of \$200. We used readily-available sensors that communicate via I2C controlled by an Arduino Uno Rev3 development board to create a single, compact device. This device can measure pressure, altitude, temperature, humidity, soil temperature, and soil humidity for under \$100. A similar approach can be taken for other projects to create custom equipment that is accurate, cost-effective, and modular.

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## The Mayflies of Utah

**Tabitha Weir, Utah Valley University**

Faculty Mentor: Heath Ogden, Utah Valley University

SESSION B (10:45AM-12:15PM)

POSTER B43

Ephemeroptera (Mayflies) are a key step in our freshwater carbon and nutrient cycles, and are great bioindicators of environmental health. Mayflies can be a precursory species for

loss of speciation to an ecosystem, as they're important for nutrition distribution. Monitoring these aquatic invertebrates gives the opportunity to monitor the health of our freshwater systems. Utah was home to one of the earliest mayfly experts: George F. Edmunds, an avid entomologist who spent 44 years at University of Utah. Edmunds in 1986 published records on the habitat and distribution of 71 species throughout Utah. Utah has seen a population growth of 200% since, and most of this growth is concentrated within a few counties. This leads to higher quantities of pollutants in freshwater systems, and higher rates of habitat disturbance for aquatic invertebrates. Edmunds (1986) listed 13 families of Ephemeroptera, with 71 total species in Utah, while reports from Utah State University since this time would indicate 15 families and 91 species. Data was collected and consolidated from local universities and museums, online databases and aquatic invertebrate surveys, and new collection data; From these new records, 10 total species are missing from Utah's collection records for the last two decades. Collection efforts continue for this project focused in areas of dense population growth, and in search of these 10 elusive species. The outcome of this research will be a field guide to the current Ephemeroptera species of Utah, including their distribution, habitats throughout the state, and diagnostic characteristics.

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## **Multiple liver enzymes underlie toxic creosote bush metabolism in woodrats**

### **Noah Armstrong, University of Utah**

Faculty Mentor: Dylan Klure, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B44

Plants and herbivores have been in an evolutionary arms race for millions of years; however, ongoing climate change is modifying the global distributions of plant and animal species at an accelerated pace, exposing herbivores to plants with novel chemical defenses. Little is known about the physiological mechanisms that enable mammalian herbivores to feed on toxic plants, although the liver is thought to play a key role. To improve our understanding of the liver's role in facilitating toxin tolerance, we investigated the mechanisms that enable the desert woodrat (*Neotoma lepida*) to feed on the highly toxic creosote bush (*Larrea tridentata*), a desert shrub that rapidly expanded across the Southwestern United States at the end of the Pleistocene. We brought woodrats into captivity, fed them experimental diets containing creosote bush, sequenced total liver RNA, and isolated protein from liver tissue. Using this approach, we identified a high diversity of detoxification enzymes that were induced in response to creosote bush feeding, including several cytochromes P450 (CYPs), UDP-glucuronosyltransferases (UGTs), and ATP-binding cassette transporters (ABCs). We used chemiluminescence western blotting to confirm the presence of several of these highly-expressed enzymes. Our results further implicate the role of the liver in facilitating toxin tolerance, improve our understanding of what substrates induce the expression of endogenous liver

enzymes, and broaden our knowledge of how mammalian herbivores may adapt to environmental change.

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## **Assessing Yellowstone seismic velocity structure using a dense seismic array**

### **Chloe Barry, University of Utah**

Faculty Mentor: Jamie Farrell, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B45

The Yellowstone magmatic system represents one of the largest continental silicic volcanic centers, notable for three explosive eruptions occurring in the last 2.1 million years [1,2]. The volcanic system is marked by frequent earthquakes, episodic ground deformation, high heat flux, and hydrothermal features [1,2]. The system is underlain by two magma reservoirs that are largely constructed of stacked sill complexes [2] and is fed by a west-northwest dipping plume in the upper mantle. The plume generates basaltic partial melts which collect in the lower sill complex located in the lower crust. These partial melts then further fractionate, and the less-dense silicic melt rises to the upper rhyolitic sill complex located in the upper crust [2]. These two sill complexes are likely connected by dikes and have been imaged through seismic tomography, however the resolution of the models is often limited by the earthquake-station ray path distribution. In order to improve these models, it is necessary to improve the ray path coverage and identify areas of the models that do not

agree with the new observations. To achieve this, a temporary dense array of 608 Zland 3-component geophones were deployed along the main roads of Yellowstone National Park from 08/18/2020 through 09/21/2020 (Figure 1). This is the first dense array of its kind to be deployed in Yellowstone. In this study, we measured body wave arrivals, or P-wave and S-wave arrivals, from local earthquakes across the dense array to better understand the subsurface magmatic structure of Yellowstone. The measured travel times are compared with predictions based on a 1D reference velocity model. The observed travel time discrepancies are then used to assess areas where the model needs to be adjusted (Figure 2). We will use body wave ray tracing to determine the 3D sensitivity of our measurements and to understand how the Yellowstone magma body, which has low velocity, contributes to our observation. This process of modeling and comparing will help us to evaluate the most recent 3D velocity model of Yellowstone [2] and provide insight for a future tomographic inversion.

[1] Farrell, J., R. B. Smith, S. Husen, and T. Diehl (2014), Tomography from 26 years of seismicity revealing that the spatial extent of the Yellowstone crustal magma reservoir extends well beyond the Yellowstone caldera, *Geophys. Res. Lett.*, 41, doi: 10.1002/2014GL059588

[2] Huang, H.H., F.-C. Lin, B. Schmandt, J. Farrell, R.B. Smith, and V.C. Tsai (2015), The Yellowstone magmatic system from the mantle plume to the upper crust, *Science*, 348, doi: 10.1126/science.aaa5648

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## Utilizing Genomic and Metabolic Data to

## **Investigate the Evolutionary Ecology of Ant-Farmed Fungi**

### **America Cox, University of Utah**

Faculty Mentor: Bryn Dentinger, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B46

Neotropical ants of the Attini tribe evolved the innate ability to farm fungi. Agaricomycetidae (mushroom forming fungi) contains two clades that are cultivated by ants: the lepiotaceous and pterulaceous cultivars. However, there are free-living relatives phylogenetically distributed throughout each cultivar clade. Comparison between the free-living relatives and attine system cultivars may identify the evolutionary differences caused by, or initially enabling, agricultural symbiosis. Our research compares free-living relatives and cultivars through genomic and metabolic analysis. We first performed DNA sequencing of the ITS barcode region and then whole genome sequencing of the cultivars. ITS sequencing allowed us to build phylogenetic trees to examine the relationships between the free-living fungi and cultivars. Whole genome sequencing allowed genomic cultivar to cultivar comparison. Attines undertake significant cultivar maintenance through the regulation of pathogenic contamination of their fungal “gardens” as well as the provision of specific growth substrates, including frass (insect feces). Noting the apparently specialized substrates cultivars receive from the ants, we conducted a pilot test for a growth media preference between a lepiotaceous cultivar, a pterulaceous cultivar, and a free-living pterulaceous relative. We placed the fungi on regular PDY media and PDY media infused with caterpillar frass and observed their growth.

Cultivars either changed growth form or had improved growth on the frass-infused media. Following the pilot test, we will run metabolic assays on the cultivars and free-living relatives on different media types for further investigation that may indicate a media preference and give further insight to the relationship between the cultivars and free-living relatives. By looking at fungal metabolic assays and genomic data, we hope to gain insight into the fungi's evolutionary history and agricultural symbiosis.

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## **Creation of Landslide Database in Iceland Assessing Mechanisms, Occurrences, and Hazards Claire Cruz, University of Utah**

Faculty Mentor: Leif Anderson, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B47

A landslide is a movement of rock, debris, or earth down a slope. Landslides are serious geological hazards and can result from other hazards such as volcanic eruptions, wildfires, tsunamis, and earthquakes. According to the World Health Organization (WHO) between 1998 and 2017, landslides caused more than 18,000 deaths worldwide. The impact of landslides can be detrimental causing loss of life, property damage, and loss of natural resources, thus knowing where they previously occurred can help mitigate damage. Additionally, once we know their distribution we can begin to understand what

controls where they occur. The proposed project will identify the locations and parameters of landslides in Iceland by creating the first comprehensive landslide database of Iceland. We are collaborating with the Icelandic Meteorological Office, specifically Dr. Tómas Jóhannesson and Dr. Jón Kristinn Helgason, in a joint effort to complete the project. Today with more and more remote sensing data available creating landslide databases is easier and easier. The focus will be on Iceland because Iceland has few trees making it easy to identify the landslides, and the rock type is almost completely basaltic (with some rhyolite) which removes one of the most difficult variables for understanding landslide occurrence, namely, variability in rock type. Iceland was completely covered by ice during the last age and glaciers helped form the steep fjord topography near the coasts.

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## **Biochemical analysis of the Smoothened cytoplasmic tail / protein kinase A binding interaction in Hedgehog signaling**

**Nate Iverson, University of Utah**

Faculty Mentor: Ben Myers, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B48

The Hedgehog (Hh) signaling pathway is an essential player in vertebrate embryonic organ development, controlling the formation of nearly every organ in our bodies. Insufficient Hh pathway activity during development results in birth defects,

while improper activation postnatally is associated with many cancers including basal cell carcinoma and medulloblastoma. Smoothed (SMO) is an atypical G protein-coupled receptor that is integral to Hh signal transduction. SMO signals intracellularly by directly binding to the protein kinase A catalytic subunit (PKA-C), sequestering it at the membrane and inhibiting its downstream enzymatic activity. The biochemical and structural basis for the SMO-PKA interaction remains largely unknown. Analysis of this protein interaction via crystallography or cryogenic electron microscopy remains difficult due to the unstructured nature of the SMO cytosolic tail. Information regarding the structural basis for how the SMO cytosolic tail binds with PKA-C can be improved upon using nuclear magnetic resonance (NMR) spectroscopy. An optimized expression protocol was used to purify the SMO cytosolic tail, and then biochemically modify the protein for structural studies. Specifically, a covalently attached nitroxide spin label, methanethiolsulfonate (MTSL) was added to various positions in the SMO cytosolic tail to enable paramagnetic relaxation enhancement (PRE)-NMR studies with isotopically labeled PKA-C. The information provided from the PRE-NMR study uncovers a better picture of the binding interaction between SMO and PKA-C. Understanding the structural basis for the SMO-PKA complex can provide critical insights into an essential step in Hh signal transduction and may lead to more effective therapeutic agents to treat a range of different cancers.

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## **Associations between Anthropogenic**

## **climate change and pollen season trends of various genera in the continental United States.**

**Derek Kober, University of Utah**

Faculty Mentor: William Anderegg, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B49

Anthropogenic climate change is tied to higher concentrations in airborne pollen and extended pollen seasons. Research indicates that pollen concentrations are positively correlated to temperature. This study aims to analyze the pollen trends in different genera, determining which plants are most impacted by anthropogenic climate change. Here we use retrospective data analysis from 60 pollen stations located in the continental United States spanning from 1990 to 2018 which had quantitative records of pollen concentrations from multiple pollen taxa. With historic climate data corresponding to each pollen station's location and measurement years, we contextualize the pollen concentrations and season duration of the genera with changes in temperature and precipitation to derive significant correlations. This research is currently being conducted and there are no conclusive findings.

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## **Characterization of protein degradative pathway targets**

**Brooke Larson, University of Utah**

Faculty Mentor: Julie Hollien, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B50

A hallmark of neurodegenerative diseases like Alzheimer's, Parkinson's and Huntington's disease is the accumulation of misfolded proteins in neuronal cells. These improperly folded proteins become toxic to the cells and can cause neuronal cell death if not properly disposed of. Disposal of proteins in a cell is also known as degradation. All cells have four pathways it can utilize to degrade proteins when they accumulate in the cell. The pathways are Macro-autophagy, Endosomal micro-autophagy, Chaperone mediated autophagy, and Proteasome degradation. Proteins degraded by these pathways are not randomly targeted to one of the four pathways. A protein is most often specifically targeted to and degraded by only one pathway. However, it is unknown what makes a specific protein a target of each of these pathways. My research aims to better understand why a specific protein would be disposed of at one pathway over another. To test this question, I have created three mice cell lines expressing three different proteins of interests each tagged with Green Fluorescent Protein (GFP). The level of fluorescence in the cell can then be measured via Flow Cytometry or Western Blot technology to indicate the amount protein in the cell. Measuring fluorescence after treatment of the cells with chemical drugs that block each of the four degradative pathways can reveal the degradative fate of these proteins. Through characterization of the degradation

of these three target proteins insight can be gained into how the cells four degradation pathways chose what proteins to target. Better understanding and characterization of the pathway's cells utilize to degrade proteins can reveal potential targets for therapeutic drug treatments of neurodegenerative diseases that affect millions.

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## **Developing a Protocol for Detecting Volcanism Through Andean Lake Sedimentary Records**

### **Lauren Page, University of Utah**

Faculty Mentor: Mitchell Power, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B51

In the Andes, volcanism is likely a main contributor to disturbances made on the surrounding ecosystems. Volcanism can be a powerful force, creating a range of changes from blasting impacts, to ash fallout nutrient enrichment, to completely overriding the system. In the Colombian Andes, with San Diego Cerro Machin Volcanic Tectonic Providence (SCVPT) -evolving over 5 million years, volcanism is clearly a large contributor to disturbances on the ecosystem. This proposed project will seek to understand the potential role and impact of volcanism as a disturbance has on the tropical Andean ecosystems. This project also seeks to confirm laboratory protocols of detecting volcanism by analyzing lake sedimentary records using Micro-XRF and Transmission

Electronic Microscopes and/or Light Microscopes machines to discover tephra. For the research community, this project would help validate use of the Micro-XRF elementary analysis data to confirm tephra deposit on Andean lake sedimentary records. For environmentalists and ecologists it would help in learning how volcanism affects ecological communities over time on this area.

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## **AEBP1 as a potential anti-fibrotic target in cardiac fibrosis.**

**George Polishchuk, University of Utah**

Faculty Mentor: Stavros Drakos, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B52

Cardiovascular diseases are the leading cause of death globally. Increased myocardial fibrosis is one of the main drivers of systolic heart failure (HF), which limits the heart's ability to pump blood adequately to the rest of the organs. To prevent cardiac rupture following cardiac stress, fibroblasts are activated as a response to stress signaling to form myofibroblasts which secrete extracellular matrix (ECM) proteins, like collagen, in a process referred to as fibrosis.

Interestingly, single-cell RNA sequencing data of human HF myocardium showed an upregulation of adipocyte enhancer binding protein 1 (AEBP1) expression compared to donor myocardium. Expression of AEBP1 has been associated with fibrosis progression in other organs, and AEBP1 inhibition has been suggested as a potential therapeutic target in hepatic

and pulmonary fibrosis. The role of AEBP1 in cardiac fibrosis is not studied and needs further investigation. With AEBP1 overexpression (OE), smooth muscle actin (SMA, marker of myofibroblast,  $n=6$ ,  $p=0.06$ ), transgelin (SM22, early marker of smooth-muscle cell differentiation,  $n=6$ ,  $p=0.03$ ), and collagen ( $n=6$ ,  $p=0.002$ ) were also observed. Likewise, AEBP1-KD resulted in significant downregulation of SM22 ( $n=6$ ,  $p=0.02$ ) and collagen1 ( $n=6$ ,  $p=0.06$ ) indicating an AEBP1-dependent pathway in cardiac fibrosis. Additionally, mice which had multi-organ fibrosis induced through angiotensin and phenylephrine 4-week treatment. 2 weeks following induction, a group of mice was treated with adeno-associated virus 9 (AAV9) containing shRNA targeting AEBP1 to induce KD while the remaining received control AAV9 ( $n=5$  each). A significant reduction in SM22 ( $n=5$ ,  $p=0.06$ ) displayed a significant reduction of fibrosis within KD mice with additional conformational data from immunohistochemistry. Thus, our study suggests AEBP1 could emerge as a potential antifibrotic target in HF due to its significant role in cardiac fibrosis.

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## **Optimization of Cobalt Catalysts in the Hydrogenation of Carbon Dioxide to Methanol**

**Rachel Whipple, University of Utah**

Faculty Mentor: Caroline Saouma, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B53

As greenhouse gas emissions increase, the capture of carbon dioxide has become a point of interest. This captured CO<sub>2</sub> can be utilized as a cheap, abundant carbon source that can then be converted back to fuels, such as methanol [1]. Current methods to produce MeOH emit greenhouse gases, so CO<sub>2</sub> conversion to MeOH would be beneficial as it would both reduce CO<sub>2</sub> emissions and utilize the CO<sub>2</sub> that is already in the atmosphere. While this conversion has been proven possible, it has been accomplished with heterogeneous catalysts that require elevated temperature and pressure to produce methanol. Homogenous catalysts can react under milder conditions, but are often made from non-abundant metals, such as ruthenium [2,3]. Exploring the possibility of using more earth-abundant metals, such as cobalt, to form the catalyst has been done, but these have been with ill-defined catalysts [1]. To optimize these cobalt catalysts and investigate the catalytic cycle, we are synthesizing a variety of well-defined homogeneous complexes and proposed cobalt(I) and cobalt(II) hydride intermediates based on a cobalt-triphos system. The performance of these catalysts is then analyzed by GCMS and compared to each other to determine the most effective catalysts.

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homogeneous ruthenium-phosphine catalyst. *Angew Chem Int Ed Engl.* 2012, 51 (30), 7499-7502.

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## **Enantioselective Synthesis of Metal Coordination Complexes Using “Chiragen” Ligands**

### **Cole Clark, Weber State University**

Faculty Mentor: Timothy Herzog, Weber State University

SESSION B (10:45AM-12:15PM)

POSTER B54

Chiral metal complexes are commonly used for enantioselective catalysis in the synthesis of biologically active compounds and pharmaceuticals, but they generally suffer from the difficult process of obtaining one enantiomer of the complex over another. The purpose of this research is to synthesize a family of ligands that can coordinate to a metal center in an enantioselective fashion to produce chiral metal complexes that do not need to be post-synthetically separated from other enantiomers of the compound. These “Chiragen” ligands are based on two bipyridine moieties linked by a chiral backbone that can only wrap around a metal center in a certain way due to steric hindrance. The backbone of these Chiragen ligands is highly customizable, so while only the length of the backbone is being adjusted here, future works could easily test many sizes, flexibilities, and functional groups to see how different effects could improve or hinder several properties or configurations. Since bipyridines are known to complex to

nearly all of the transition metals, the synthesized Chiragen ligands will be coordinated to multiple different metals to investigate the properties of the formed compounds and their potential utility in other areas. Nuclear Magnetic Resonance (NMR) and X-Ray Diffraction Crystallography (XRD) will be used to characterize the ligands and the metal complexes. Some of the complexes are also expected to exhibit interesting optical properties, which could make them useful in photo redox applications or photovoltaics. For these, UV/Vis Spectroscopy may be used to characterize the complexes even further. Currently there are few results to report on. Fortunately, once the family of ligands has been created, the formation and characterization of metal complexes will provide a lot of data and results in a relatively short timeframe. The results obtained from this should provide plenty of useful information that could guide future investigations.

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## **Culvert Failure in Burned Utah**

### **Watersheds**

#### **Christian Stewart, Utah State University**

Faculty Mentor: Patrick Belmont, Utah State University

SESSION B (10:45AM-12:15PM)

POSTER 55

Consumptive water use and climate-change-induced drought have pushed the Colorado River and Great Salt Lake to the brink of disaster. Reservoirs in the Colorado River like Lake Powell and Lake Mead continue to hit all-time lows (below 30% capacity) and are approaching levels that can no longer

generate hydroelectricity. More than 40 million people deplete 100% of the Colorado River's flow, and the river has not reached the ocean for more than 50 years. Human water usage has reduced the volume of the Great Salt Lake by 64%. The lake is now at an all-time low (Null and Wurtsbaugh). Scientists are currently investigating how the drying lakebed is creating toxic dust storms that could harm millions of Utahns and decrease Utah's famous snowpack. The Great Salt Lake also carries "Hemispheric Importance" for North American bird populations (WHSRN). Transbasin diversions transfer water from the Colorado River basin to the Wasatch Front and farming communities in the Great Basin in Utah. These transfers are generally considered to be vital to maintain the health of Utah's economy and to guarantee a secure water supply for Utah's growing population. The most significant transbasin diversion in Utah is the transfer of Colorado River water from Strawberry Reservoir to the Spanish Fork River in Utah County. The Strawberry Water Users Association and the Central Utah Project are the two principal players in this major water transfer. Transbasin diversions make up a part of Utah's allocation of the Colorado River as described by the "Law of the River," including the Upper Basin Compact of 1948. Some transbasin diversions have garnered social, economic, and environmental controversy. That is certainly the case with the proposed Lake Powell Pipeline, which would transfer water from the Upper Colorado River Basin to the Lower Basin and provide water to Washington County, Utah. Transbasin diversions in Colorado have generated significant controversy between Eastern Colorado municipalities and Western Colorado farmers. Although the Strawberry Tunnel and Central Utah Project were less controversial, these diversions have resulted in significant impacts to the Duchesne River and



its tributaries. Because transbasin diversions provide a physical connection between Utah's largest cities and the Colorado River, Utah municipalities, agriculture, and ecosystems will be increasingly shaped by the fate of the Colorado River.

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## **Cross-Frame Technique for Flasher Pattern Thickness Accommodation**

**Lais Oliveira, Brigham Young University**

**Andy Avila, Brigham Young University**

Faculty Mentor: Spencer Magleby, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B56

The advantages that satellites, telescopes, and similar objects offer have engineers searching for the best methods of sending these objects into orbit. Such items are limited by volume and weight, which sparks the development of devices that launch in a stowed state and deploy once in space. One attractive option is the Flasher because of its great stowed volume to deployed surface area ratio. The radial folds of the pattern wrap around each other to make a kind of spiraling shape when viewed from above. This pattern works well enough when it is paper thin but the thickening process produces panel interference, an overall non-rigid surface, and manufacturing difficulties. Previous research has attempted to solve this thickness accommodation challenge, resulting in the membrane technique and the tapered panel technique. A new area of research, the cross-frame technique, is presented as an

alternative solution to thickening the Flasher pattern. Influenced by the tapered panel approach, geometric design for a single cross-frame panel consists of two arms at different levels. This creates a discretized step that provides multi-level hinge points. Unlike the tapered panel approach, the cross-frame members pass through the interior of the panel rather than border the perimeter. The panels are joined together at the middle of their shared edge, leaving the corners free from interference. Consequently, the members of the cross-frame panels can be thickened to the point where a hard stop between panels can be developed. This reduces floppiness throughout the device while in its deployed state. A 2-meter diameter prototype was created using 3D printed PLA parts and spinnaker tape. Folding tests have proven that the cross-frame method successfully avoids panel interference while maintaining a level of rigidity in the overall device. Future research includes designing stronger joints, selecting material for the members, and developing a method for inserting an optical membrane. As it is, the cross-frame technique stands as a viable thickness accommodation for the Flasher pattern as well as for other similar folding devices.

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## **Investigating the Mechanism of Action of Histidine Ammonia Lyase**

### **Dallin Billings, Southern Utah University**

Faculty Mentor: Elizabeth Pierce, Southern Utah University

SESSION B (10:45AM-12:15PM)

POSTER B57

Histidine ammonia lyase (HAL) is a metabolic enzyme whose mechanism has not been fully characterized. Deamination requires the presence of an electrophilic prosthetic group (MIO), which is formed by cyclization of the protein backbone involving alanine, serine, and glycine. This is similar to the cyclization reaction that forms the chromophore in green fluorescent protein (GFP), though the process in HAL positions the active site exposed to the solvent, whereas the GFP chromophore is buried in the protein. Backbone cyclization results in the formation of an alkene by elimination of the serine hydroxy group. This serves as the electrophile for the enzymatic mechanism. The covalent enzyme-substrate intermediate during the catalysis of L-histidine to ammonia and urocanate is unclear, however, there are two main hypotheses of the intermediate's structure-namely an N-MIO complex formed from nucleophile attack of the amino group in the substrate, and a Friedel-Crafts complex formed by nucleophile attack from the aromatic ring of the substrate. We are optimizing the purification of HAL from *Streptomyces griseus* using ammonium sulfate precipitation and ion exchange and hydrophobic interaction chromatography. Once protein purification methods have been refined, we plan to probe the protein using analogs of L-cysteine (shown to irreversibly inactivate the enzyme) and to monitor changes to the enzyme activity and UV-visible spectrum. One preliminary focus of interest is to determine whether a nitrogen or sulfur serves as the attacking nucleophile in the primary step of the inhibition mechanism, which might be observed spectroscopically with L-cysteine derivatives using highly conjugated substituents near the sulfur and nitrogen heteroatoms. Once we have determined the attacking nucleophile, we would like to see if this correlates to the

mechanistic nucleophile in the catalysis on histidine. Additionally, we would like to determine if HAL can be utilized to form fluorescent chromophores after the addition of L-cysteine derivatives with highly conjugated systems. Additional collaborators: Kyson Muhlestein, Southern Utah University

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## **Designing inducible DNA Constructs to be expressed in avian models**

**Megan Crother, Brigham Young University**

**Dalyn Davis, Brigham Young University**

**Lant Jenkins, Brigham Young University**

Faculty Mentor: Jeffery Barrow, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B58

Currently, nematodes, fruit flies, and zebrafish are effective models for gene manipulation. Avian models have served as embryonic models and have historically proved to be powerful in exploring developmental processes such as neural tube or limb development. Because of high chick fecundity, a relatively short period of development, and the accessibility of the chick embryo, the development of chick models is ideal for gene manipulation and would allow for an increased ability to study the relationship between genes and phenotypes. However, the inability to access single cell zygotes has led to an inability to derive stem cells that contribute to the germ line. As part of a

larger project to develop the chick as a model for ontogeny, we are designing drug inducible, lineage traceable DNA constructs that we will introduce to the germ line of chickens. Briefly, these constructs are first introduced into chicken primordial germ cells (cPGCs). The genetically modified cPGCs are injected into chick embryos where they colonize the gonad of the embryo. These embryos are allowed to develop, hatch, and grow to adulthood where they can pass on genetic constructs to progeny. In transgenic progeny, we can activate the expression of transgenes through injection of a drug whenever or wherever we desire to examine the consequences of aberrant gene activity in an otherwise normal embryo. We have generated constructs that through the introduction of a drug activate or inactivate important developmental pathways and express green fluorescent protein (GFP). Therefore, we are able to examine the fates of cells subjected to abnormal signaling at any given time or place in development. We anticipate that the development of these powerful genetic tools will be of broad interest to the scientific community.

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## **Variability of atropine and scopolamine levels in *Datura***

**Lia Rabellino, Utah Valley University**

Faculty Mentor: Michael Rotter, Utah Valley University

SESSION B (10:45AM-12:15PM)

POSTER B59

There are approximately 12 species in the genus *Datura*, a

member of the nightshade family known for its toxic chemical content. This herbaceous plant can reach up to two meters in height and has large, trumpet-shaped flowers. *Datura* is an opportunistic genus that tolerates arid climates and can be invasive outside its native range. Our research is concerned with two toxic compounds, atropine and scopolamine, that are present in all *Datura* species and are believed to have evolved as a response to herbivore attack. Atropine and scopolamine are thought to exist in erratic levels, making it difficult to predict chemical concentrations. In addition to being powerful predator deterrents, these compounds can cause severe poisoning and death in humans. Conversely, both chemicals are commonly used in pharmaceuticals to treat conditions such as gastrointestinal spasms and colic. *Datura* also has a long history of use in various cultures as a sacred entheogen. To understand the chemical variation in *Datura*, we conducted a comprehensive meta-analysis. Through the Web of Science database, we recovered 89 peer reviewed papers using the search terms “*Datura* atropine scopolamine” and extracted chemical concentration data from 18 of these. We also added additional papers from a citation search. We then looked at the variation of these compounds within species of *Datura* and throughout the genus. Our intention is to provide evidence that the variability of scopolamine and atropine concentrations in *Datura* are a result of genetics, and that this trait has allowed the plant to combat predation. Determining the degree of unpredictability in these compounds will give us important insights into evolutionary processes, invasive species management, and a deeper appreciation of the ethnobotanical uses of this mysterious plant. We hope our study will be the first to supply direct evidence supporting this hypothesis of evolved variability.

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## **Effects of immune system activity and methamphetamine on dopamine terminal function**

**Erin Taylor, Brigham Young University**

**Lauren Ford, Brigham Young University**

**Eliza White, Brigham Young University**

Faculty Mentor: Jordan Yorgason, Brigham Young University  
SESSION B (10:45AM-12:15PM)

POSTER B60

Much of addiction research in the mesolimbic dopamine (DA) pathway is focused on immune interactions due to high correlation of drug use with infection. Recent work suggests that microglia, native immune cells of the central nervous system, may interact with methamphetamine (METH) to alter its effect on DA release in this pathway. However, the mechanism and effects of microglial function on addictive behavior are unclear. Recent work using lipopolysaccharide (LPS), an antigen that activates microglia, has demonstrated that microglia in the ventral tegmental area contribute to methamphetamine effects on dopamine release through cell body interactions. However, it is unknown whether microglia at terminal regions like the accumbens are involved in psychostimulant effects. Using FSCV in brain slices, the present study attempts to quantify the effect of microglial activation

on DA terminal function in the mesolimbic DA pathway, particularly the nucleus accumbens (NAc). The present study also uses two-photon microscopy to examine morphological changes in microglia in response to LPS and METH. Together, FSCV and two-photon microscopy demonstrate the connection between microglia activation and DA terminal function. Bath-application of 1  $\mu\text{g/mL}$  LPS significantly increased the amplitude of DA release after four hours, but had no effect on reuptake. LPS also changed morphology of microglia consistent with an inflammatory immune response. In contrast, acute administration of 10 $\mu\text{M}$  METH did not affect the amplitude of DA release at the DA terminal but did significantly decrease the rate of DA reuptake. METH application showed similar morphology changes to LPS. Co-administration of METH after 4 hours of LPS attenuated METH's effect on DA reuptake, showing that inflammation is interacting with DA terminal function. Though further exploration is required to elucidate their exact mechanisms, there is a clear connection between microglial activation and DA terminal function in the NAc.

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## **Investigation of the utility of various detergents to disrupt *Staphylococcus aureus* biofilms**

**Jocelyn Wells, Brigham Young University**

Faculty Mentor: Brad Berges, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B61



*Staphylococcus aureus* is a dangerous human pathogen that causes about 20,000 deaths per year in the US as well as costing the US healthcare system billions of dollars annually. One of the reasons that *S. aureus* is so deadly is that it forms biofilms. Bacterial biofilms are surface associated assemblages of bacteria embedded in an extracellular matrix. Biofilms are extremely difficult to treat because neither the host immune response nor antibiotics can easily penetrate the matrix. In addition, *S. aureus* cells adhere tightly to one another, forming dense “grape clusters” of cells that are difficult to separate. Both of these factors, in addition to complicating treatment, make it difficult to study the bacterium, since many methods require isolating individual cells. One way of breaking up biofilms and bacterial clusters is to use a chemical surfactant in combination with mechanical agitation. We tested 5 different detergents (Triton X-100, Tween 20, Sodium deoxycholate, CHAPS, and N-lauroylsarcosine (Sarkosyl)) at various concentrations. Each detergent was deposited into a well containing a *S. aureus* biofilm and vigorously pipetted up and down. The resulting mixture was then streaked on agar plates in serial dilutions and colony forming units (CFU) were counted. Ideally, a detergent with a higher CFU count than the bacterial media control would indicate that a detergent successfully separated bacterial cells that would have otherwise remained bound and formed the same colony. Our results showed that a 0.01% solution of Triton X-100 was the only detergent tested to show more CFU than the control. Most of the other detergents produced less CFU, indicating that they were too strong of a concentration and were killing the cells. Future work will be done to determine whether 0.01% Triton X-100 shows statistically significantly more CFU than the bacterial media control.

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## **Discovering effects of Fatty Acids on Nr4a1-NBRE interactions.**

**Alex Benbrook, Brigham Young University**

Faculty Mentor: Jeffery Tessem, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B62

Diabetes Mellitus is a chronic condition that affects millions of people worldwide. The main cause of diabetes is a reduced viable beta cell mass, the basis for this being reduced proliferation, increased cell death, and a decrease in glucose stimulated insulin secretion. Proper beta cell function is reliant on the transcription factor Nr4a1. Loss of Nr4a1 leads to a reduction in Beta cell proliferation and glucose stimulated insulin secretion. Not only do patients with type 2 diabetes exhibit a loss of viable beta cell mass, they also show a decreased expression of Nr4a1. Recent studies have shown that Nr4a1 binds to unsaturated fatty acids. We have shown that this binding reduces Nr4a1 transcriptional activity and cellular localization. We hypothesized that Nr4a1's ability to bind to its response element, NBRE, is impaired by the same fatty acids that are prevalent in type 2 diabetes. In order to test this hypothesis, we used an electrophoretic mobility shift assay (EMSA), which uses a fluorescently labeled DNA to determine Nr4a1-DNA interactions. We ran the EMSA in the presence of Fatty acids and observed the change they had on the band noting the effects carbon chain length and degree of unsaturation had on the band. Here we present the results of our studies.

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## **Effects of Post-Translational Histone Modifications on Transcription Rate**

### **Aaron Bohn, Brigham Young University**

Faculty Mentor: Steven Johnson, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B63

The structural organization of DNA in eukaryotic cells is highly implicated in the regulation of gene expression and thus cellular properties and behavior. At the most fundamental unit of this organization, approximately 147 base pairs of DNA wraps about 1.7 times around a histone octamer core, forming a collective unit called the nucleosome. The positioning and occupancy of these nucleosomes around the promoter elements of genes is known to be a strong regulator of transcription in eukaryotic nuclei, and post-translational modifications (PTM's) to the protruding N-terminal tails of histone proteins are known to influence chromatin structure and thus gene expression; however, relatively little is known about the residual effect of histone PTM's on transcription rate. Here, we present a novel method for measuring the transcription rate of chromatin with variable histone composition using an engineered DNA construct consisting of *C. elegans* promoter elements and high-affinity nucleosome positioning sequences<sup>1</sup> followed by the Broccoli<sup>2</sup> aptamer, a more versatile derivative of the Spinach<sup>3</sup> aptamer. This terminal RNA aptamer will bind a DFHBI fluorophore molecule and fluoresce upon completion of RNA transcripts, allowing for the quantification of real-time

transcription rates using common qPCR instruments. After using salt dialysis to reconstitute chromatin in vitro from the engineered DNA construct and histones with varying PTM's, this technique will enable us to measure the hypothesized changes in transcription rate as histones in the gene body are differentially modified. If successful, the data collected using this technique will offer insights into the effects of PTM's on transcription rate, ultimately allowing for more precise manipulation of transcriptional output and thus gene expression in living organisms.

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## **Microwave-assisted synthesis of (E)-stilbene derivatives by palladium- catalyzed Suzuki-Miyaura cross-coupling reaction**

## **Madison Brown, Southern Utah University**

Faculty Mentor: Nathan Werner, Southern Utah University

SESSION B (10:45AM-12:15PM)

POSTER B64

Microwave irradiation is a useful method to heat food and organic reactions. It can provide shorter reaction times and unusual reactivity when compared to traditional, conduction heating on a hotplate. The conduction heated palladium-catalyzed Suzuki-Miyaura cross-coupling reaction of (E)-2-phenylethenylboronic acid pinacol ester with aromatic bromides was discovered and developed at SUU. However, the analogous reaction heated by microwave irradiation was unknown. Here, we describe the synthesis of (E)-stilbene derivatives by palladium-catalyzed Suzuki-Miyaura cross-coupling reaction of (E)-2-phenylethenylboronic acid pinacol ester with aromatic bromides heated by microwave irradiation. The reaction conditions developed for conduction heating were evaluated for reactions heated by microwave irradiation. Various electronically diverse aromatic bromides were studied in reactions heated by microwave irradiation. The yields and reaction times of reactions heated by microwave irradiation were improved when compared to reactions heated by conduction. Interestingly, the scope of compatible aromatic bromides bearing challenging electron-donating substituents was increased when microwave heating was used.

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## **Identifying Biological Remnants in Fossils with Raman Spectroscopy**

## **Molly Christensen, Utah Valley University**

Faculty Mentor: Dustin Shipp, Utah Valley University

SESSION B (10:45AM-12:15PM)

POSTER B65

Recent research suggests that soft tissues are preserved in ancient fossils as far back as the dinosaurs. However more micro-analytical methods are needed to continue learning about our ancient ancestors. Raman spectroscopy is an excellent candidate for studying ancient soft tissues because it is flexible for measuring many types of samples and is known for its high sensitivity to molecular differences. This research is focused on finding biological markers of fossils in reducing and oxidative geologic environments. The task is to collect fossils from reducing and oxidative environments to find out how many of those fossils have traces of proteins and other biological signatures with a Raman spectrometer. If biological material is not lost by fossilization, then we can peer into our predecessors proteins and see how they evolved. This kind of research would open a new door in paleontology. It would allow for studies to be done on evolutionary processes and learning about the biochemistry of ancient organisms.

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**Mechanotransduction at the septate  
Junction in Planaria compares to the  
Hedgehog pathway phenotypes during  
regeneration**

**Austin Hanna, Brigham Young University**  
**Ricardo Romo, Brigham Young University**  
**Dallin Wassmer, Brigham Young**  
**University**

Faculty Mentor: Dario Mizrachi, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B66

The use of stem cells is fast advancing regenerative therapies. To fulfill the promise of regenerative medicine it is required that we understand fully both the stem cell and the endpoint tissue we aim to regenerate. Cells have three sources of energy: chemical, electrical, and mechanical. We know a fair amount about the first two, and very little about the third. The study of mechanical transduction is difficult because the stimulus at the site of a transducer is generally unknown. It is now evident that biomechanical stimuli are as crucial for regulating stem cell behavior as biochemical stimuli. In the case of degenerative diseases, recent advanced therapies promise to slowdown/stop progression, but there is no evidence brain health can be restored. In our laboratory, using a regenerative model, fresh water Planaria, we identified that cell-cell contact and concomitant mechanotransduction, mediated by the membrane protein occludin (OCLN), is one important stimulus during brain regeneration. The discovery of homology between the planarian and the mammalian CNS opens a door to examine parallels in regeneration and plasticity. Thus, it will be essential to understand how brain regeneration is controlled by mechanical transduction. Brain regeneration is under the control of biochemical stimuli through the Hedgehog signal

transduction pathway. We aim to compare the effects of biomechanical stimuli of OCLN and biochemical stimuli of Hedgehog pathway during Planaria brain regeneration. Our laboratory is in a unique position to expand our knowledge of brain regeneration and plasticity, and provide new tools and evidence to better understand mechanobiology.

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## **Elucidation of radical quenching mechanisms for five novel antioxidants.**

### **Wes Christiansen, Utah Valley University**

Faculty Mentor: Emily Heider, Utah Valley University

SESSION B (10:45AM-12:15PM)

POSTER B67

The purpose of this research is to determine the mechanism of radical quenching of novel antioxidants. In chemistry, a free radical is defined as a compound with a single unpaired valence electron. These species are usually unstable and can damage molecules such as DNA by uncontrolled oxidation reactions. When a radical reacts with a molecule and single electron transfer occurs, the compound which lost the electron has been “oxidized.” As a result, a new radical is produced, and the process is repeated in a chain reaction. This process is potentially dangerous to many living organisms including human tissues and is related to aging. Antioxidants, as the expression implies, exist to counter this phenomenon by ‘quenching’ the radical thus inhibiting further oxidation reactions. Vitamin C and E are common antioxidants that most



individuals are familiar with in everyday life. This research investigated two reaction mechanisms: single electron transfer (SET) and hydrogen atom transfer (HAT). By reacting the antioxidants with the stable radical 2,2-diphenyl-1-picrylhydrazyl, or DPPH, the rate of radical reaction can be determined under controlled conditions that favor either the SET or HAT mechanism. While both are mechanisms are possible in the DPPH quenching reaction, one will dominate over the other in certain conditions. These conditions include pH, solvent, and antioxidant strength. Current data show that methanol and ethanol solvents favor single electron transfer due to the alcohol's tendency for hydrogen bonding. Our research studied the rate of DPPH quenching for five novel antioxidants: 3-hydroxythiophene-2-carboxylic acid (HTC), 2H,4H,5H,6H,7H,7aH-thieno[3,2-C] pyridin-2-one (TPO), Methyl 3-hydroxy-1H-pyrrole-2-carboxylate (MHPC), 2,5-dihydro-4-hydroxy-2-oxo-1H-pyrrole-3-carboxylic acid methyl ester (PCME), and 5-Trityl-5,6,7,7a-tetrahydrothieno-[3,2-c] pyridin-2(4H)-one (TTTP).

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## **Anti-Microbial Properties of Cobalt**

**Maren Dawson, Weber State University**

Faculty Mentor: Timothy Herzog, Weber State University

SESSION B (10:45AM-12:15PM)

POSTER B68

Disease can be transmitted in a variety of pathways, including bacteria. The study and eradication of disease is

important to help increase the general health of the population. Cobalt is an element known to contain anti-microbial properties that inhibit the growth of bacteria. To test the inhibition of bacteria, tris ethylenediamine cobalt iodide was synthesized in two enantiotopic, Dextrorotary and Levorotary, forms. Three other cobalt complexes were also synthesized for use. The chemical formula for these complexes are  $[\text{Co}(\text{NH}_3)_4\text{CO}_3]\text{SO}_4$ ,  $[\text{Co}(\text{NH}_3)_4\text{CO}_3]\text{NO}_3$ , and  $\text{Co}(\text{NH}_3)_5\text{Cl}_3$ . The next step is examining the anti-microbial properties cobalt complexes contain by using a Minimum Inhibitory Concentration (MIC) plating technique. Four types of bacteria will be tested in combination with each cobalt complex, in triplicate, using a 96 well plate. The four types of bacteria being tested are E. Coli, Klebsiella Pneumoniae, MRSA, and Streptococcus A. The five different concentration levels that will be used are 0.1M, 0.01M, 0.001M, 0.0001M, and 0.00001M. Triplicate data for each compound at each concentration will be recorded for the results. The purpose of the project is to discover the most effective technique and determine which cobalt complex is the best inhibitor. Using that information, we could propose a drug treatment that can be used to prevent diseases and conditions caused by the bacteria. With future projects, we hope the medicinal applications and toxicity levels of the cobalt complexes from this research project are explored. This would help increase the chance of finding a cure for the diseases and conditions these bacteria cause.

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## **Measuring Odonates with Flying Colors: Building a Database of Odonate Coloration**

## **in Vietnam**

### **Eva Driggs, Brigham Young University**

Faculty Mentor: Seth Bybee, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B69

Odonata (dragonfly and damselfly) color vision is broad and extremely interesting at both the physiological and molecular level. Odonates appear to be almost entirely visual using color cues to find mates and discriminate between species. However, their diversity in body coloration is less well known. Vietnam's high diversity of odonate species allows for a large range of visible spectrum color: from ultraviolet to infrared. A spectrophotometer was used to objectively measure the full spectrum of reflected light from 250 to 750 nm. We measured a compilation of various body parts from live specimens collected in Vietnam. As we started to find particularly interesting color patterns in families or genera – specifically Chlorocyphidae and Rhipidolestes – we narrowed our focus to certain species. We compared and contrasted the color patterns of species from these groups as they had overlapping distributions, habitats, and diel patterns. This is the start of a database that has the potential to address questions about the evolution of community color composition and coloration as a possible indicator of odonate and ecosystem health. We have also taken coloration measurements from French Guiana, Gabon, and the US and hope to build the database on a more global level in the future.

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## **A Potential for Reproductive Diapause in Neotropical Butterflies**

**Kyri Forman, Utah Valley University**

Faculty Mentor: T. Heath Ogden, Utah Valley University

SESSION B (10:45AM-12:15PM)

POSTER B70

Reproductive Diapause is a trait commonly used by butterflies and other insects to survive harsh conditions in the more temperate regions of the world. In temperate species, diapause is triggered by various environmental factors including changes in temperature, photoperiod, or humidity, and is commonly used to survive colder climates brought on by winter. While diapause is well-studied in temperate species of insects, there is very little known about the usage of diapause in tropical species. This research is a preliminary to find possibilities of reproductive diapause in neotropical butterflies in the Madre De Dios Region of Southeastern Peru. This region has distinct wet and dry seasons, impacting the numerous organisms found there. For many species of Lepidoptera present in this region, necessary host plants may dry up or become otherwise inaccessible during the dry season, creating unfavorable conditions during this time of the year. Individual butterflies were collected during the onset of the dry season in June and July and dissected to analyze for signs of reproductive diapause. Potential signs of reproductive diapause were seen in *Eunica pusilla* (Nymphalidae: Biblidinae), and up to 6 species of Satyrinae. This signifies a possibility of reproductive diapause being used as a strategy in neotropical butterflies, a previously unknown phenomenon in any insect occurring in the Amazon Rainforest.

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## **Chytrid Studies in Washington County, Utah**

**Asheley Atkin, Utah Tech University**

**Sarah HeiNz, Utah Tech University**

Faculty Mentor: Curt Walker, Utah Tech University

SESSION B (10:45AM-12:15PM)

POSTER B71

Chytrid fungus causes a disease that attacks the keratin in amphibian skin and damages their nervous systems. Over the summer of 2022, we swabbed local Baja tree frogs throughout Washington County, Utah then performed PCR to determine if there was any chytrid present. There was no chytrid found on any of the frogs swabbed. Since chytrid cannot live above 23°C, any chytrid that may have been in the area likely died due to the high temperatures experienced locally. We believe this explains the persistence of Baja tree frogs in the area.

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# **Effect of Inlet Tube Diameter and Residence Time on the Evaporation of Organic Aerosol Particles During Airborne Sampling**

**Lucia Fortado, Weber State**

Faculty Mentor: Demetrios Pagonis, Weber State

SESSION B (10:45AM-12:15PM)

POSTER B72

Evaporation is crucial in airborne sampling, where air outside of the research plane is very cold and the air inside of the research plane is contrastingly hot. The evaporation occurs from the time the aerosols enter the inlet tubes of the research plane to the time the aerosols reach the measuring instrument. In this study, the effect of inlet tube diameter size and the residence time of air in an inlet tube on organic aerosol (OA) evaporation was researched through a semi-volatile organic concentration partitioning model to study such evaporation. The mass fractions remaining (MFRs) in three different OA atmospheric conditions were collected and plotted against varying diameters and residence times. After comparing the summary plots, it was concluded that the extent of evaporation was lowest when diameter was as large as possible-given the range of 0.0038m to 0.051m-and residence time inside of the inlet tube was as short as possible-given the range of 0-10s. This partitioning model was made within the computer program of Python, version 3, to allow for open-source distribution.

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# **Time flies: Chromosome number changes in the evolutionary history of *Drosophila***

## **Audrey French, Utah Valley University**

Faculty Mentor: Carl Hjelman, Utah Valley University

SESSION B (10:45AM-12:15PM)

POSTER B73

Historically, chromosome number has been one of the first pieces of information collected about an organism's genome. These numbers have been shown to vary widely across organisms (Blackmon and Demuth 2015, Perkins et al. 2019, Sylvester et al. 2020, Morelli et al. 2022). Chromosome numbers change due to fission events, where chromosome number increases, and fusion events, where chromosome number decreases. As *Drosophila* species have been used as model organisms for nearly a century, there is an abundance of information on chromosome number, chromosome shapes, and sex chromosome systems. Chromosome shapes are described as rod (telocentric), j (submetacentric), v (metacentric), and dot (small and heterochromatic). Sex chromosome systems present in this genus include the XY, XO, and neo-sex chromosome systems. There are more than 1,600 species of *Drosophila* identified and classified into two large subgenera which have diverged for 40-65 million years: *Drosophila* and *Sophophora*. Recently, *Drosophila* genus karyotype data were compiled into an open source database (Morelli et al 2022). While there is a plethora of information on chromosomes in the *Drosophila* genus, no work has specifically focused on the rates of chromosome number change in this genus. To address this problem, I am using comparative phylogenetic analyses through the *chromePlus* package in R (Blackmon et al., 2019)

with a previously published phylogeny of 152 species in the *Drosophila* genus (Hjelmen et al., 2019). Specifically, I am investigating how the rate of chromosome number and shape evolution differs between subgenera and sex chromosomes systems. Through these methods, I am able to compare the rates of fusion and fission between the groups of interest. In the future, these methods will be expanded to the entire Diptera order. These works contribute to the growing body of knowledge on chromosome and genome structure evolution.

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## **Effect of Climate Change on *Papilio Indra* Lepidoptera**

### **Colton Gardner, Utah Valley University**

Faculty Mentor: Wayne Whaley, Utah Valley University

SESSION B (10:45AM-12:15PM)

POSTER B74

Climate change may be responsible for the extinction of numerous plant and animal species. Recently, drought in the Western United States caused by climate change has raised concerns. Amongst these, it was hypothesized that climate change has had detrimental effects on the *Indra* Swallowtail butterfly and their host plants. This rare butterfly is endemic to the Western United States. This is concerning because these butterflies are pollinators with mutualistic symbiotic relationships such that its extinction will have a cascading effect on the environment. In this research study, 7 locations throughout Nevada, California, and Arizona were chosen to determine the fitness of the butterfly populations in drought



conditions. This butterfly deposits eggs on a specific plant of family Apiaceae which serve as maturation sites for caterpillars. The locations were studied before the drought and had healthy plants with an abundance of caterpillars, meaning that the butterflies were reproducing and thriving. To determine the health of these populations, several factors were studied including plant health, egg numbers, and caterpillar activity. Drought caused decreased plant health, with reduced plant numbers. Moisture is important for Indra butterflies because they will not exit diapause until water has fallen. Under drought conditions they sometimes wait years before exiting diapause to reproduce. In all locations Indra swallowtails had not left their diapause for a substantial amount of time. In addition to not seeing Indra adults near host plant locations, there was no evidence of caterpillars or eggs on plants that in years past were filled with them. The data from the locations were compared with prior data when there was normal moisture. The findings were obvious: climate change had a negative effect on the Indra butterfly. Water is imperative for these populations, and evidence shows that the lack of moisture has severely reduced plant and butterfly fitness.

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## **Creating Universal Caddisfly Rearing Enclosures for in Lab Use Danyon Gedris, Brigham Young University**

Faculty Mentor: Paul Frandsen, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B75

Several methods have been used to rear caddisfly larvae over the many years they've been studied. This means that the ways and means are diverse. However, most studies have relied on the creation of custom aquarium tanks or flow chambers and provide few specifics about how to construct their enclosures. Also, since every study has its own objectives and hypotheses to test, the tanks made often are tailored to the experiment instead of being universal in scope. This means that future projects like the ones being worked on in the Frandsen Lab require additional time and resources to create new tanks. Current projects in the lab focus on using these caddisfly larvae in experiments outside of their tanks. Consequently, efforts to create aquarium tanks for rearing have focused on making optimal living conditions instead of tailoring the tanks to the experiment. So far 3 proposed tanks are being tested: simple aquariums using air stones to introduce dissolved oxygen, a lab stream that cools the water and provides a sterile stream like environment, and flow inducing aquariums that use the aeration to introduce directed flow into the system. This research aims to find the optimal conditions that will allow caddisfly larvae to live through all 5 instars and emerge. In addition to simply replicating what past studies have done, the goal is to make an easily replicable lab enclosure so future research can rear caddisflies without the hassle of adapting every tank to the needs of the experiment. Preliminary results have found that the caddisflies of the families Helicopsychidae, Limnephilidae, Brachycentrus and Leptoceridae survive well in simple aquarium tanks. Hydropsychidae thrive more often in the flow inducing aquariums where they can produce their nets to collect organic material moving in the tank. The simulated stream so far has not been favorable for any caddisflies retrieved from the wild.

## **The Gains in Effort Belief and Self Competence in Mastery-Based Grading in Active General Chemistry 1 classrooms.**

**Grant Hendrickson, Utah Valley University**

Faculty Mentor: Heather Wilson-Ashworth, Utah Valley University

SESSION B (10:45AM-12:15PM)

POSTER B76

Due to the pressure of having one opportunity to show proficiency on assessments, some students struggle in science classes despite knowing the material they are taught. This pressure discourages students, can promote academic failure, and ultimately result in students leaving the sciences. Mastery-Based Grading (MBG), a nontraditional grading approach, provides multiple opportunities for students to show mastery of the course learning objectives. Hypothesis: MBG leads to increased student self-competence and effort belief compared to non-MBG courses. This hypothesis is based on self-determination (Deci & Ryan and others, 1991) and expectancy-value theory (Eccles, 1983). At a private midwestern college, general chemistry I students in an active learning, MBG course (53 students) and a lecture course (48 students) with a traditional grading policy were surveyed. Reflection questions based on the impact of MBG on students' self-competence and effort belief were administered. Surveys were given during week 2 and week 14 of the semester. Using anonymized data,

a coding scheme was developed, and the data was coded to consensus. The preliminary data suggest that students perceived professor and tutor assistance to be contributors to their success in the course. Students also recognized MBG components such as test retakes and test analysis as valuable tools for improving their grades. MBG has the potential to increase students' self-competence and effort belief which promotes student retention and success in difficult science courses and majors.

Deci, E. L., Vallerand, R.J., Pelletier, L.G. & Ryan, R.M. (1991) "Motivation and education: The self-determination perspective" *Educational Psychologist*, 26, 325-346.

Eccles (Parsons), J. (1983) "Expectancies, values, and academic behavior." in J.T. Spence (Ed.) *Achievement and Achievement Motivation*. San Francisco: W.H. Freeman.

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## **The Gains in Effort Belief and Self-Competence in Mastery-Based Grading in Active General Chemistry 1 classrooms.**

**Christian Moody, Utah Valley University**

**Nicholas Jeffery, Utah Valley University**

**Grant Hendrickson, Utah Valley University**

Faculty Mentor: Heather Ashworth, Utah Valley University

## SESSION B (10:45AM-12:15PM)

## POSTER B76

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## **Effect of Inlet Tube Diameter and Residence Time on the Evaporation of Organic Aerosol Particles During Airborne Sampling**

**Lucia Fortado, Weber State**

Faculty Mentor: Demetrios Pagonis, Weber State

SESSION B (10:45AM-12:15PM)

POSTER B77

Evaporation is crucial in airborne sampling, where air outside of the research plane is very cold and the air inside of the research plane is contrastingly hot. The evaporation occurs from the time the aerosols enter the inlet tubes of the research plane to the time the aerosols reach the measuring instrument. In this study, the effect of inlet tube diameter size and the residence time of air in an inlet tube on organic aerosol (OA) evaporation was researched through a semi-volatile organic concentration partitioning model to study such evaporation. The mass fractions remaining (MFRs) in three different OA atmospheric conditions were collected and plotted against varying diameters and residence times. After comparing the summary plots, it was concluded that the extent of evaporation was lowest when diameter was as large as possible-given the

range of 0.0038m to 0.051m-and residence time inside of the inlet tube was as short as possible-given the range of 0-10s. This partitioning model was made within the computer program of Python, version 3, to allow for open-source distribution.

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## **Time flies: Chromosome number changes in the evolutionary history of *Drosophila* Audrey French, Utah Valley University**

Faculty Mentor: Carl Hjelman, Utah Valley University

SESSION B (10:45AM-12:15PM)

POSTER B78

Historically, chromosome number has been one of the first pieces of information collected about an organism's genome. These numbers have been shown to vary widely across organisms (Blackmon and Demuth 2015, Perkins et al. 2019, Sylvester et al. 2020, Morelli et al. 2022). Chromosome numbers change due to fission events, where chromosome number increases, and fusion events, where chromosome number decreases. As *Drosophila* species have been used as model organisms for nearly a century, there is an abundance of information on chromosome number, chromosome shapes, and sex chromosome systems. Chromosome shapes are described as rod (telocentric), j (submetacentric), v (metacentric), and dot (small and heterochromatic). Sex chromosome systems present in this genus include the XY, XO, and neo-sex chromosome systems. There are more than 1,600 species of *Drosophila* identified and classified into two large subgenera which have

diverged for 40-65 million years: *Drosophila* and *Sophophora*. Recently, *Drosophila* genus karyotype data were compiled into an open source database (Morelli et al 2022). While there is a plethora of information on chromosomes in the *Drosophila* genus, no work has specifically focused on the rates of chromosome number change in this genus. To address this problem, I am using comparative phylogenetic analyses through the chromePlus package in R (Blackmon et al., 2019) with a previously published phylogeny of 152 species in the *Drosophila* genus (Hjelman et al., 2019). Specifically, I am investigating how the rate of chromosome number and shape evolution differs between subgenera and sex chromosomes systems. Through these methods, I am able to compare the rates of fusion and fission between the groups of interest. In the future, these methods will be expanded to the entire Diptera order. These works contribute to the growing body of knowledge on chromosome and genome structure evolution.

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## **Advanced Alkaline Fuel Cell**

**PJ Martin, Utah Valley University**

**Jackson Rose, Utah Valley University**

Faculty Mentor: Kevin Shurtleff, Utah Valley University

SESSION B (10:45AM-12:15PM)

POSTER B79

In the modern era, perhaps the most pressing issue is that of power generation. It is important that a source which is inexpensive, reliable, efficient, sustainable, and carbon free be



developed. One such effort has been to develop the hydrogen fuel cell. Fuel cells meet many of the requirements listed above save one, current designs are too expensive. The catalysts used in most modern hydrogen fuel cells are often platinum group metals, which significantly increases the cost of manufacturing. The resulting high price has proved a significant barrier to adoption. Alkaline fuel cells are comparatively cheap as the catalysts are relatively inexpensive, but they suffer from some reliability issues. One problem with alkaline fuel cells is the formation of carbonates, which are often produced when carbon dioxide reacts with the potassium hydroxide electrolyte. During operation, carbonates tend to build up on the catalytic sites rendering the fuel cell completely inoperable. However, the chemistry can be manipulated to eliminate this failure. The potassium hydroxide electrolyte in an alkaline fuel cell can be replaced with an organic amine. Carbonates are soluble in many amines and thus will not precipitate out of solution. This will prevent carbonates from building-up on the catalytic site and may and even clean these sites. At Utah Valley University, strategies for extremely low-cost fuel cell production are being designed and tested. Currently, nickel and silver nanoparticle catalysts are being electrodeposited onto carbon cloth samples, which are then examined via S.E.M. The purpose of this is to establish what size of electrodeposited particles will afford the maximum catalytic activity. Optimizing particle size for the hydrogen oxidation reaction will help to improve efficiency and effectiveness of the fuel cell, which will reduce costs. Smaller model samples are to be built to test both the amine as well as the different catalyst samples. Once an optimal particle size and amine have been identified, scaling the process is next. The goal for this identification is by the end of the year this year. Early into next year, the scaling will begin. A full-scale

alkaline amine fuel cell system will be built. It will be tested as a twelve volt system for current density, lifetime and total costs for comparison to other fuel cell systems.

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## **Effect of Climate Change on *Papilio Indra* Lepidoptera Colton Gardner, Utah Valley University**

Faculty Mentor: Wayne Whaley, Utah Valley University

SESSION B (10:45AM-12:15PM)

POSTER B80

Climate change may be responsible for the extinction of numerous plant and animal species. Recently, drought in the Western United States caused by climate change has raised concerns. Amongst these, it was hypothesized that climate change has had detrimental effects on the Indra Swallowtail butterfly and their host plants. This rare butterfly is endemic to the Western United States. This is concerning because these butterflies are pollinators with mutualistic symbiotic relationships such that its extinction will have a cascading effect on the environment. In this research study, 7 locations throughout Nevada, California, and Arizona were chosen to determine the fitness of the butterfly populations in drought conditions. This butterfly deposits eggs on a specific plant of family Apiaceae which serve as maturation sites for caterpillars. The locations were studied before the drought and had healthy plants with an abundance of caterpillars, meaning that the butterflies were reproducing and thriving. To determine the health of these populations, several factors were

studied including plant health, egg numbers, and caterpillar activity. Drought caused decreased plant health, with reduced plant numbers. Moisture is important for Indra butterflies because they will not exit diapause until water has fallen. Under drought conditions they sometimes wait years before exiting diapause to reproduce. In all locations Indra swallowtails had not left their diapause for a substantial amount of time. In addition to not seeing Indra adults near host plant locations, there was no evidence of caterpillars or eggs on plants that in years past were filled with them. The data from the locations were compared with prior data when there was normal moisture. The findings were obvious: climate change had a negative effect on the Indra butterfly. Water is imperative for these populations, and evidence shows that the lack of moisture has severely reduced plant and butterfly fitness.

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## **Creating Universal Caddisfly Rearing Enclosures for in Lab Use Danyon Gedris, Brigham Young University**

Faculty Mentor: Paul Frandsen, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B81

Several methods have been used to rear caddisfly larvae over the many years they've been studied. This means that the ways and means are diverse. However, most studies have relied on the creation of custom aquarium tanks or flow chambers and provide few specifics about how to construct their enclosures. Also, since every study has its own objectives and hypotheses

to test, the tanks made often are tailored to the experiment instead of being universal in scope. This means that future projects like the ones being worked on in the Frandsen Lab require additional time and resources to create new tanks. Current projects in the lab focus on using these caddisfly larvae in experiments outside of their tanks. Consequently, efforts to create aquarium tanks for rearing have focused on making optimal living conditions instead of tailoring the tanks to the experiment. So far 3 proposed tanks are being tested: simple aquariums using air stones to introduce dissolved oxygen, a lab stream that cools the water and provides a sterile stream like environment, and flow inducing aquariums that use the aeration to introduce directed flow into the system. This research aims to find the optimal conditions that will allow caddisfly larvae to live through all 5 instars and emerge. In addition to simply replicating what past studies have done, the goal is to make an easily replicable lab enclosure so future research can rear caddisflies without the hassle of adapting every tank to the needs of the experiment. Preliminary results have found that the caddisflies of the families Helicopsychidae, Limnephilidae, Brachycentrus and Leptoceridae survive well in simple aquarium tanks. Hydropsychidae thrive more often in the flow inducing aquariums where they can produce their nets to collect organic material moving in the tank. The simulated stream so far has not been favorable for any caddisflies retrieved from the wild.

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## Representations of the Symmetric Group

## from Geometry

**Emil Geisler, University of Utah**

Faculty Mentor: Sean Howe, University of Utah

SESSION B (10:45AM-12:15PM)

POSTER B82

Throughout this abstract,  $\mathbb{C}$  represents the complex numbers,  $\mathbb{Q}$  represents the rational numbers, and  $S_n$  represents the symmetric group with  $n$  elements. Representation stability was introduced to study mathematical structures which stabilize when viewed from a representation theoretic framework. The instance of representation stability studied in this project is that of ordered complex configuration space, denoted  $\text{PConf}_n(\mathbb{C})$ :

$$\text{PConf}_n(\mathbb{C}) := \{ (x_1, x_2, \dots, x_n) \mid x_i \neq x_j \}$$

$\text{PConf}_n(\mathbb{C})$  has a natural  $S_n$  action by permuting its coordinates which gives the cohomology groups  $H^i(\text{PConf}_n(\mathbb{C}); \mathbb{Q})$  the structure of an  $S_n$  representation. The cohomology of  $\text{PConf}_n(\mathbb{C})$  stabilizes as  $n$  tends toward infinity when viewed as a family of  $S_n$  representations. From previous work, there is an explicit description for  $H^i(\text{PConf}_n(\mathbb{C}); \mathbb{Q})$  as a direct sum of induced representations for any  $i, n$ , but this description does not explain the behavior of families of irreducible representations as  $n$  tends toward infinity. We implement an algorithm which, given a Young Tableau, computes the cohomological degrees where the corresponding family of irreducible representations appears stably as  $n$  tends to infinity. Previously, these values were known for only a few Young Tableaus and cohomological degrees. Using this algorithm, results have been found for all Young Tableau with up to 8 boxes and certain Tableau with

more, which has led us to conjectures based on the data collected.

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## **The use of niche modeling to characterize the microhabitat of hybrid oaks (*Quercus undulata*) in Utah**

**Carson Veazie, Southern Utah University**

**Sydney Chatfield, Southern Utah**

**University**

Faculty Mentor: Matt Ogburn, Southern Utah University

SESSION B (10:45AM-12:15PM)

POSTER B83

Western Utah is home to two distinct species of oak, Gambel oak (*Quercus gambelii*) and Dixie live oak (*Quercus turbinella*), which can hybridize to form an intermediate species that has been named *Quercus x undulata*. In spite of previous research on these shrubs, we are still unsure of how the hybrid has survived in small isolated locations well outside of the range of one parent species (*Q. turbinella*, which is restricted in Utah to Washington, Kane, and San Juan Counties). We performed a microhabitat niche modeling study at the Three Peaks Recreation Area (Iron County, Utah) to characterize the abiotic and biotic factors most predictive of *Q. x undulata*, and to contrast the niche of *Q. x undulata* with *Q. gambelii*, which also occurs locally at Three Peaks. We collected plot-level data to determine abiotic and biotic niche factors correlating with the presence/absence of *Q. x undulata*, including slope, aspect,

soil type, soil chemistry, vegetation cover, and other associated woody plant species. We found that, while both oaks prefer shallow-soiled areas at Three Peaks with exposed granitic bedrock, *Q. x undulata* was significantly more likely to occur in south-facing exposures, while *Q. gambelii* showed less evidence of preference in aspect. We hypothesize that this microhabitat preference of *Q. x undulata* reflects the adaptation to hotter conditions of its *Q. turbinella* parent, and that growth in hotter, drier microhabitats may explain the persistence of similar hybrid patches throughout western Utah, including more northerly sites even further removed from the current distribution of *Q. turbinella*. Our surveys also revealed the presence of a few *Q. turbinella* individuals at Three Peaks, representing a first report of this hot-desert species in Iron County. These results will provide the basis for further studies of the evolutionary history and ecological requirements of these fascinating native Utah plants.

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## **Scale patterns of *Uta stansburiana* through time and place**

**Hunter Gordon, Utah Tech University**

Faculty Mentor: Geoff Smith, Utah Tech University

SESSION B (10:45AM-12:15PM)

POSTER B84

As global change continues to disrupt weather patterns and local climate, understanding animals' responses to water and heat stress becomes more important. Scalation patterns in desert reptiles might vary depending on water availability and

temperature. Common side-blotched lizards, *Uta stansburiana*, are found in a variety of habitats spanning north to central Washington State and south to Baja California and represent an ideal model organism to explore the relationship between aridity and scalation. This study examines scale patterns from different time periods, weather conditions, and geographical locations using a combination of museum specimens and recently-caught individuals. By investigating multiple locations across different times, we can better predict what kinds of responses animals might have in the hotter, drier future climate models predict for the American Southwest.

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## **Phage-Host Interactions in FhuA**

### **Dependent Bacteriophages**

**Ian Baeten, Brigham Young University**

Faculty Mentor: Bill McCleary, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B85

Bacteriophages are the natural enemy of bacteria. They infect and kill bacterial cells similarly to how animal viruses infect and kill our (eukaryotic) cells. Being viruses, bacteriophages need to get inside of their host to be able to replicate and survive. To do this, phages use receptor binding proteins (RBPs) to bind to various molecules on the surface of bacterial cells, which allows them to attach and initiate the first step of infection. Several novel bacteriophages were isolated from sewage samples across the Wasatch Front of Utah that infect *Escherichia coli* strain MG1655 and are being used to



gain greater understanding of that initial step of binding and attachment between phage and host. Over 40 phages were tested against four different potential phage receptors, and approximately 25% of them were found to use the FhuA protein. FhuA is an outer membrane transport protein that helps the bacterial cell acquire essential iron, especially in low concentration amounts. FhuA looks like a barrel within the membrane that has multiple loops that extend out from the surface. FhuA proteins can be a factor in the pathogenicity of some microbes, and as such, studying and characterizing the interactions between host FhuA and phage RBPs is of medical interest. It was found that bacteriophages JLBYU37 and JLBYU41 are among those that use FhuA as their receptor. Their genomes were sequenced and annotated and submitted to NCBI. Further characterization was done on these two organisms, including Scanning Transmission Electron Microscopy (STEM), one-step growth experiments to determine burst size, and analysis onto which loop of the FhuA protein they attach. JLBYU37 belongs to the Demerecviridae family, and it has an icosahedral capsid that is 61 nm tall and a long non-contractile tail that is 128 nm in length. JLBYU41 is part of the Drexlerviridae family and has a capsid height of 65 nm, and a non-contractile tail that is 140 nm long. JLBYU37 and JLBYU41 have burst sizes of 10 PFU/mL and 41 PFU/mL, respectively. The analyses reported in this poster presentation help us understand how phages interact with their host cells, and this information may aid in developing future applications such as phage therapy or ecological projects.

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## **A computational investigation of a cyclic amino-borane complex**

**Jaxon George, Utah Tech University**

Faculty Mentor: Dr. Diana Reese, Utah Tech University

SESSION B (10:45AM-12:15PM)

POSTER B86

Recent global interest in clean, renewable energy has placed a significant emphasis on hydrogen storage research. This research investigates several similar cyclic amino-borane complexes ( $\text{CH}_2\text{CH}_2\text{BHNH}_3$  and  $\text{CH}_2\text{CH}_2\text{NHBH}_3$ ) regarding their hydrogen storage potential. Static calculations using a density functional indicate that the energy difference between the intact complexes and the complexes with dissociated  $\text{H}_2$  for the two configurations are 6.45 and 8.33 kcal/mol, respectively. Wavefunction-based methodologies and multiple density functionals were used to evaluate the potential energy landscape for these molecules-with careful attention to coordinates containing the hydrogens that dissociate to form  $\text{H}_2$ . Ab initio molecular dynamics simulations were completed at 300K and 1000K using the t-HCTHh density functional to further investigate motions that occur within this molecule and possibly foster dissociation of the  $\text{H}_2$  unit. The molecular dynamic simulations illustrate that low-frequency modes, B-H and N-H oscillations, and rotations of the terminal moiety predominate. However, the lack of mode coupling associated with these dynamics indicate these complexes are largely classical in nature. In future works, transition state calculations will be performed to determine the energy barrier present between the associated and dissociated form of each complex and to elucidate the reaction mechanism of the  $\text{H}_2$  unit.

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## **Changes to morphine sensitivity in the ventral tegmental area after morphine conditioning**

**Caylor Hafen, Brigham Young University**

Faculty Mentor: Jordan Yorgason, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B87

Dopamine circuit function in the nucleus accumbens (NAc) and ventral tegmental area (VTA) is implicated in the reinforcing effects of drugs of abuse including opioids. Previous investigations have reported sensitization of the VTA after morphine conditioning. Further characterization of sensitivity changes to the mu receptor and other receptors in the opioid family as well as further characterization of intra-VTA circuitry is necessary. Previous research has also demonstrated that women often use drugs differently and that addiction treatment is not equally effective between sexes thus requiring further investigation into sex differences in the addiction pathway. Our data supports the hypothesis that mu opioid receptor desensitization occurs during acute and prolonged exposure to opioids such as morphine, which may have long lasting effects on dopamine circuit function. We performed fast scan cyclic voltammetry (FSCV) in morphine-conditioned mice. We report that in NAc brain slices, morphine has no apparent direct effects on dopamine release. In contrast, morphine bath application increases VTA dopamine release, which is reversed

by naloxone. Interestingly, morphine induced increases in VTA dopamine release were greater in morphine vs saline conditioned mice, supporting a model of circuit sensitization. We report that this circuit sensitization is supported by sensitization of mu opioid receptors in both sexes and delta opioid receptors in females. This is possibly biologically counteracted by a desensitization of kappa opioid receptors. Surprisingly, blocking voltage gated potassium channels resulted in a switch in morphine effects, where morphine reduced VTA dopamine release. Morphine treated mice had reduced sensitivity to morphine effects on dopamine release in the presence of potassium channel blockers, suggesting that potassium channels possibly underlie the increases in sensitivity observed in morphine conditioned mice.

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## **Characterization of E. Coli specific, FhuA dependent bacteriophage**

**Colton Hansen, Brigham Young University**

Faculty Mentor: William McCleary, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B88

Antibiotic resistance is a new issue faced by the medical field, and as a result there has been a push for research into alternative forms for treatment of bacterial infection. The focus of our efforts in Dr. William McCleary's research lab have been centered around the characterization of E. coli specific bacteriophages. The hope is to better understand the bacteriophage host interaction with the long term goal of

investigating the use of bacteriophages to treat antibiotic resistant bacterial infections. The cellular infections of These bacteriophages have been shown to only target the FhuA protein which is an outer membrane iron siderophore transporter. This transports ferrichrome specifically. The three bacteriophages that have been the focus of our studies are named phage 37, phage 41, and phage 60. Many tests have been performed to characterize these novel bacteriophages. These include the sequencing of the individual phage genomes, electron microscopy, and the identification of which protein loop is bound by each phage. The focus of my work has been centered around identifying the lysogenic potential of P37, P41, or P60. During our research we have seen that *E. coli* quickly mutates to develop resistance to these phage when grown in favorable conditions. *E. coli* becomes resistant to all of these phage as soon as the FhuA gene is knocked out or mutated. In order to test if these phage could become lysogenic, the *E. coli* strain, MG1655, was grown on fully nutritious LB agar plates for 3 to 5 days at a time, spotted with 5uL of phage. This promoted the formation of bacterial mesas which are healthy phage resistant colonies inside of a clearing caused by the phage. Subsequent verification of phage resistance led us to perform polymerase chain reaction tests that would hopefully show us that the phage DNA had been integrated into the host genome. These tests have been done under normal rich media and also under nutrient poor/growth limiting media. Despite the presence of genes that code for recombinase proteins, none of the tests that have been run have indicated a tendency for these bacteriophages to become lysogenic. The tests run to confirm this have not ever shown an example of a lysogenic strain of *E. coli* with these three bacteriophage. Being able to show that it does not happen or at least it is very unlikely

for a certain phage to become lysogenic means that it can be trusted as a good ingredient for any antibiotic-resistant phage treatments. The conclusion of this part of the experiment is that Phages 37,41, and 60 are non-lysogenic and do not achieve phage resistance through super infection exclusion.

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## **Microplastics in the Snowpack on the**

## **Wasatch Mountains**

**Andersen Haslam, Utah Valley University**

Faculty Mentor: Sally Rocks, Utah Valley University

SESSION B (10:45AM-12:15PM)

POSTER B89

Andersen W. Haslam, Anthony Phasay, Sara S. Rocks. Department of Chemistry, Utah Valley University, Orem, Utah, USA. Microplastics have been contaminating natural waters and lands in even the most remote areas of the globe. Microplastics are synthetic particles less than 5 mm in diameter and are the result of mismanaged plastic waste. Most research regarding the concentrations of microplastics has been carried out on the world's oceans. Little is known about the effect of microplastic distribution in terrestrial environments and the long-term health impacts for humans. This research is focused on quantifying the concentration of microplastics in snowpack located in the Wasatch mountains in Utah, USA. The snowpack blanketing the Wasatch mountains serve as the major water supply for Salt Lake City and surrounding cities. While these mountainous regions remain

mostly uninhabited, that does not eliminate the threat of microplastic pollution due to their ability to travel large distances in the wind. Snow samples were taken in various locations on the Wasatch mountains at different depths to determine the prevalence of microplastics. Plastics were then identified and counted using fluorescent dye and light microscopy. Quantifying the plastic content in the snowpack will contribute to the scientific evidence combatting the overconsumption of plastic.

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## **Treatment of Ins-1 Beta Cells with Oleate Affect the Expression of The Glycolytic Downstream Targets of Nr4a1 and Nr4a3 and Insulin Secretion**

**Emily Hill, Brigham Young University**

Faculty Mentor: Jeffery Tessem, Brigham Young University

SESSION B (10:45AM-12:15PM)

POSTER B90

Type 2 diabetes (T2D) is a serious disease in which beta cells of the pancreas have decreased or lost their ability to secrete insulin. The orphan nuclear receptors Nr4a1 and Nr4a3 are necessary for proper insulin secretion. Furthermore, unsaturated fatty acids preferentially bind to Nr4a1 and Nr4a3, which decreases the ability of the Nr4a's to bind DNA promoters and drive gene expression. Therefore, we hypothesized that Ins-1 beta cells treated with oleate have

decreased expression of succinate dehydrogenase (SdH) and enolase-1 (Eno1), two of the downstream genetic targets of Nr4a1 and Nr4a3, and that insulin secretion is decreased. Here we present our findings from our measurements of mRNA and protein expression of SdH and Eno1 in Ins-1 beta cells cultured with varying concentrations of oleate via qPCR and western blotting. In addition, we measured glucose stimulated insulin secretion (GSIS) under the same experimental conditions. A more thorough understanding of the effects of unsaturated and saturated fatty acids on Nr4a1 and Nr4a3 will have serious implications on the dietary habits of pre-diabetic individuals.



**Sciences. Session B**  
**- Oral**  
**Presentations,**  
**Dumke**  
**Conference,**  
**Alumni House**

SESSION B (10:45AM-12:15PM)

**Location: Dumke, Alumni House**

Deep-Seated Gravitational Slope Deformation  
in the Sawatch Range of Colorado

## Maddie Festin, University of Utah

Faculty Mentor Jeffrey Moore, University of Utah

SESSION B 10:45-11:00AM

Dumke, Alumni House

Sciences

Deep-seated gravitational slope deformations (DSGSDs) are large-scale, creeping mass movements often involving entire mountain slopes. These enormous landslides may be on the order of kilometers in height and length, move a few millimeters to centimeters a year, and can generate secondary hazards from landslides and debris flows. While there have been many studies on DSGSD from the European Alps, few similar studies have been conducted in the United States. This research aims to identify DSGSD in an area of 2200 square kilometers in the Sawatch Range of Colorado, followed by mapping, geomorphic analysis, and comparison with satellite Interferometric Synthetic Aperture Radar (InSAR) displacement data. We used satellite imagery and Light Detection and Ranging (LiDAR) data to identify DSGSD across the mountain range, followed by a week-long field visit to collect ground data and imagery. Results show that DSGSD are relatively common across the Sawatch range, and many of these phenomena are actively moving. We identified 28 sites that exhibit physical characteristics of DSGSD, of which eight appeared to be moving with a downward velocity of 1-2 cm/y . About half of the identified DSGSDs were west-facing. Almost all DSGSD occurred in granitic bedrock, with a few in metamorphosed rock. The largest DSGSD was over 8 km<sup>2</sup>, but most fall between .5-1 km<sup>2</sup>. This research provides insights into their distribution and geomorphology while contributing to the broader catalog of DSGSDs.

## Albedo Evolution and the Shifting Arctic Ice Pack

David Gluckman, University of Utah

Faculty Mentor Ken Golden, University of Utah

SESSION B 11:05-11:20AM

Dumke, Alumni House

Sciences

During the late spring and summer, Arctic sea ice experiences some of its most drastic changes. As highly reflective snow and ice surfaces melt, they are replaced by darker, light-absorbing melt ponds and ocean water, lowering the overall albedo (the ratio of reflected to incident solar radiation) of the Arctic ice pack. Over the last 40 years, we have observed a dramatic decline of summer sea ice extent as well as a shift from a largely perennial to a more seasonal Arctic ice pack. Smoother seasonal ice, which forms during the winter and melts to open water during the summer, has significant topographical differences from rougher, hummocky multiyear ice. Using both levelset and temporal modeling approaches, we investigate the connection between sea ice surface topography and resulting albedo during melt pond evolution. Our findings suggest that surface topography is an important driver of ice-albedo feedback. In this talk, I will discuss these findings and how the significant differences in the albedo profiles of seasonal versus multiyear ice help drive the system toward the disappearance of multiyear ice.

## Thermal Evolution of Brine Fractal Geometry in Sea Ice

## Nash Ward, University of Utah

Faculty Mentor Kenneth Golden, University of Utah

SESSION B 11:25-11:40AM

Dumke, Alumni House

Sciences

The brine microstructure of sea ice and its strong dependence on temperature govern key processes critical to the role of sea ice in climate and the polar marine ecosystems. The brine phase also largely determines electromagnetic behavior in sea ice remote sensing. It has long been suspected that the brine microstructure displays fractal characteristics, a self-similar geometry over varying scales. Here I present the first comprehensive, quantitative study of the fractal dimension of brine in sea ice and how it depends on temperature and porosity. Using X-ray tomography data from Arctic sea ice, for both columnar and granular ice, we employ three different methods of computing the fractal dimension. We find all data agreed closely with a simple theoretical curve relating fractal dimension to porosity, which holds for exactly self-similar porous media, such as the famous Sierpinski triangle, as well as statistically self-similar porous media, like sandstones. Furthermore, we discovered there exists an ordinary differential equation model which accurately represents the evolution of the fractal dimension and porosity of the sea ice data through changes in temperature. This ODE has also been shown to hold for the porosity and fractal evolution of exactly self-similar geometries, namely the Sierpinski triangle and the Apollonian gasket. These findings open the door to sea ice applications of widely used theoretical models and tools for predicting the fluid and electromagnetic transport properties of composites with fractal microstructure. We also explore the

influence of the fractal geometry of the brine phase on how microbial life is organized in this multiscale porous habitat.

## Indicators of Floodplain Connectivity in Arid Riverscapes

Paige Sargeant, Utah State University

Faculty Mentor Wally Macfarlane, Utah State University

SESSION B 11:45-12:00PM

Dumke, Alumni House

Sciences

The majority of streams in the Colorado River Watershed are highly degraded systems with low floodplain connectivity and simplified, planar riverbeds. The consequences of stream deterioration have been accentuated by recent drought and are evident in Utah's failing hydroelectric dams and the Great Salt Lake's receding shoreline. Many organizations are working to restore these streams in order to support native fish populations, increase stream flow length and volume, and prevent or reverse desertification in watersheds; however, these projects require frequent and robust monitoring over large areas which is time intensive and expensive. Limited budgets and unwieldy, census-like monitoring methods are significant hurdles to watershed recovery. Fluvial geomorphologists have identified several riverscape entities (such as rapids, pools, woody debris, and floodplains), but the correlative relationships between these features are relatively unexplored. A geomorphologist can tell you that fallen logs are good for slowing down stream flow, allowing water to seep into the surrounding water table and increase base flows that persist

through drought, but it's difficult to say exactly how many trees need to fall into the channel before there is a measurable positive effect. I aim to bridge the gap between data-collection and geomorphic understanding by statistically analyzing the relationships between geomorphic characteristics, data-collection methods, and how much a stream's flow is interacting with the land and vegetation that surrounds it (i.e., floodplain connectivity). Correlative statistical tests will highlight what riverscape units are the best indicators of stream health (and, therefore, most important to monitor/restore) and whether they are most efficiently measured in the field or remotely via satellite and/or drone imagery. This information will allow for field work protocol streamlining, budget flexibility, and expanded restoration progress in western watersheds.

**Sciences. Session B**  
**- Oral**  
**Presentations,**  
**Henriksen, Alumni**  
**House**

SESSION B (10:45AM-12:15PM)

**Location: Henriksen Room, Alumni House**

Fingerprint car automation project

Tensor Elmikawy, Utah Valley University

Faculty Mentor Alex Panin, Utah Valley University

SESSION B 10:45-11:00AM

Henriksen Room (1st floor), Alumni House

Science and Technology

Michelson interferometer is extremely sensitive optical device capable of measuring as small displacement of mirrors as a fraction of the wavelength of laser used for interferometry (usually  $\sim 1/10 \lambda$  or so for one-pass interferometer, down to  $1/100$  for multi-pass interferometer). However, its high sensitivity is an obstacle to use it in real world applications as it requires bulky and expensive setup (big stabilized optical table, temperature controlled lab room, etc). We are building a compact interferometer which does not require such set-up yet is capable of measuring elastic and thermal deformations of solids on 10-100 nm scale. Furthermore, coupling our interferometer with fast light sensor and computer allows us to monitor both thermal drift and seismic/vibrational noise and derive deformation-only related signal. Preliminary results of our measurement will be discussed in our presentation.

## Development of an Anti-Biofilm Polyurethane Foam for use in Negative Pressure Wound Therapy

Nate Hooper, University of Utah

Faculty Mentor Dustin Williams, University of Utah

SESSION B 11:05-11:20AM

Henriksen Room (1st floor), Alumni House

Science and Technology



Negative pressure wound therapy (NPWT) is a prevalent treatment for traumatic, battlefield-related injuries. Wound contamination often occurs since greater than 75% of military wounds test positive for a pathogenic isolate at the time of injury. GRANUFOAM Silver by KCI is the most commonly used variation of commercially available antimicrobial foam for NPWT. However, silver nanoparticles are minimally effective against biofilm. This project incorporates a biofilm-specific bactericide into a PU foam matrix that is capable of reducing biofilm-bioburden in an in vivo porcine excision wound model. A PU foam was developed and infused with a 10% w/w concentration of CZ-01179 to compare against GRANUFOAM Silver which also has a 10% w/w concentration of silver nanoparticles.. An in vivo porcine full-thickness excision wound model was developed using Yorkshire pigs, 35-45 kg. The pigs were anesthetized and subjected to a surgical procedure creating four wounds, two with dimensions of 4×4 cm and two with dimensions of 3×3 cm, down to the fascia of the epaxial muscles. Upon completion of NPWT treatment, the pig was sacrificed and the wounds were harvested for microbiological quantification and histological analysis. The CFU/g of the tissue was attained through homogenization of the tissue followed by serial dilution. Histological analysis proceeded to understand the geography of biofilm in the tissue. Inoculation of the full-thickness excision wounds resulted in ~8 log<sub>10</sub> MRSA, *A. baumannii*, and natural flora CFU/g of tissue. After 7 days of treatment, V.A.C. GRANUFOAM Dressing™ produced a +.3 log<sub>10</sub> against MRSA, 1 log<sub>10</sub> against *A. baumannii*, and 1 log<sub>10</sub> against natural flora. Treatment with GRANUFOAM Silver produced a .1 log<sub>10</sub> reduction against MRSA, 1 log<sub>10</sub> against *A. baumannii*, and 1.7 log<sub>10</sub> against natural flora. Treatment with CZ-01179 PU foam resulted in a

3.1 Log<sub>10</sub> reduction against MRSA, 3.8 Log<sub>10</sub> reduction against *A. baumannii*, and 3.7 Log<sub>10</sub> reduction against natural flora.

## A Novel Hybrid Modeling Method for Strain Evolution

Jude Horsley, University of Utah

Faculty Mentor Frederick Adler, University of Utah

SESSION B 11:25-11:40AM

Henriksen Room (1st floor), Alumni House

Science and Technology

Much is known about the progress of diseases in competition on a macroscopic scale. In general, competitive exclusion is the governing principle, so that the strain with the higher *R* value will spread more effectively and drive the other to extinction. However, this is not the full story. Viral mutations occur frequently due to the huge number of individual cells that exist within even a single body. It is therefore reasonable to question whether a viral strain might have to compete within the body with newly mutated strains. Each strain may have slightly different transmission parameters, as well as different parameters that dictate the progress of the infection within the body. These two parameters then evolve side-by-side. This work sought to create a model which took each of these factors into account while remaining realistic and produced results in keeping with observed data. In particular, it sought to determine whether mutant strains could coexist, or would necessarily exclude one another. A novel hybrid-style model was developed in R which explores the interplay between two

strains of a virus-one which multiplies more quickly in the body, while the other is more effective at spreading between individuals. This was accomplished by blending stochastic and deterministic models. Within the body, the process of multiplication of virions was treated deterministically; whereas mutation of strains and person-to-person infection were treated as stochastic processes. Not only is this realistic, but it circumvents the computationally expensive pitfalls of fully stochastic agent-based models. The curves generated by the model take on a sigmoid shape which very closely resembles invasion curves observed during the initial advent of the Delta and Omicron strains of COVID-19 (see attached figure). Upon this success, the model was further modified to include a variable number of strains, with programmable mutation rates between each strain. This was once again checked against observed infection curves of known diseases, confirming that the model was consistent with reality. New work is now being done to model mutation through the construction of a virtual genome. We conclude that the model we created is a useful tool for investigating the evolution of multiple strains of a virus in competition. Some work has been done with this model in investigating the role of evolutionary valleys in delaying the evolution of new strains. Work is currently being done to investigate the model's implications for the coexistence of mutant strains. We continue to improve the model and find new implications for the development of rapidly evolving viruses.

## Science and Technology

Mayfly Phylogenomics, Using Anchored Hybrid Enrichment to Hypothesize the Relationships of Ephemeroptera

Trevor Millar, Utah Valley University

Faculty Mentor T. Heath Ogden, Utah Valley University

SESSION B 11:45-12:00PM

Henriksen Room (1st floor), Alumni House

Current hypotheses of the relationships of major mayfly lineages remain controversial due to low nodal support of previous phylogenetic studies dealing with both morphological and molecular data. Contradictions in these studies have led to classification systems that do not accurately depict the evolutionary history of Ephemeroptera. The present study seeks to clarify these disputed relationships by leveraging targeted capture sequencing along with a novel hybrid enrichment pipeline to generate abundant amounts of data, bolstering the confidence in the topology produced herein. Nearly 500 highly conserved exonic regions of the genomes of approximately 150 distinct taxa were targeted for amplification and sequencing using a custom probe set (Ogden et al., 2019). The next generation sequence reads were parsed in a custom pipeline and the fully assembled reads were appended in a single supermatrix for phylogenetic analyses using both 1st and 2nd nucleotide positions and amino acid sequences. This is the most robust analysis of Mayfly phylogeny to date, and indicates that current mayfly taxonomy necessitates revision.

**Social Sciences.**  
**Session B - Oral**  
**Presentations.**  
**Collegiate Room,**  
**Union**

SESSION B (10:45AM-12:15PM)  
COLLEGIATE ROOM, **A. Ray Olpin University**  
**Union**

The Impact of COVID-19 on Marriage and  
Divorce Rates

Kathryn Grendell, Brigham Young University

Kimalie Nye, Brigham Young University

Samantha Bailey, Brigham Young University

Olivia Black, Brigham Young University

Seth Driggs, Brigham Young University

Faculty Mentor Spencer James, Brigham Young University

SESSION B 10:45-11:00AM

Collegiate, Union

Social Sciences

The economic recession between 2008-2010 impacted many facets of life across the globe. For instance, marriage rates declined slightly while suicide rates rose as a result of the economic recession. We predicted that because of this change, during the recession in several Western countries, divorce and suicide rates would both increase. After the Great Recession, we predicted that marriage and divorce rates would be correlated among several Western countries. Using data from the Global Families Research Initiative at Brigham Young University, collated from different data sources such as the United Nations, the individual country's department of statistics, and through correspondence with international statistics bureaus, our results suggest that while divorce and suicide had a significant correlation between the years 2008-2019, marriage and divorce only were significantly correlated between 2013-2019. Marriage and suicide had no correlation for any of the years between 2008-2019. These findings suggest that as divorce rates rose, marriage rates fell during the few years during and after the recession. It was not until 2013 that marriage and divorce began to stabilize together. Additionally, suicide and divorce appeared to rise in

conjunction with one another and then fall and stabilize, and this is a pattern that has continued to present itself over the last decade. Future studies may consider how the COVID-19 pandemic further influenced the relationships between these rates.

## Indifference Coping: Understanding Stigma and HIV-Spreading Behaviors.

Ives Hong, Utah Tech University

Faculty Mentor Dannelle Larsen-Rife, Utah Tech University

SESSION B 11:25-11:40AM

Collegiate, Union

Social Sciences

Human Immunodeficiency Virus (HIV) causes men who have sex with other men (MSM) to sustain serious health problems. When HIV progresses to AIDS, the immune system deteriorates increasing the risk of opportunistic infections, chronic disease and potentially death. Due to the many physical health complications, mental health implications may be overlooked. HIV stigma may contribute to poor mental health and seeking autonomy and relationality as a method of coping. Thus, people infected with HIV may engage in disease-spreading behaviors such as not testing for sexually transmitted infections, and engaging in unprotected sex to cope with the psychological burden of HIV. One behavior seen in MSM is gift-giving, or the process of intentionally transmitting HIV to a partner (Klein, 2014) as an act of relationality and self-determination (Thorneycroft & Smilges, 2022). People who have

HIV may feel isolated and a loss of control over their mental and physical health status. Gift-giving may provide a way to cope with indifference and some sexual liberty. Consensual gift-giving is “generationing” while nonconsensual gift-giving is known as “stealththing.” Despite the lack of discussion amongst MSM, gift-giving behaviors are prevalent in gay pornography and real sexual encounters (Klein, 2014; Brennan, 2016). Whether gift-giving is consensual or not, it plays an important role in disease transmission. There is a paucity of research about gift-giving in MSM, especially potential psychological explanations for the practice. The proposed study will examine the association between gift-giving and HIV stigma. It is expected HIV stigma, depression and anxiety will be associated with gift-giving behaviors. Participants will be approximately 400 MSM who will complete measures of HIV stigma, depression and anxiety, and gift-giving behaviors (unprotected sex, generationing and stealththing). Results from this study may inform prevention and intervention efforts around behaviors associated with sexually transmitted diseases and HIV stigma.

## Leadership and Success at Southern Utah University

Benz Wycklendt , Southern Utah University

Faculty Mentor Katie Englert , Southern Utah University

SESSION B 11:45-12:00PM

Collegiate, Union

Social Sciences

We do not have to be a politician to be a leader. We can all make a difference, because leadership is not about position



but rather influence. Leaders are best when people know they barely exist. When a job is done, a leader's aim is fulfilled. Leadership is a choice, but not a rank.

In this paper, several interviewees reminded me that action without a vision is simply passing time. Vision without action implies the same concept of daydreaming. If we drive a car without a destination, a leader will get lost. So to rephrase, a leader without passion and enthusiasm will lack credibility if they do not make a genuine difference.



# **Lunch and Remarks**

## **12:30PM - 1:30PM**



## **Lunch Remarks**

### **Lunch**

**12:30PM – 1:30PM**

**Ballroom (2nd floor), Alumni House**

*Boxed lunch provided to registered participants. Event open to the public. Registered participants receive a lunch ticket upon check-in.*

### **Brief remarks**

**Senior Vice President for Academic Affairs  
and Provost Mitzi Montoya, University of  
Utah**

Dr. Montoya joins the University of Utah as the new Senior Vice President for Academic Affairs and Provost. She brings

with her strong leadership skills, including years of service in dean and provost positions at several universities in the U.S., including the University of New Mexico, Oregon State and Arizona State University. Montoya's experience in leading large academic enterprises has given her an eye toward problem-solving and engagement. Throughout her career she has supported student and faculty success, enhanced entrepreneurial ecosystems, and led collaborative initiatives to find solutions for social, technical and political challenges. As provost, Montoya seeks to inspire students, faculty and staff; lead innovation efforts; and help the U become a top 10 public university with unsurpassed societal impact.

## **Senior Associate Vice President for Academic Affairs Chase Hagood, University of Utah**

Dr. Thomas Chase Hagood serves as the Senior Associate Vice President for Academic Affairs and Dean of Undergraduate Studies at the University of Utah. His approach to student development and passion for student success initiatives emerged from a commitment to research-based, faculty development as well as academic training as a historian and wealth of experiences as a faculty member. Since his arrival at the U in July 2021, SAVPAA Hagood's work at Utah includes cultivating creative partnerships between the various units of Undergraduate Studies and other entities across the university to enrich students' learning experiences as well as enhancing the University's national and international reputation for excellence in undergraduate education. SAVPAA Hagood earned his Ph.D. from University of Georgia.

## **Interim Vice President for Research Erin Rothwell, University of Utah**

Dr. Erin Rothwell currently serves as the Interim Vice President for Research, Associate Vice President for Research and Professor of Obstetrics and Gynecology in the School of Medicine. Born in Oceanside, California, Dr. Erin Rothwell received her B.S. degree in Recreation Therapy and M.S. degree in Park & Recreation Management from the University of South Alabama. In 2004, Dr. Rothwell moved to Salt Lake City to pursue her PhD in Recreation Therapy at the University of Utah. She served her Postdoctoral Training in the College of Nursing at the U while studying clinical trials and public health. In 2010, Dr. Rothwell received a competitive fellowship opportunity in the Medical College of Wisconsin where she studied Bioethics.

Dr. Rothwell's research focus is on ethical, social, and legal implications of genetic and technological advancements on individuals and families specifically within newborn screening, prenatal testing, and biobanking. She is the contact principal investigator for the NIH Utah Center in Excellence for Ethical, Legal, and Social Implications (ELSI) for Research in Genetics (1RM1HG009037), and principal investigator on an R01 titled: Comparing Game Facilitated Interactivity to Genetic Counseling for Prenatal Screening Education (R01 HG011921). Dr. Rothwell also has extensive expertise on informed consent and research ethics. She has published a new qualitative methodology for focus groups called Deliberative Discussion Focus Groups which is based on over 70 focus groups and 500 participants across 5 NIH grants.

## **Associate Dean Annie Isabel Fukushima, Undergraduate Studies, University of Utah**

Dr. Annie Isabel Fukushima is Associate Dean of Undergraduate Studies, the Director of the Office of Undergraduate Research, and Associate Professor of Ethnic Studies in the School for Cultural & Social Transformation at the University of Utah. She is the author of the award-winning book, *Migrant Crossings: Witnessing Human Trafficking in the US* (Stanford University Press, 2019). She also serves as the Co-Principal Investigator and Founder of the University of Utah Gender-Based Violence Consortium. Fukushima is also a member of the Board of Directors for the Utah Domestic Violence Coalition.

## **Edén Cortes-Lopez, Special Projects Coordinator, Utah System for Higher Education**

The Utah System of Higher Education (USHE) is governed by the Utah Board of Higher Education and is comprised of Utah's eight public colleges and universities and eight technical colleges. The CEO of USHE is the Commissioner of Higher Education.



# Guided Tour II:

## 1:30PM - 2:30PM

Utah Museum of Fine Arts

Join us for a guided tour at the Utah Museum of Fine Arts. Share in conversation as you explore the UMFA's global collection that spans 5000 years of creativity. You'll also spend time with *Many Wests: Artists Shape an American Idea*, a special exhibition featuring contemporary work from five museums that highlights many voices—including Black, Indigenous, Asian American, Latinx, and LGBTQ+—who stake a claim in the American West.

*Registered Participants are able to sign up for the tours. Missed*

*the registration deadline and want to join a tour? Contact our@utah.edu by February 12, 2022.*

# **Session C: 1:45PM - 3:15PM**



**Arts. Session C -  
Poster  
Presentations,  
Ballroom, Union**

**SESSION C (1:45-3:15PM)  
Location: Ballroom, A. Ray Olpin University  
Union**

## **Socially-Engaged Arts Curricula Development with the USU Guild for Community Arts Meg Wilson, Utah State University**

Faculty Mentor: Laura Gelfand, Utah State University

SESSION C (1:45-3:15PM)

POSTER C70

Utah State University has been awarded the Carnegie Community Engagement Classification. USU's Caine College of the Arts, however, has thus far only been minimally involved in community-engagement certification for its offered courses. Emerging artists must be trained to utilize the arts ethically, effectively, and sustainably, as well as to analyze and critically revise their own arts engagement with their community. Faculty of community-engaged courses gain networking opportunities with engaged faculty in other disciplines, foster relationships between institutions and local organizations, and find new opportunities for collaborative work. Through the research of contemporary cases of political arts engagement, sustainable behavior change, and community-based social marketing, we have developed a new framework to support arts faculty in the effective implementation of socially-engaged curricula. The pillars of this framework are: participatory curriculum planning, collaborative research and analyses, horizontal classroom discussion, outside the classroom work and hypotheses testing through art, and critical group evaluation leading to the redesign of the study module itself. In collaboration with the USU Center for Community Engagement, we have developed the USU Guild for Community

Arts to train student mentors to assist peers in their artistic projects and to partner faculty with community members to achieve these ends. The Guild will empower students to increase inclusion, diversity, and equity both on and off campus through collaborative research and creative work. Our research continues this spring in the pilot application of Community Engaged Learning courses in the arts developed under this new framework, as well as quantitative and qualitative analyses from stakeholders and participants following their conclusion and a resulting revision of course modules.

**Business. Session C**  
**- Poster**  
**Presentations,**  
**Ballroom, Union**

**SESSION C (1:45-3:15PM)**

**Location: Ballroom, A. Ray Olpin University**  
**Union**

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**The Intersectionality of Entrepreneurship  
and Latinx Critical Theory: Promoting  
Access to Credit for Latinx Entrepreneurs  
of Construction Companies with  
Alternative Methods of Financial**



## Reporting

### Luis Ramirez, University of Utah

Faculty Mentor: Lyda Bigelow, University of Utah

SESSION C (1:45-3:15PM)

POSTER c71

Disproportionate outcomes exist in entrepreneurship based on the identity of the founders. The Hispanic/Latinx population in the U.S. grew by 23% from 2010 to 2020, which represented over half of the total growth in the U.S. population. Yet despite accounting for 19% of the population, Hispanic owned businesses account for only 5.8% of all businesses. Even in low-barrier industries there is underrepresentation, in part because they lack access to education and start-up capital. We are especially interested in understanding how a Hispanic/Latinx identity impacts entrepreneurial outcomes in the low-barrier industry of construction. Since many studies explore the obstacles and barriers in education for Hispanic/Latinx students, this paper explores the challenges in accessing start-up capital in the form of credit. Using a quantitative methodology and Critical Race Theory Framework, we collected data from the Utah Department of Occupational and Professional Licensing to estimate the number of contractor construction companies owned by Hispanic/Latinx founders. We used this data to conduct a survey on entrepreneurs of construction companies in Utah. The survey collected firm data (e.g., cash flows, legal entity, trade, employees, etc.) and owner demographic data (e.g., education, immigration, nationality, phenotype, language, etc). Using Python, the firm and owner demographic data will be used as independent variables for a regression analysis that predicts the cash-basis revenue

performance of construction companies. The findings of our research provide alternative methods of financial reporting and credit risk assessment for promoting Latinx entrepreneurship in construction and solving the shortage of affordable housing.

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## Facial Recognition and AI Ethics: A Review of Literature to Develop a Framework of the Current State of our Understanding and Guidelines for AI System Development

Isaak Grettum, University of Utah

Faculty Mentor: Sankar Srinivasan, University of Utah

SESSION C (1:45-3:15PM)

POSTER C72

Ethics is currently developing into a fundamental problem in creating Artificial Intelligence (AI). From sampling methods for training data to user intent, issues with the ethical use of AI have been propping up. One such case is one in which a black man, Robert Julian-Borchak Williams, was misidentified as the suspect in a robbery, to which he bore no resemblance, by a facial recognition AI servicing a Detroit Police department (Hill). In another case, Gender Shades found that million-dollar facial recognition software from companies such as Microsoft, IBM, and Amazon had error rates for black females up to thirty-four percent greater than for white males (Najibi). In contrast to these events, emotion recognition and face detection AIs have been assisting children on the autism spectrum to

improve their social skills (“Applying AI for social good”). Cases such as these have been the driving force to provide more safeguards for AI development. Though AI can be used for the ethical good, its potential for the ethical bad can hold it back from wider use, costing developers and businesses their jobs and income. As the usages of AI continue to expand in daily usage from social media recommendations to self-driving cars, it has become pertinent to explore the ethical dilemmas surrounding them. The market has since agreed, as agencies such as the Center for Information Technology Policy (CITP) and private experts delve into this vast new field. We will be synthesizing this research from several different sources & perspectives in order to find a more overarching guide for the public & private sectors. This will include the aforementioned prominent journals and first-hand accounts with experts. We will find an understanding of the overall state of the market through the review of literature from multiple fields of study, however, particularly concentrating on their perspectives focusing on AI for facial recognition. These fields of study will include but are not limited to psychology, economics, American Law, sociology, art, criminology, and sustainability. In a glancing likeness to Asimov’s Laws from Isaac Asimov’s philosophical short story Runaround, We will create a comprehensive set of principles and guidelines facing current ethical cases. This AI common law and guidelines will be used by system operators & managers to ensure ethical practices, thereby instantiating precedent for future growth and adaptation. This system would lessen racial profiling and hopefully cease it, on a governmental and private level. Would allow smartphones to be safer in protecting the contents of a phone, or other data storage. The cons of a system like this could be a controversial divide between ethical ideologies,

much like the American political system. However, it is a much-needed start in the ever-expanding field of Artificial Intelligence systems.

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## **Solving the Housing Crisis in Utah**

**Kevin Yang, University of Utah**

Faculty Mentor: Sankar Srinivasan, University of Utah

SESSION C (1:45-3:15PM)

POSTER C73

The focus of our research is to explore solutions to tackle the housing crisis in Utah. The pandemic has had a significant impact on our society and economy at large. In Utah in particular, with a heavy influx of families and professionals, the already hot housing market has come under immense pressure. Due to high demand and low inventory the Salt Lake housing market has appreciated substantially in the last few years making it challenging to own a home for new homebuyers (first-time homebuyers). The home rental rates have also appreciated substantially making it expensive to rent a place of one's choice without incurring substantial monthly expense. According to Emily Harris's report for the University of Utah, "Utah was the fastest-growing state in the nation from 2010 to 2020".(Emily Harris, Moving Past Net Migration: Demographic Characteristics of Utah's Recent Migrants). Another contributor to the housing shortage in Salt Lake is the rapid growth of the city. For example, Utah's population growth rate from 2010 – 2020 was 18.4%, which was the highest in the nation. In this research we explore possible solutions that

could be applied to improve the housing situation in Utah. We do this systematically in the following ways – 1) examine what scholars have identified as solution for situations such as the one we have in Utah 2) examine what densely populated and expensive places like HongKong and Singapore have done to ensure housing for all 3) we take a look at models like AirBnb and Uber/Lyft that has made it possible to have idle resources to be of use to those in need while adding to the economic output and see if some lessons could be gleaned for a technology based solution to the current problem in Utah. We propose novel solutions by synthesizing our insights from the above methodology for the consideration of public policy experts. This research and its findings (proposed solutions) will be significant because it addresses one of the fundamental humans needs – Shelter and sees how to make it affordable and accessible to everyone. It also explores both established solutions (as seen from published research and those adopted by other successful places in the world) and also by attempting to identify a novel approach by adapting the success we have seen with business models that underlie the sharing economy.

**Education. Session  
C - Poster  
Presentations,  
Ballroom, Union**

**SESSION C (1:45-3:15PM)**

**Location: Ballroom, A. Ray Olpin University  
Union**

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**Developing Interactive-Reading  
Workshops for Culturally and  
Linguistically Diverse Families  
Jessica Clark, Brigham Young University  
Stephanie Hernandez, Brigham Young**

## University

### Mellany Groll, Brigham Young University

Faculty Mentor: Connie Summers, Brigham Young University  
SESSION C (1:45-3:15PM)

#### POSTER C74

Previous research has shown that early literacy experiences with parent and child engagement improve language, literacy, and academic outcomes for children. But, few studies have included culturally and linguistically diverse families. The purpose of the current project was to develop an interactive reading workshop for parents of preschoolers from culturally and linguistically diverse (CLD) backgrounds for use in a larger study.

We collaborated with a local preschool to create a five-week evidence-based workshop for parents of children in the preschool. Workshop presentations were developed through an iterative process of practice and discussion and reviewed by the faculty advisor and community partners. Current research literature informed the content and strategies utilized in the workshops for interactive book reading. Presentations, books, video examples, and handouts were offered in English, Spanish, and Portuguese to accommodate the diverse language needs of the preschool families. Presentations were also adapted to be inclusive of children with diverse developmental needs. Culturally responsive practices were incorporated including discussion among parents to allow for the sharing of ideas and insights. These practices ensured the content of the workshop was not prescriptive which implied that there are diverse ways to help children develop literacy skills. In addition, books, incentives, food, and child care were provided for retention of

participants. Navigating timelines and implementing feedback from community partners and parents presented challenges in our collaboration. These challenges were addressed as a team through open communication with our local partners and by setting clear expectations. We learned the need for flexibility when working with partners and the value of simplicity in our workshops. Lessons learned included the importance of incorporating multiple perspectives and voices, prioritizing responsiveness to feedback, and projecting diverse viewpoints.

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## **Weber State Student Leadership Social Issues Team: Why Students' Completion**

### **Numbers for FAFSA are at All Time Low**

**Cayden Schroader, Weber State University**

**Emma Blanch, Weber State University**

**Kary Makela, Weber State University**

Faculty Mentor: Ryan Cain, Weber State University

SESSION C (1:45-3:15PM)

POSTER C75

Weber State University found a decrease in the number of students completing the FAFSA form over the last several years. The Social Issues Team (SIT), a subgroup of the Community Engagement Team at Weber State University, took on the active gathering of information about barriers and challenges students might face in completing the FAFSA form. According to research regarding FAFSA form completion,



students from varying socioeconomic, education, and racial backgrounds have greater obstacles to overcome to access needed federal aid in certain instances (McGuigan et. al., 2016). Some of the more prominent concerns included students' awareness and knowledge of the program, the eligibility of the students applying (Long, 2022), debt aversion (Boatman et. al., 2017, Cunningham & Santiago), and parents' cooperation in providing financial information (Thompson, 2019). The SIT developed a ~45 question survey instrument to measure frequency of barriers to completing the FAFSA form identified by the literature review. The instrument also includes open-ended items to allow participants to report unanticipated barriers to completion. The survey asks questions regarding whether or not they have completed the FAFSA application in the past, difficulties in filling out the application, how confident they felt filling out the application, and various demographic questions that may be beneficial in discerning patterns and trends in the findings. The SIT sent the draft survey to students and higher education experts on the WSU campus for evaluation to refine the instrument. Following survey refinement and IRB approval, the survey will be sent out to WSU students asking about potential barriers they may have when actively completing the FAFSA form. The SIT anticipates a total of 1,000 responses. If findings follow previous research trends, then WSU could show a link between FAFSA form completion and the areas students need greater guidance in completing. A possible corresponding effort may result in more students having access to the aid they need to better fund their education. Also, an active program (Page, et. al., 2020) to target students of a specific demographic, which may result in a higher percentage of completion of the FAFSA form, and receive subsequent funding, at WSU.

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# **Virtual Reality in Dental Hygiene Education**

## **Amber Hawkins, Utah Tech University**

Faculty Mentor: Lisa Welch, Utah Tech University

SESSION C (1:45-3:15PM)

POSTER C77

An Investigation into the Efficacy of Dental Hygiene Skill Practice using a Virtual Reality Application Compared with Traditional Practice Methods. Purpose: A pilot study to evaluate the efficacy of skill practice in virtual reality (VR) compared with skill practice in real-life, using an application designed to simulate the fundamental dental hygiene skills of operator, patient and light positioning. Methodology: Educational intervention comparison study. Pre/post intervention competency testing performed by a blinded investigator. A convenience sample of 56 first semester dental hygiene students from two institutions in two states were invited to participate. A 66% response rate of 37 participants completed data collection. Participants were pre-tested, randomly assigned to either the test group (VR) or the control group (real life who practiced in a dental operatory using a dentiform), allocated 30 minutes of practice time, then post-tested. Participants were awarded a five-dollar incentive Amazon gift card upon completion of data collection and invited to complete a four-question post data collection survey. Data analysis was conducted using a two-tailed paired t-test with medium effect size of 0.5, alpha of 0.05 and a power of .84 for 37 participants. Survey results were reported using descriptive statistics. Results: Preliminary analysis suggests no significant difference in learning between the control and test

populations. However, this may be attributed to methodology limitations; possibly, skill practice for 30 minutes was not enough time to make a distinguishable difference in participant skills. Comprehensive analysis and interpretation of the results are scheduled to be completed December 2022. Conclusion(s): Although no significant difference in learning was observed the research has the potential to lay the foundation for further studies. Currently, dental skills are developed using models in simulation laboratories, with practice on fellow students and ultimately on patients. Virtual reality applications would enable students to practice without the use of expensive dental equipment, in a safe, low stakes environment; ultimately contributing to increased experiential learning and student and patient safety.

**Engineering  
Session C- Oral  
Presentations, Den,  
Union**

**SESSION C (1:45PM – 3:15PM)**

**Location: Den, A. Ray Olpin University Union**

Mobile Base for Physical Human-Robot  
Interaction and Co-manipulation  
Nate Ludlow, Brigham Young University

Faculty Mentor Marc Killpack, Brigham Young University

## SESSION C 1:45-2:00PM

Den, Union

Engineering

There is a lack of high-payload, low-cost mobile robot bases with high enough levels of mobility to perform effective human-robot manipulation. This research aims to provide an open-source option for a mobile base that can aid humans in carrying large and heavy objects. We designed, constructed, and developed code for an omnidirectional mobile base to enable research in human-robot co-manipulation applied to search and rescue situations. The base was designed with four individually steerable caster wheels to facilitate omnidirectional movement, allowing it to move in any direction to dynamically match the motion of a human. These casters are mounted on differential rocker arms to allow the base to move over small to mid-sized obstacles and objects on the ground. This should allow the base to be better suited for traversing rough terrain often found in search and rescue operations. The base is equipped with a pneumatically actuated soft continuum robot arm attached to a rotating turret to interact with the object being carried. This research aims to extend or build on the results of Freeman [BYU Scholars Archive, 9433 (2022)] and Jensen [Frontiers in Neurorobotics, 15, 626074 (2021)] by providing a testing platform for human-robot co-manipulation experiments using the human-human data co-manipulation data gathered. The mobile base can achieve speeds of greater than 3 m/s (6.7 mph) in any direction and can carry a payload of greater than 68kg (150lbs) making it suitable for human-robot co-manipulation of large objects and heavy loads. It was additionally able to run on battery power for over an hour and can traverse uneven ground. The future trials run with this mobile base will provide greater insight into

the parameters involved in effective co-manipulation of heavy objects and will be used to for insight into robot assisted search and rescue tasks.

## Engineering Outreach with Soft-Robotics: How to Design a Lesson in Design

### Haylee Sevy, Brigham Young University

Faculty Mentor Marc Killpack, Brigham Young University

SESSION C 2:05-2:20PM

Den, Union

Engineering

Starting in the Fall of 2021, the BYU Robotics and Dynamics lab started working on a soft robotics outreach curriculum originally developed by the Fabratory at Yale. The activity the curriculum is centered around involves making a pneumatically driven soft-robot gripper out of silicone. The basic construction involves assembling a 3d printed mold to define the shape designed by the student(s), filling the mold with silicone to create the body of the gripper, and attaching the silicone gripper to a piece of fabric to create closed air-channels. The project itself was shown to have a high attention retention rate with students, as seen from data collected from surveys taken by students who participated, but the grippers that they created did not have a high success rate in terms of longevity or functionality. We explored many design iterations to increase the rate of successful outcomes with the outreach activity. Variables that were changed included the design of the mold, the type of silicone used, and the way the instructions

are presented. We were able to simplify and shorten many of the steps in the manufacturing process that students would need to go through. We also reduced the prep work needed beforehand. Overall, these changes will make the activity easier for K-12 teachers to conduct in their classrooms, as well as give young students a more positive interaction and association with engineering and robotics.

## An Automated, Parameterized Model of Maize Stalk Strength via Machine Learning

Ryan Hall, Brigham Young University

Faculty Mentor Douglas Cook, Brigham Young University  
SESSION C 2:25-2:40PM

### Den, Union Engineering

A fully parameterized model of the maize stalk morphology was created using machine learning techniques. A database of 1000 CT scans of maize stalks served as the training data. The model consists of over 50 geometric parameters and 14 physical material properties. The parameterization scheme allows independent control of each physical feature of the stalk. This was accomplished by linking key landmarks with empirical eigenfunctions to capture morphological patterns in the transverse and axial directions. The parameterized model was validated by comparing results of models based on actual maize stalk shapes with parameterized counterparts in multiple loading scenarios: axial, torsion, bending, transverse

compression, flexural stiffness, and ultimate bending strength. The resulting model accurately captures behavior of actual stalks, can be “fit” to any specimen, and can be used to perform sensitivity and optimization studies. The model creation, validation, and preliminary sensitivity results will be presented.

## Case Study: Powered Hip Exoskeleton Reduces Metabolic Cost of Walking in Individual with Hemiparesis

Kai Pruyne, University of Utah

Faculty Mentor Tommaso Lenzi, University of Utah

SESSION C 2:45-3:00PM

Den, Union

Engineering

Every year about 795,000 Americans suffer a stroke. Though the mortality rate has decreased, stroke commonly results in physical disability due to hemiparesis, muscle weakness in one side of the body. Hemiparesis causes stroke survivors to struggle with mobility as it results in poor balance, reduced range of motion, and early onset of fatigue. Powered exoskeletons have been proposed as a potential solution to this problem. Powered exoskeletons are wearable devices that support the movements of the user by providing assistance from electric motors. Exoskeletons have been successful in assisting healthy subjects who have a consistent and symmetric gait. However, the ability of a powered exoskeleton to assist the



wearer depends on the capability of the exoskeleton controller to synchronize with the biological movements of the user. Hemiparetic subjects have asymmetric gait patterns that make it challenging for the exoskeleton controller to synchronize with the user. Therefore, developing assistive controllers based on the hemiparetic gait is necessary for powered exoskeletons to effectively assist stroke subjects. The goal of my undergraduate research is to address the problem of human-robot coordination in the context of assistive powered exoskeletons for individuals with hemiparesis. To this end, I have developed a controller that provides flexion and extension assistance to one or both of the user's hip joints. The assistive torque profile and timing is adjusted based on each subject's gait cycle and where they need the most support. The controller tracks the wearer's previous steps to predict their next ones, providing consistent and reliable exoskeleton assistance. Each side can be controlled independently to deliver different amounts of assistance with different timing to a subject's hemiparetic side and unaffected side. To preliminarily verify the viability of this assistive control approach, I conducted a case study with one individual with hemiparesis walking with and without a powered hip exoskeleton while we measured metabolic cost. The participant walked on a treadmill at 0.9 ms<sup>-1</sup> for a series of 6-minute-walk-tests (6MWT): one without the exoskeleton and three with the exoskeleton. The exoskeleton provided bilateral flexion and extension assistive torque to both hip joints. Our results show that the powered hip exoskeleton reduced the metabolic cost of walking by 34%. This reduction is equivalent to removing a 58-lbs backpack for a healthy individual. The results of this study will inform future metabolic and clinical study designs, focusing on assisting stroke survivor ambulation with the powered hip exoskeleton.



**Engineering,  
Session C - Oral  
Presentations, Pano  
East, Union**

**SESSION C (1:45-3:15PM)**

**Location: Pano East, A. Ray Olpin University  
Union**

Optimization of Computation Framework and  
User Interface to Analyze 4D Flow Cardiac MRI  
Garrett McClellan, University of Utah

Faculty Mentor Lucas Timmins, University of Utah

## SESSION C 1:45-2:00PM

Pano East, Union

Engineering

Cardiovascular disease (CVD) is a rapidly growing problem that has become responsible for the highest percentage of global deaths[1][2]. The detection of CVD in patients is critical for proper treatment, with one such technique being cardiac magnetic resonance imaging (cMRI)[3]. Collected cMRI data can be used directly for the calculation of wall shear stress (WSS), which is the frictional force exerted on the wall of vessel by the blood[4]. The WSS calculation removes the need for complex patient-specific computational modeling techniques[5] and can be done using velocity or volumetric flowrate[4][6]. WSS was found to be a factor in the correlation between blood flow and atherosclerosis[7]. Atherosclerosis is the build-up of plaque on vessel walls and was found as an underlying condition in patients who developed CVD[8] thus it can be used in the detection of a patient's risk of CVD. The aim of this project was to use MATLAB R2021a to optimize the computational algorithms used for the calculation of WSS directly from cMRI data, as well as to create a graphics user interface (app) for the calculation and validation of the WSS technique as a CVD detection method. Originally there were multiple MATLAB functions written and utilized in separate MATLAB scripts performing the calculations. These functions were optimized and then the MATLAB App Designer was used to create the app that utilized the optimized functions to analyze the cMRI data. The app is much easier to validate and repeat the WSS method than the previously used process. This project is significant because as this app evolves and these calculation methods are validated it will have the potential to provide an earlier less invasive CVD detection method.

Providing the patients more time to make lifestyle changes, potentially having a greater impact on their health, drastically reducing their risk of CVD.

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## An Engineered Subcutaneous Self-Injection Testbed to Assess the Impact of Fluid Viscosity, Syringe Type, and Needle Gauge Sabrina Su, University of Utah

Faculty Mentor Jay (Jungkyu) Kim, University of Utah

SESSION C 2:05-2:20PM

Pano East, Union

### Engineering

Subcutaneous injection (SC) into the fatty tissue between skin and muscle introduces medication to the body through a low-cost and convenient method. SC injections are often used for administering medications that are incompatible with oral delivery. Patients can self-administer these medications via a variety of injection devices – syringes being very common. For certain medications such as biologics, higher drug concentrations lead to higher viscosity medications. However especially for syringe-based products, sometimes patient strength capabilities are not considered, making it difficult for the patients to apply a steady force on the plunger throughout the injection and eventually complete the injection. The focus

of this research is to establish a testing platform for evaluating the dynamic SC injection performance for different viscosity fluids by monitoring the force that patients apply to the syringe plunger throughout injection and the corresponding fluid flow profile. Two alternative testing systems (passive and active testbed) are assembled. A passive system with prefilled syringes of high and low viscosity simulates injection through different needle gauges. During the injection, the force applied by the patients to the syringe plunger is monitored. The active system simulates different fluid viscosities by using a hose clamp to alter the cross-sectional area of a tubing, thereby controlling fluidic resistance. The active system monitors syringe plunger force as well as a flow profile of syringe-based SC injection. From these SC injection testbeds, we will be able to understand the relationship between applied force and fluid viscosity. The proposed testbeds enhance our understanding of the relationship between fluid viscosity, applied force, syringe type, and effective injection with the results potentially influencing syringe design, needle gauge selection, and upper limits of medicine viscosity for SC injection.

Using in-vivo models to understand limitations  
of clinical applications of light scattering  
spectroscopy for biopsies

Sarthak Tiwari, University of Utah

Faculty Mentor Robert Hitchcock, University of Utah

SESSION C 2:25-2:40PM

Pano East, Union  
Engineering

Invasive biopsies are critical in the medical diagnosis and characterization of diseased tissues, but are hindered by risk of infection, tissue damage, and high post-processing time. Optical approaches for tissue characterization allows for faster and less invasive procedures [1]. One promising optical approach is light-scattering spectroscopy (LSS) [2, 3]. Using LSS, we distinguished tissue based on properties like nuclear density [4], and tissue composition [3]. However, questions remain about the efficacy of LSS in vivo, and its clinical applications. A potential use of LSS is identifying the cardiac conduction system, e.g. to avoid damaging during surgical repair of congenital defects. Here, we describe a study on the in situ, beating heart in canines to provide insight into the capabilities of LSS.

Spectra were gathered in vivo from four adult canine models using a catheterized LSS probe [3,4]. 10 samples of 200 spectra were gathered from the atrium, ventricle, vena cava, and blood. Data analysis was performed in Matlab r2021a. The spectra were calibrated, normalized, and averaged across each set of 200 spectra. principal component analysis (PCA) and Uniform Manifold Approximation and Projection (UMAP) were used to reduce dimensionality [5]. ANOVA, with a Tukey-Kramer post hoc test and a significance level of 0.05, was used to identify differences between the first principal components of the different tissue regions [6]. The same approach was used with the first UMAP index. The results of the PCA and UMAP are shown in figure 1. The first two principal components explain 66.3% and 21.9% of the variance respectively. ANOVA using the first principal component yielded differences ( $p < 0.05$ ) between all groups except between the atrium and ventricle



( $p=0.86$ ). The UMAP shows more visible separation between tissues, and ANOVA yielded every group to be statistically different using the first index ( $p<0.05$ ). These results demonstrate the ability of the spectra to differentiate between tissue. The relative similarity of spectra from the atrium and ventricle was expected because both regions consist of muscle cells, which vary structurally from the blood and vena cava. We demonstrate the feasibility of using LSS in vivo to non-destructively characterize tissue regions in the heart. UMAP identified tissue-specific clustering in the first index, indicating that key information about tissue properties lie in the spectra. This study informed future studies for our LSS system. Further work using supervised learning approaches and heterogeneous tissue samples will provide more insight into the capabilities of LSS for tissue discrimination [4,5]. LSS' ability to differentiate tissue based on composition, both ex and in vivo, facilitates translation for medical applications. Our studies suggest that LSS has promise as a means of diagnosing and characterizing tissues in the heart, thereby improving our ability to quickly identify and effectively treat diseases.

Acknowledgements: This work was supported by the grant NIH-R01 HL135077.

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## Electrical Impedance Dermography as a Biomarker for Non-Melanoma Skin Cancer

## Elaine Wong, University of Utah

Faculty Mentor Benjamin Sanchez, University of Utah

SESSION C 2:45-3:00PM

Pano East, Union

Engineering

Clinical diagnosis of basal cell (BCC) and squamous cell (SCC) carcinoma subtypes is challenging. There are multiple subtypes of BCC and SCC that can be difficult to distinguish clinically and ideally require different biopsy techniques for optimal histologic analysis and therapeutic decision-making<sup>1</sup>. Visual detection of BCC and SCC can be facilitated with the aid of dermoscopy<sup>2</sup> but determining prior to biopsy whether a lesion is superficial or more deeply invasive is usually not possible. There is a great clinical need to develop new technologies to augment visual skin examination to guide biopsy-decision-making and improve management of lesions suspicious for BCC and SCC. To date, there is no bedside technique available that is low cost, easily applied, quantitative, objective, and capable of overcoming these diagnostic hurdles. EID is a newer non-invasive, quantitative, and objective tool sensitive enough to detect alterations in the electrical properties of skin cancers. The overarching hypothesis of my proposal is that EID can be used to distinguish BCC subtypes and between SCC-in situ, invasive SCC, and inflamed keratosis that cannot be appreciated clinically. The “superficial” form of BCC is confined to the epidermis and can be effectively treated by non-surgical means. The “nodular” form of BCC consists of a collection of round tumor cells occupying the upper part of the dermis and can be treated by destruction or surgically depending on its size and location. “Micronodular” and “infiltrative” forms of BCC consist of smaller aggregates of

tumor cells or angulated or stranded tumor cells, respectively, infiltrating the deeper dermis and usually require surgical treatment. Importantly, these invasive subtypes of BCC can present as papules or plaques that cannot reliably be distinguished clinically from nodular or the more superficial subtype of BCC. The superficial form of SCC can resemble BCC, and it is challenging clinically to distinguish this entity from invasive SCC; the former is best biopsied by shave technique while the latter is best biopsied by punch technique to assess depth of invasion<sup>3</sup>. These histologic changes cannot be reliably appreciated visually and thus distinguishing subtypes of BCC and SCC presents a clinical conundrum. EID technology could contribute to overall clinical assessment by increasing confidence and diagnostic accuracy that will inform biopsy-decision making in patients with lesions suspicious for skin cancer. My research showed EID to be very effective and efficient at diagnosing BCC and SCC. In the BCC study, I obtained a specificity of 88%. Similarly, in the SCC study, I achieved an averaged area under the curve of 0.968, sensitivity of 94.6%, and specificity of 96.9% (Fig.1). In both cases, my results exceed the diagnostic accuracy of using the dermoscope, the clinical gold standard technology.

**Health and  
Medicine. Session  
C - Oral  
Presentations,  
Conference Room,  
Sill Center**

**SESSION C (1:45PM – 3:15PM)**

**Location: Conference Room, Sill Center**

Don't Fear the AI: A Systematic Review of

# Machine Learning for Prostate Cancer Detection in Pathology

## Alexander Gibson, Brigham Young University

Faculty Mentor Dennis Della Corte, Brigham Young University

SESSION C 1:45-2:00PM

Sill Center

Health and Medicine

Prostate cancer is the second-most diagnosed cancer in men worldwide. It is also the fifth leading cause of death in men. When a patient is referred to a pathologist due to the presence or suspicion of prostate cancer, a pathologist may take a needle core biopsy, which produces six to twelve slides of prostate tissue. The pathologist then stains the tissue (usually using a hematoxylin and eosin stain) and analyzes the tissue samples using a Whole Slide Scanner. The scanner digitizes physical slides into high resolution giga-pixel images. As the shortage of pathologists continues, remaining pathologists are left to analyze more samples than before. Pathologists also face significant inter-observer variability. Thus, the use of artificial intelligence (AI) can drastically increase the productivity and impact of a single pathologist. Researchers across the globe are inventing new machine learning algorithms to detect and classify prostate tissue. This literature review explains how artificial intelligence is being used to detect prostate cancer. After reading over 400 papers, we narrowed our pool of papers down to 142 relevant papers. We classified all machine learning results and methods into 11 different categories (see figure in uploaded PDF). Papers reported algorithm performance according to many different metrics, but we determined that Kappa values, Area under the Curve values, and Accuracy

values are the most meaningful metrics. Some papers used a binary classification method to classify tissue, and some papers used a multi-class method. All relevant algorithms were categorized according to their methods and performance. We conclude that pathologists will not be replaced by machine learning algorithms; however, AI can enhance the performance and efficiency of pathologists. An increase in pathologists' effectiveness could improve access to healthcare in underdeveloped areas and emergent nations.

## Chimeric Autoantigen Receptor (CAAR) T cells as a Novel Immunotherapy for Autoreactive B Cells in Graves' Disease

Mackenzie Hansen, Brigham Young University

Faculty Mentor Kim O'Neill, Brigham Young University

SESSION C 2:05-2:20PM

Sill Center

Health and Medicine

Graves' Disease is the fourth most common autoimmune disease in the US. The main cause of Graves' Disease is the overstimulation of the thyroid gland by thyroid stimulating hormone receptor (TSHR) specific antibodies produced by autoreactive B cells. Current therapies for Graves' Disease include antithyroid drugs, radioiodine therapy, and surgery, but these do not address the underlying mechanism of the autoimmune response. Our aim is to generate a targeted method to attack the disease using engineered chimeric

autoantigen receptor (CAAR) T cells. Our CAAR T cells contain varying epitopes of TSHR that autoreactive B cells will recognize, bind to, and activate. The activated CAAR T cell will then kill the autoreactive B cell. We will compare our candidate CAAR T cells to see which epitope expresses and binds most effectively. We will also perform cytotoxicity assays to measure the targeting and killing ability of our CAAR construct against B cells from Graves' Disease patients. The use of CAAR T cells specifically targeting autoreactive B cells would open a new avenue of treatment for Graves' Disease and potentially other autoimmune diseases.

## Intact endothelial cell autophagy preserves outcomes of acute ischemic stroke in mice

### Milo Light, University of Utah

Faculty Mentor John Symons, University of Utah

SESSION C 2:25-2:40PM

Sill Center

Health and Medicine

Approved treatments for acute ischemic stroke (AIS) include thrombolysis (clot dissolution) and thrombectomy (clot removal). Most patients are ineligible for these procedures because they must be initiated within 4.5h (thrombolysis) or 24h (thrombectomy) of AIS symptom onset. New targets for intervention are needed. Here we evaluate the contribution from endothelial cell (EC) autophagy to outcomes of AIS. AIS creates a nutrient stress and activates EC autophagy. Heightened EC autophagy in response to AIS helps to : (i) identify, tether, and shuttle damaged proteins to the lysosome

for degradation and recycling; (ii) generate ATP from recycled macromolecules; and (iii) preserve arterial function by enabling EC nitric oxide production. First we hypothesized that depleting EC autophagy worsens outcomes of AIS. Adult mice with intact autophagy (ATG3 WT) or depletion of autophagy regulated gene 3 (Atg3) specifically in ECs (ATG3 EC<sup>-/-</sup>) were challenged with 60-min middle cerebral artery occlusion followed by 23 h reperfusion. By design, AIS increased ( $p < 0.05$ ) EC autophagy in brains from ATG3 WT but not ATG3 EC<sup>-/-</sup> mice. Infarct volume was larger, and neurobehavioral and physical deficits were more severe (all  $p < 0.05$ ), in ATG3 EC<sup>-/-</sup> vs. ATG3 WT mice ( $n=7$  per group). Second, we hypothesized that amplifying autophagy improves outcomes of AIS. For 3-weeks adult mice consumed standard chow that was (rapa) or was not (control) supplemented with the mammalian target of rapamycin complex 1 (mTORC1) inhibitor rapamycin, a potent activator of autophagy. As evidence of mTORC1 inhibition, fasting-induced p-s6K : s6 was greater ( $p < 0.05$ ) in liver segments from rapa vs. control mice ( $n=4$  per group). AIS-induced outcomes concerning infarct volume, and neurobehavioral and physical performance, were superior in rapa vs. control mice ( $n=8$  per group). These results indicate EC autophagy depletion worsens, whereas EC autophagy activation mitigates, outcomes of AIS. Our ongoing studies are targeting EC metabolism to improve outcomes of AIS.

## Identification and Analysis of Compounds To Improve CTNNB1-mutated Hepatocellular



# Carcinoma (HCC) in Transgenic Zebrafish

Audrey Su, University of Utah

Faculty Mentor Kimberley Evason, University of Utah

SESSION C 2:45-3:00PM

Sill Center

Health and Medicine

Hepatocellular carcinoma (HCC) is the most common primary liver cancer with a 5-year survival rate of <20%, and it was the sixth leading cause of cancer mortality in 2020. One of the most commonly mutated genes in HCC is  $\beta$ -catenin (CTNNB1), accounting for ~20-40% of patients with HCC and leading to constitutively active Wnt signaling. Due to the necessity of Wnt signaling in healthy liver tissue, there are few precision medicine-based treatments for patients with either CTNNB1-mutated HCC or HCC as a whole. Instead of targeting specific mutated protein(s), this research focuses on analyzing dysregulated pathways downstream that are susceptible to treatment. Our aim is to characterize the effects of mutated CTNNB1 on lipid metabolism and tumorigenesis. To understand the role of lipid metabolism in HCC, we screened 194 metabolic/protease-related compounds using our lab's transgenic CTNNB1 zebrafish model of HCC. Wild-type and transgenic larvae were exposed to either DMSO control or experimental compound from 3 to 6 days post fertilization (dpf), and liver size was recorded at 6 dpf. Compounds that decreased liver size in transgenic zebrafish were considered positive hits. We confirmation-tested 10 compounds with additional doses and greater sample sizes. Our results showed that FAAH-IN2 and pitavastatin decreased larval liver size in transgenic zebrafish, while GSK1940029 increased liver size.

To further characterize these compounds' effects, we used oil red-o staining to analyze changes in lipid storage. Our work successfully identified key compounds that significantly affect larval liver size in transgenic zebrafish. These findings could lead to better treatments for both CTNNB1-mutated HCC and HCC as a whole. Future work includes studying differences in hepatocyte proliferation and analyzing alterations in immune cell migration in zebrafish treated with FAAH-IN2, pitavastatin, and GSK1940029, as well as continued confirmation testing in remaining compounds.

**Humanities and  
Arts. Session C -  
Oral Presentations,  
Room 312, Union**

**SESSION C (1:45PM – 3:15PM)**

**Location: Room 312, A. Ray Olpin University  
Union**

Philosophy of Love and Forgiveness

Sydney Ballif, Brigham Young University

Faculty Mentor Andrew Reed, Brigham Young University

SESSION C 1:45-2:00PM

Room 312, Union

Humanities

Defining love and conceptualizing forgiveness is a trending topic in the philosophical discourse. Determining how, what, and why we love is at the forefront of intellectual's minds. My research paper aims at creating a scaffolding of love through the lens of Charles Griswold's conditions of forgiveness. Transposing Griswold's conditions onto love provides a robust and fuller definition of love and affords a clearer orientation for romantic love

## Points, Lines, and Bodies: The Mereological Problem in Leibniz

Jackson Hawkins, Brigham Young University

Faculty Mentor Mike Hansen, Brigham Young University

SESSION C 2:05-2:20PM

Room 312, Union

Humanities

Of all the great 17th century metaphysical systems, that of Gottfried Leibniz is undoubtedly the most extravagant. Oscillating between meticulous logic and fantastic speculation, the challenge of appropriately interpreting Leibniz's project is exacerbated by the scarcity of full-length treatises in his corpus. The great majority of Leibniz's philosophical insights

are contained in brief essays, prolegomena to unfinished works, and correspondences with his contemporaries, resulting in a remarkably diffuse body of literature. The work of tracing the historical and intellectual development of Leibniz's numerous distinctive concepts is thus as important as it is difficult. In this project, I strive to illuminate at least one aspect of this progression, namely, the issue of Leibniz's mereological thought: how parts relate to wholes in his view. It is well known that the Leibnizian system hinges on causally-isolated, simple substances which Leibniz would eventually dub "monads". However, the question of how the monads relate to extended matter — whether as parts or in some other fashion — is significantly more opaque. As my research demonstrates, Leibniz does indeed possess a sophisticated mereological worldview, but the extent to which it lends itself to a single, coherent metaphysical picture may be uncertain. I attempt to expose an apparent disconnect which arises from an intertextual consideration of several Leibnizian discourses, and seek a way of reconciling this inconsistency while remaining faithful to Leibniz's long-term philosophical project.

## The Reality of Kafka's Absurdity: The Trial

### Brandan Ivie, Southern Utah University

Faculty Mentor Nicole Dib, Southern Utah University  
 SESSION C 2:25-2:40PM  
 Room 312, Union  
 Humanities

Kafka's *The Trial* is a piece of absurdist fiction that pulls its

audience into the central conflict and asks the question: what is Jay's crime? Unfortunately for the audience sense of closure, this very question is never overtly answered; furthermore, when we understand the genre expectations, we begin to realize this uncertainty was purposeful rather than incidental. Instead, the question of the crime is what allows us to explore the abstract presence of "The Law" within this obscure world. In this presentation, I will explore the formal and structural elements of *The Trial* to argue that this literary world may be more hyper realist than its surrealist appearance may present. I will further demonstrate how the dystopian world of *The Trial* reflects our real world in many intriguing ways, particularly that of the world at the rise of Nazi power in the early 20th century. However, while Kafka's novel may critique a regime like that one, it serves as a reflection on the human condition and Western society's tendency to want to locate criminality in clear, certain terms. My paper will also discuss how there is guilt that is present within human individuals that the novel is committed to examining, and this sense of guilt is tied to the nature of Jay's crime as well as to the nature of his society. Through this analysis I will address Jay's unidentified crime as a plot device, and I will ultimately link this to the novel's investment in critiquing power systems through law, literature, and justice.

**"And Who Has Not Had Their Ears Tickled?"**

**Sophia and the British Musical Miscellany**

**Janice Bunker, University of Utah**

Faculty Mentor Jane Hatter, University of Utah

## SESSION C 2:45-3:00PM

Room 312, Union

## Arts

Historian Charles Burney (1726-1814) mentions an ancient Grecian woman named Lamia who played the flute. Plutarch and Athenaeus both wrote about her as a “most celebrated” female flutist. Burney’s opinion is that her fame was based on her abilities as a courtesan rather than her abilities on the flute. Greek artifacts from this time often depict female musicians performing naked and describe them in erotic terms. However, it is possible that some female musicians were not prostitutes, yet were perceived and portrayed as sexual objects because their performances were controlled and viewed by men, and the artifacts we have were created by men. In the eighteenth century, similar attitudes existed: public female performers “were” socially inferior and morally loose, and most public performances were controlled by men. Domestic female performers were considered socially and morally superior, but there was a fine line of demarcation. In addition, flute was not considered a proper instrument for a woman. Thus, information about female flute players performing either in public or at home is difficult to find, and if it exists, is in non-traditional resources. The current research project will review non-traditional literature for clues about female domestic musicians who may have played the flute. For example, we have financial records that show a Scottish noblewoman purchased a flute and paid for flute lessons for one of her daughters from 1702 to at least 1717. James Freebairn, a Scottish historian, mentions several women whose flute-playing delightfully “tickled the ears” of their audiences around 1727. We have artwork from the mid-1700s depicting female flutists. A strong piece of evidence is the Scottish National

Library's copy of the first volume of *The British Musical Miscellany* bearing the signature Sophia Eyre and the year 1733 on the title page. As was common with miscellanies of the time, the pieces are arrangements of theater, popular, and folk songs. The score includes separately notated flute parts, which made it more attractive to amateur musicians, many of whom were women. It is possible that some female domestic musicians could have played the flute. The current research project will analyze pieces in the score, including their origin, technical details, and their post-publication existence. This will shed light on the musical culture in which female domestic musicians lived and transmitted musical knowledge to the next generation. Results from the current research project will reveal hints about the musical lives of eighteenth-century women and their networks of influence, and add significantly to the growing body of knowledge about underrecognized women musicians who were working toward enlarging their musical spheres and paving the way for the female musicians of today.



**Humanities.**  
**Session C - Oral**  
**Presentations.**  
**Boyer Conference**  
**(2nd floor), Alumni**  
**House**

**SESSION C (1:45-3:15PM)**  
**Location: Boyer Conference (2nd floor),**  
**Alumni House**

**How well did Mormon Pioneers Practice**

## **what they Preached? – An Analysis of LDS-Native American Interactions in Early Utah History**

**Ciara Galbraith, Brigham Young University**

Faculty Mentor Jenny Pulsipher, Brigham Young University

SESSION C 1:45-2:00PM

Boyer Conference (2nd floor), Alumni House

Humanities

On July 24, 1847, Brigham Young, the second President of The Church of Jesus Christ of Latter-day Saints, entered the Salt Lake Valley, and famously declared, “This is the place.” From that moment on, thousands of church members, known as “Saints,” migrated from across the United States and Western Europe to settle the Utah Territory as their long-awaited land of “Zion.” However, those early pioneers were disgruntled to discover they were not the first tenants living within the Salt Lake Valley. This research highlights to what extent religious beliefs and prophetic teachings influenced the way Mormon pioneers interacted with the peoples indigenous to the Utah Territory. To more fully understand these interactions, an extensive and exhaustive search through The Book of Mormon, Church doctrine, and early prophetic counsel is required, along with the study of diaries of the early pioneers, oral histories from both the Saints and the native peoples and/or their descendants, newspaper articles, and previous research on the general topic conducted by other historians. Many stories from those records have already been reiterated in scholarly books and journals, passed down through family lines, and been proudly told at many of a family gathering. However, existing

analyses of the Mormon-Native American dichotomy are nearly nonexistent. It is one matter to discuss what happened, but it is another matter entirely to discuss why it happened. Using these various sources, this research discusses to what extent early Mormon pioneers in the Utah Territory practiced what they preached, and what cultural prejudices may have curbed their “righteous-doings.” Aside from the “Lamanite missions,” history taught within the Latter-day Saint community conveniently excludes any mention of Native Americans. My intent is to complicate that history.

## **“To Inherit God Himself?": The Metaphysical Transformation of Man in Cotton Mather’s *Biblia Americana* Michael Green, Brigham Young University**

Faculty Mentor Paul Kerry, Brigham Young University

SESSION C 2:05-2:20PM

Boyer Conference (2nd floor), Alumni House

Humanities

This research examines Cotton Mather’s *Biblia Americana*, the first scriptural commentary written in North America, his largest and most comprehensive work, and only recently discovered by scholars after more than two hundred years of neglect. The *Biblia Americana* is an enlightened response to the early eighteenth-century ascension of higher criticism, which sought to impose a historical-literal exegesis on the Bible and thereby threatened its secularization. This research is concerned with Mather’s theological assertions in the *Biblia*

Americana, both in how he reaffirms or rejects Reformation exegetical methodologies and conclusions while simultaneously trying to absorb certain aspects of Enlightenment thinking. Specifically, this research explores how Mather's theorization of experiential piety influenced his ontological conception of both God and man, which consequently shaped his soteriological and eschatological claims. This includes an examination of Christ's dyohypostatic nature, the creation and function of the human soul, experiential piety in relation to mortal life, and the post-mortal processes of resurrection and metaphysical transformation. The *Biblia Americana* reveals that Mather possessed a unique theological stance that included a progressive spirituality nurtured through a personal connection with divinity and culminating in the glorification of the soul and body. These findings reconceptualize Mather's character and legacy, which currently stands as a symbol of aggressive Puritanism; challenges the narrative of moderate Biblical exegetists as stagnant and purely apologetic, rather than as active, explorative, and creative; and illuminates a theology that in some ways radically departs from Reformation theology and returns to a more patristic mindset. Thus Mather's *Biblia Americana* acts as a bridge between the Enlightenment and the American First Great Awakening.

# **The Concept of Holiness in the Book of Mormon: A Thematic Textual Analysis**

## **Rebekah Wilson, Brigham Young University**

Faculty Mentor Isaac Calvert, Brigham Young University

SESSION C 2:25-2:40PM

Boyer Conference (2nd floor), Alumni House

Humanities

This article presents a thematic analysis on the concept of Holiness as presented in the primary source text of The Book of Mormon. Fields of academic inquiry including counseling psychology, humanities, sociology and anthropology have seen a recent surge of interest in the meaning and experience of holiness in the midst of the 21st century's interfaith and multiculturalist trends. This paper seeks, in part, to contribute to this scholarly conversation by presenting a multifaceted description of this text's perspective on the meaning and lived experience of holiness. We began this project by conducting an exhaustive thematic analysis of the text by searching for key terms directly related to the overarching theme of holiness including (together with their grammatical derivatives) holy, unholy, holiness, sanctify, sacred, consecrate, desecrate and sanctification. Having found 17 themes in our primary analysis, we then conducted secondary and tertiary analyses of salient themes to arrive at three principal thematic categories: God as holiness, dispositional holiness and reciprocal holiness. Each of these thematic categories include multiple subthemes. The first theme describes how various facets of the nature of holiness itself are seen as synonymous with God's character, attributes

and actions. The second makes the dual assertion that one's disposition can be both an initiating catalyst for holiness as well as a consequence of the experience and pursuit of holiness. The last theme suggests that holiness can only be fully realized by the mutual participation of both God on one hand and humanity on the other. We hope that this research will contribute to growing contemporary discussions regarding holiness by examining the meaning of holiness based on primary analysis of this sacred text.

## **“Surfaces and Appearances”: Character, Physiognomy, and Communication in Charles Dickens’s and Wilkie Collins’s *A Message from the Sea***

### **Rachel Gouff, Brigham Young University**

Faculty Mentor Jamie Horrocks, Brigham Young University

SESSION C 2:45-3:00PM

Boyer Conference (2nd floor), Alumni House

Humanities

Charles Dickens has been known as “the inventor of Christmas” since his 1843 Christmas Carol popularized the holiday. Most readers, however, are unaware that Dickens actually wrote many other “Christmas” stories and published them to be read during the festive season. These stories—including *A Message from the Sea* (1860)—often had nothing to do with Christmas itself. Rather than snowy villages and evergreens, *A Message from the Sea* includes ghosts, cannibals, a murderous innkeeper, a mysterious message in a bottle, and

a long-lost brother. In this thrilling tale of adventure, full of shady characters and near-death experiences, whether or not a character survives depends on their ability to read moral character in the physical appearances of others. The visibility of one's inner virtue in one's outward appearance, or "physiognomy," was a popular concept in Victorian England and appears frequently in Dickens's literature. In fact, physiognomy was widely considered a science and was treated as such; if a person was beautiful they were assumed to be good, if a person was ugly they were assumed to be bad. Physiognomy was taken so seriously that people were sometimes accused or acquitted of crimes based solely on their physical appearance. My presentation examines physiognomy within Dickens's Christmas novella *A Message from the Sea*. Rather than simply embracing or rejecting the pseudo-science, Dickens suggests that although physiognomy is reliable in determining a person's moral character, it falls short when it comes to accurately reading a character's real emotions or personal history. Thus, in this novella, physiognomy reveals itself to be an art as superficial as the message in the bottle that the story centers around, a message whose "ink had faded and run." Dickens represents messages conveyed physiognomically as largely intelligible, but limited enough that relying on physiognomy alone will always leave one vulnerable to misunderstanding.

**Science. Session C -  
Poster  
Presentations,  
Ballroom, Union**

**SESSION C (1:45-3:15PM)**

**Location: Ballroom, A. Ray Olpin Student  
Union**

**The Evolution of Tolerance to Disinfectants  
of Staphylococcus Lugdunensis  
Zackary Hoskins, Utah Valley University**

Faculty Mentor: Lauren Brooks, Utah Valley University



## SESSION C (1:45-3:15PM)

## POSTER C1

Most disinfectants advertise that they work effectively against 99% of bacteria. While many might think this claim refers to the fact that the disinfectant kills 99% of bacteria, this instead means the disinfectant reduces 99% of colonies in a handful of species. Given the diversity of bacteria, it is essential to know how other, lesser studied species react to disinfectant both with the initial exposure to disinfectants and whether they can evolve tolerance to it. In this project, I investigated how *Staphylococcus lugdunensis* responds to ethanol at various concentrations and whether it is capable of evolving tolerance. The *Staphylococcus lugdunensis* was tested exposing a standard concentration (0.1 Optical Density) to ethanol diluted from 100% to 10% in 10% increments. Once the range of survival was determined, survivors from the highest concentration were liquid cultured to ensure exponential growth and exposed again to the diluted ethanol in 2.5% increments. The results of this model system suggest that the bacteria can evolve tolerance to ethanol. While this bacterium is rarely considered a pathogen, and is instead more often considered a commensal component of the skin microbiota, making it important to determine how it responds to alcohol-based hand sanitizers. Additionally, the properties of this bacteria might also be applicable to other forms of *Staphylococcus*, such as the more pathogenic *S. aureus*, making the results of this research of interest to determine the effectiveness of alcohol-based hand sanitizers on this pathogen.

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## **Relatedness of Lactobacillus Abundance to the Significance of Latitude's Effect on the Microbiome of Drosophila Melanogaster**

**Connor Hough, Brigham Young University**

Faculty Mentor: Johnathan Chaston, Brigham Young University

SESSION C (1:45-3:15PM)

POSTER C2

The effect of Lactobacillus (LAB) abundance on the microbiome and lifestyle of Drosophila Melanogaster has been studied multiple times over the years with varying conclusions. The works of Henry et al and Walters et al differ in their results despite having similar research done along the same cline in the East Coast. I will analyze the differences between the raw data of these studies in order to come to a more definitive conclusion about the relationship between latitude and LAB abundance. Henry et al also includes information and raw data about the microbiomes of flies, frass (fly feces), and the flies diet. I will be analyzing the raw data from Henry et al as well, to determine the relationship between these three elements. Together, these analyses will help me to learn why these similar studies came to such different conclusions about the effects of LAB and latitude as well as any relatedness there is between the microbiomes of fly, frass, and diet microbiomes to each other and the geographic cline.

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## **Saltcedar Biocontrol Beetles: Helping or**

## Hurting?

### Christy Houston, Utah Valley University

Faculty Mentor: Michael Rotter, Utah Valley University

SESSION C (1:45-3:15PM)

#### POSTER C3

Non-native salt cedar trees (*Tamarisk* spp.) have spread throughout riparian ecosystems in the western United States. The salinity and phytochemicals contained in the leaves and roots of these plants kill native flora like willow and cottonwood trees, creating monocultures. These monocultures are known as ecological deserts with few animals remaining. However, with limited habitat, some native fauna can maintain small populations in these invaded zones. Chemical and mechanical removal methods for salt cedar are labor-intensive and have varying degrees of success. Tamarisk beetles, (*Diorhabda* spp) were introduced as a biocontrol to destroy salt cedar trees. They eat the foliage, causing progressive dieback. Although this does eradicate salt cedars there is concern that the dieback may lead some fauna without any suitable habitat. In this study we consider how biocontrol of tamarisk influences native plant growth/propagation and biotic soil decomposition. Our study first compares the phytochemicals of biocontrol and non-biocontrolled salt cedar sites and the impact these differences may have on ecological function. Further experiments will include providing a choice chamber to isopod colonies and growing native willows in soil mixed with the leaf litter to see if there are any significant differences between the two.

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## **Direct One-pot Grignard Formation and Addition to Imine Electrophiles**

### **Kaden Jensen, Southern Utah University**

Faculty Mentor: Matthew Prater, Southern Utah University

SESSION C (1:45-3:15PM)

POSTER C4

Many Grignard reagents will form at ambient temperature if an organohalide is given sufficient time to react with magnesium. The organomagnesium species is highly reactive, and prone to undergo Wurtz coupling with another Grignard reagent to form the homocoupled product. In order to mitigate this

homocoupling product formation, we envisioned preparing the Grignard reagent while an imine electrophile is in the same solution to afford an amine product. Amines are common in pharmaceutically relevant compounds. This methodology could also be applied to other electrophiles. Early results include isolated yields above 70%.

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## **The Postprandial Induction of the Nr4a Transcription Factors is Essential for GSIS**

### **Jordan Johns, Brigham Young University**

Faculty Mentor: Jeffery Tessem, Brigham Young University

SESSION C (1:45-3:15PM)

POSTER C5

Jordan W. Johns, Jacob A. Herring, Jeffrey S.

Tessem. Diabetes is a disease that affects millions of people worldwide and is becoming more prevalent. A hallmark symptom of diabetes is the inability to regulate blood glucose levels after a meal. The Nr4a family of transcription factors regulates the expression of key glucose metabolism genes, and type 2 diabetics have significant decreases in mRNA expression of Nr4a1 and Nr4a3 in the pancreatic islet. Furthermore, Nr4a1KO mice cause decreased beta cell mass and insulin secretion. We have shown that changing media glucose concentrations from 2.5mM to 11mM, a change indicative of a normal postprandial response, is sufficient to induce Nr4a1 and Nr4a3 expression in beta cells. This same change in glucose concentration is responsible for beta cell insulin secretion. We hypothesized that the postprandial induction of the Nr4a's is essential for beta cell glucose sensing and insulin secretion, and that glucotoxic conditions that impair insulin secretion fail to induce Nr4a expression. Here we show how the postprandial Nr4a gene expression affects beta cell glucose stimulated insulin secretion under normal glucose concentrations and glucotoxic conditions to prove this hypothesis.

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## **Effects of Choice on Lactobacillus and Acetobacter Concentrations in the Microbiome of *Drosophila melanogaster***

**Maggie Johnson, Brigham Young University**

Faculty Mentor: John Chaston, Brigham Young University

SESSION C (1:45-3:15PM)

POSTER C6

The microbiome, which is all the genetic material of microorganisms in a particular environment, has a significant impact on the host. This field of study reveals answers to questions relating to bacterial significance and the relationship between the two and the microbiome, which in turn can affect the phenotype of the host organism. *Drosophila melanogaster* has been a model species for microbiome work for years because it possesses a microbiome that can be easily manipulated due to the simplicity of the microbiome's composition. Here, we utilize the two dominant species found in the gut microbiome of the fruit fly, acetic acid bacteria and lactic acid bacteria, to determine genetic trends relating to the effect of choice on the microbiome of the fruit fly and its relationship to the concentration of both of these types of bacteria. We do this by simulating a scenario where the fruit fly is presented with the choice between the two types of bacteria and discussing the resulting projected data.

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## **Expressing and Purifying Type IV CRISPR Accessory Proteins**

**Alivia Jolley, Utah State University**

Faculty Mentor: Ryan Jackson, Utah State University

SESSION C (1:45-3:15PM)

POSTER C7

CRISPR (Clustered Regularly Interspaced Short Palindromic

Repeat)-Cas (CRISPR-associated) adaptive immune systems defend bacteria and archaea against phages, plasmids, and other mobile genetic elements. Each Type IV CRISPR system contains a subtype-specific gene and is hypothesized to be essential for function. The Type IV-A system encodes ATP-dependent 5'-3' DNA helicase called CasDinG, while the Type IV-B systems encode a putative pyrophosphatase named CasCysH. Here we investigate the function of the type IV CRISPR systems by expressing, purifying, and characterizing the accessory proteins from the type IV systems. This project is a first step towards understanding the structure and mechanism of type IV systems and the possibility of repurposing type IV systems in future applications.

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## **Palladium-Catalyzed Cross-Coupling of (E)-Octenylboronic Acid Pinacol Ester with Aromatic Chlorides**

**Maddelyn Lunt, Southern Utah University**

Faculty Mentor: Nathan Werner, Southern Utah University

SESSION C (1:45-3:15PM)

POSTER C8

Alkenes are used in the chemical synthesis of plastics, fine chemicals, and biologically active molecules including medicines. The simplest alkene, ethylene, is an important plant hormone that can be used in agriculture to ripen fruits. The palladium-catalyzed Suzuki cross coupling reaction is an efficient method to synthesize substituted alkenes with control

of the 3-dimensional geometry of the groups bonded to the alkene. An alkyl-substituted alkyne was found to undergo a 9-BBN catalyzed hydroboration reaction with pinacolborane to produce the alkyl-substituted, (E)-alkenylboronic acid pinacol ester in 69% yield. The palladium-catalyzed cross-coupling of this alkyl-substituted, (E)-alkenylboronic acid pinacol esters was then studied with aryl chlorides. The reaction parameters were evaluated to maximize the yield of the cross-coupling product. The scope of compatible aryl chlorides was then evaluated under the optimized reaction conditions. Nine ortho- and para-substituted aryl chlorides bearing various electron-donating and electron-withdrawing groups were found to undergo the coupling reaction with the alkyl-substituted, (E)-alkenylboronic acid pinacol ester in 54%-98% yield.

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## **Effects of host genetic feeding preferences in shaping microbiota composition in *D. melanogaster***

**Caroline Massey, Brigham Young  
University**

Faculty Mentor: John Chaston, Brigham Young University

SESSION C (1:45-3:15PM)

POSTER C9

The microorganisms within a host, commonly referred to as the microbiota, play an important role in the development of an organism and their life history traits, including fecundity



and lifespan. For example, in the model organism *Drosophila melanogaster*, it has been shown that host genotype can significantly alter the microbiota composition (Dobson 2015, Chaston 2016), meaning that host genotype can play a substantial role in how the microbiota is determined and can influence the locally adapted traits of an organism. What is not fully understood are the mechanisms by which host genotype selects the microbiota composition. My intentions are to understand how the genetic feeding preferences of *D. melanogaster* help determine host microbiota composition. To do this, I will set up assays where I will measure the variation exhibited in the microbiota of genotypically different flies when given a choice of different microbes in their diet; or when no choice is provided. This work will contribute to uncovering how host genotype influences the microbiota variation observed between genetically distinct organisms.

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## **Smart Animals and Social Critters: The relationship of Protocadherin evolution and neuronal diversity and the impact of DSCAM evolution on sociality**

### **Remington Motte, Utah Valley University**

Faculty Mentor: Carl Hjelman, Utah Valley University

SESSION C (1:45-3:15PM)

POSTER C10

Neuronal complexity varies widely throughout the tree of

life. Clustered protocadherins (PCDH) are known to play a significant role in neural diversity and synapse maturity in vertebrates and cephalopods (Noonan, Myers, et al. 2013). DSCAM (Down Syndrome Cell Adhesion Molecule) proteins play a similar role in arthropods in regard to neuronal wiring and axonal guidance (Armitage, Bravo, et al. 2012). Due to the role and conservation of PCDH and DSCAM in brain development, it is thought that they played an important role in the brain evolution of both arthropods, vertebrates, and cephalopods. In order to investigate the relationship of the gene evolution and neuronal diversity and evolution, I examined the similarities of the evolution of PCDH transcripts across twenty vertebrate and cephalopod species. Due to the large number of PCDH genes, I focused on PCDH11X and PCDH20 due to the overlapping presence in the selected species. PCDH11X is an x-linked protocadherin that has been linked to late onset Alzheimer's disease, while PCDH20's function is yet to be determined. Furthermore, I investigated the evolution of DSCAM2 in fifty arthropods in relation to sociality. These analyses were completed using Bayesian phylogenetic methods with follow up comparative phylogenetic analyses. Based on the phylogenetic trees created, we can conclude that the most recent common ancestor of vertebrates and cephalopods likely had both PCDH11X and PCDH20. I mapped neuron number and diversity to visualize patterns and estimate ancestral character state. Additionally, I investigated the correlation between DSCAM and sociality in arthropods. Further research should be done on the evolution of PCDH in cephalopods, specifically comparing mollusk PCDH to vertebrate PCDH in order to fully understand the origin and evolutionary path of PCDH.

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## **UVFlora: Verbenaceae**

### **Audrey ODonnal, Utah Valley University**

Faculty Mentor: Michael Rotter, Utah Valley University

SESSION C (1:45-3:15PM)

POSTER C11

The Field manual of the Utah Valley Flora is a student-led project to create a field guide to the vascular plants of the Utah Valley Region. The reasons for this updated field guide are to have simple dichotomous keys for newer botanists and to have updated terminology and taxonomy. We also wanted to give students, such as myself, an opportunity to give students hands-on experience and to take ownership and authorship chances.. The methods that are being used to complete this field guide include student work in botany courses at UVU, as well as student independent research. Resources that we have are UVU's herbarium along with various reputable herbarium databases. Using these documented plant specimens we are able to write original descriptions and create maps. Currently the Field Manual is 1/4 completed overall with Gymnosperms completed, Ferns and allies halfway completed, and Angiosperms 1/5 of the way done. Specifically for my research, I have been working on a key for the family Verbenaceae. Here we present a flow chart of the process to complete a section of the flora. As mentioned previously, this field guide will be an opportunity for many students to be authors and the student authors include those in the field botany class, the flora of Utah class along with independent studies students.

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## **Halogenation of ester derivatives of L-tyrosine N-oxime**

**Morgan Payne, Utah Valley University**

Faculty Mentor: Steve Chamberland, Utah Valley University

SESSION C (1:45-3:15PM)

POSTER C12

The optimized preparation of an array of brominated, chlorinated, and iodinated oxime-containing ester derivatives of L-tyrosine is reported. The use of these halogenated precursors in the total synthesis of natural and non-natural products of biological relevance has been a focus of this research group. Moreover, halogenation of a phenol opens the door to the regioselective formation of C-C bonds through palladium-catalysis and custom substitution of phenols with heterocycles. Oxime-containing L-tyrosine methyl ester and L-tyrosine tert-butyl ester were used as templates in these halogenation reactions, as shown in the Figure provided. Each dihalogenated product was formed via an oxidative dearomatizing spirocyclization process. The monohalogenation, dihalogenation, and hetero-dihalogenation processes featured efficient purification steps unique to each product type. These products were prepared in high yield and purity with all of the products being isolated in at least 90% purity with most yields in excess of 75%. A streamlined preparation of the products of the L-tyrosine methyl ester on large scale has also been performed and developed.

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## **Expression, Purification, and Cocrystallization of Hip1 with NS-049 2, a Lead Compound for the Treatment of Tuberculosis**

**Karla Pena, Utah Valley University**

Faculty Mentor: Nathan Goldfarb, Utah Valley University

SESSION C (1:45-3:15PM)

POSTER C13

Tuberculosis (TB) remains an insidious scourge of civilization. The causative agent, *Mycobacterium tuberculosis* (Mtb), is a global health crisis, and TB ranks as the second leading cause of death from an infectious disease worldwide after the human immunodeficiency virus (HIV). In 2020, there were approximately 1.5 million deaths reported from TB and an estimated 10 million new cases of TB. Consequently, there is an extremely urgent need for the discovery of new therapeutics effective against both drug resistant and nondrug resistant strains of TB. The product of the Rv2224c gene, Hip1 (hydrolase important for pathogenesis), is a Mtb cell-wall associated serine hydrolase that plays an important role in the pathogenic strategies of Mtb. It plays a role in cell envelop maintenance and in the dampening of host cell proinflammatory responses. Functional studies indicate that Hip1 is a promising target for drug discovery. In fact, mice infected with a Hip1 mutant strain survive significantly longer than wild-type Mtb-infected mice and exhibit mild lung immunopathology despite high bacterial burdens. Here we present the expression, purification,

and cocrystallization of Hip1 with a novel, potent ( $K_i = 309 + 15 \text{ pM}$ ), reversible, covalent inhibitor, NS-049-2. The  $2.9 \text{ \AA}$  crystal structure is the first ligand-bound structure of Hip1 and will be useful for the development of novel TB antibiotics and diagnostic assays.

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## **Degrading Plastic: Brewer's Yeast to The Rescue!**

### **Manette Perez, Salt Lake Community College**

Faculty Mentor: Lane Law, Salt Lake Community College

SESSION C (1:45-3:15PM)

POSTER C14

Plastic waste is a large problem in our industrialized world, and it has affected both our health and our ecosystem. With the discovery of the plastic degrading enzymes, PET (Pet hydrolase) and MHET (Mono-(2-hydroxyethyl) terephthalic acid) from the bacteria *Ideonella sakaiensis*, we have a potential solution for plastic waste. A fusion protein of PETase and MHETase is theoretically capable of breaking down plastic into ethylene glycol and terephthalate. The transformation of *S. cerevisiae* with an expression plasmid containing the gene for the PET-MHET fusion protein, will allow the generation of organic fuels, such as ethanol, from the degradation of plastic. PET-MHET will be inserted into our pYES2 plasmid and used to transform *S. cerevisiae*. Verification of expression and enzymatic activity will follow. Transformed PET-MHET yeast

will then be grown in the presence of the plastic to determine levels of degradation.

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## **Second Harmonic Generation Characterization of Tensile Deformation Lydia Petersen, Brigham Young University**

Faculty Mentor: James Patterson, Brigham Young University

SESSION C (1:45-3:15PM)

POSTER 15

Application of tensile stress can alter material structure. Metals commonly undergo this type of mechanical deformation, which can be detrimental to its structural integrity and ultimately lead to failure. Subsequently, it becomes valuable to characterize mechanical deformation to prevent failures. We propose using second harmonic generation (SHG) to evaluate metal deformation. SHG is a viable option for such characterization, as it is a non-linear optical technique, used to study material surfaces. When a metal undergoes stress, dislocations occur, and grain boundaries are disrupted in a way that would become apparent at the metal's surface. These surface changes could then be detected through SHG methods. Additionally, SHG provides non-destructive evaluation (NDE) of materials, so characterization can occur without adding additional stress. We are using SHG to characterize steel samples before and after tensile stress. Stress is applied to steel samples at various rates and to different stages of deformation. Our aim is to find trends

between the amount of tensile deformation applied to steel and the amount SHG signal detected. This would allow for a relatively accessible way to evaluate wear on metals, so that in industry, it can be determined when to replace parts before they break.

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## **Paleoecology in the Great Basin, Nevada**

**Alyssa Richards, University of Utah**

Faculty Mentor: Larry Coats, University of Utah

SESSION C (1:45-3:15PM)

POSTER C16

In the Northern Snake Range of Nevada, 20 packrat (*Neotoma* sp.) middens have been collected for use in palaeoecological reconstruction of the late Pleistocene and early Holocene. Samples from this region bring the palaeoecological record back to 38,000 $\pm$ 14C yr BP are being used to understand how mesic and xeric plants have migrated in response to environmental changes. Packrat middens contain assemblages of plant macrofossils, most of which are identifiable to species. Bristlecone pine (*Pinus longaeva*) is a midden species of interest due to its narrow climate envelope today. In the Great Basin, Bristlecone pine is most abundant above 3000m in porous, limestone soils. Midden macrofossils identify the range of bristlecone pine in the late Pleistocene and early Holocene down to 2000m, indicating environmentally dependent migration of Bristlecone during this period of rapid environmental change. Multiple middens from the area contain Bristlecone pine, with dates ranging from 32,000 $\pm$ 14C yr BP



to 11,000 $\pm$ 14C yr BP. Some modern middens also contain Bristlecone due to cliffside microclimates where the tree can still compete for survival. Specimens from earlier time periods show that Bristlecone was much more abundant in number in lower elevation bands than today. These changes in Bristlecone habitat may also provide a platform for understanding the migration of other tree species in the face of anthropogenic climate change.

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### **Changes in Intrinsic Tryptophan/Tyrosine Fluorescence (ITF) as a Method to Study Conformational Changes in Oxidized Proteins**

**Steven Rimmasch, Weber State University**

Faculty Mentor: Tracy Covey, Weber State University

SESSION C (1:45-3:15PM)

POSTER C17

Determining protein structure is of extreme importance as it pertains to drug development, discovery of protein function, and identifying disease states in cells. Similarly, identifying different conformational changes proteins experience plays a role in all the previously mentioned disciplines as well as how the cell recognizes and reacts to these altered proteins. Protein structure and subsequent conformational changes can be determined with a high degree of accuracy through methods such as X-ray crystallography, Cryo-EM, and NMR. However, these methods are time consuming, difficult, and require expensive equipment. Here, we aim to develop a lower resolution Intrinsic Tryptophan/Tyrosine Fluorescence (ITF) based method to determine changes in protein structure due to oxidation and relate this to how proteins are selectively digested. Bovine Serum Albumin (BSA) has been used as our

model protein to determine changes in protein structure. Our results show that hydrogen peroxide treated BSA has a concentration dependent change in ITF compared to non-treated BSA. This suggests that oxidized BSA undergoes a conformational change that alters the exposure of its tryptophan and tyrosine residues to the solvent. For this presentation, I will discuss my work using ITF as a fast, easy, low-resolution method to probe structural changes in BSA and other proteins exposed to various conditions.

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## **Facilitative Parasitization of Brown Marmorated Stink Bug Eggs Between Native and Invasive Trissolcus Wasps**

**Zachary Ross, Utah State University**

Faculty Mentor: Diane Alston, Utah State University

SESSION C (1:45-3:15PM)

POSTER C18

The continuing and increasing presence of invasive species across the United States continues to create more and more interspecific interactions between species. My research aims to identify a relationship between the invasive *Trissolcus japonicus* and the native *Trissolcus euschisti*, and whether or not a facilitative parasitic relationship exists between native and invasive species of wasp. I expected to find a beneficial effect given to the native wasps due to this relationship, with more successful emergences being seen when egg masses have been previously parasitized by the invasive species. To test this

claim, *Halyomorpha halys* egg masses were exposed to wasps in three different sets of trials. First, both species were given egg masses to parasitize independently, allowing for accurate measurements of parasitization without the influence of another wasp. The third set of trials involved placing one wasp after another, giving each a set amount of time to parasitize before being removed and replaced with the competitor. Through comparison and analysis of the different results, both beneficial and deleterious, we can begin to form a more complete picture of how they might interact with each other, and what this could mean for both species. The results gathered lend insight into how the invasive wasp is interacting with natives as it becomes more and more established across the country, as well as how the native is faring with the introduction of a new invasive competitor. Not only could this shed insight into how the two different wasp species interact, but it could also provide insight into how the invasive *Halyomorpha halys* is being hindered by native species, as well as how the native species may be benefiting from an additional host.

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## **Enrichment of organic carbon: the effect on soil water repellency**

**Emma Shelton , Utah Tech University**

Faculty Mentor: Gabriela Chilom, Utah Tech University

SESSION C (1:45-3:15PM)

POSTER C19

Organic carbon is a key component of the terrestrial ecosystem as it is responsible for many physical and chemical properties of soils, including water retention and wettability. Soil organic carbon storage may be increased by direct methods as adding manure or other organic amendments.

The goal of this study is to increase the carbon loading to the soils and test the effect it has on the water repellency of the soils. A series of batch sorption experiments with dissolved organic matter (Leonardite humic acid) and four local soils, collected from the Utah-Arizona border, was conducted to obtain enriched soils with a range of organic carbon loadings. The enrichment in soil organic carbon was quantified directly using a CHN analyzer. The water repellency of soils was subsequently assessed using water drop penetration time (WDPT) test and the molarity of an ethanol droplet (MED) test. Comparative analysis of the dependence of water repellency and enrichment of organic carbon in soils was performed for the four soils used.

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## **The Insects of Capitol Reef: A Collaborative Approach to Creating a Field Guide**

**Kelsey Stone, Utah Valley University**

Faculty Mentor: T. Heath Ogden, Utah Valley University

SESSION C (1:45-3:15PM)

POSTER C20

Capitol Reef national park possesses a wealth of arthropod

diversity (NPS, 2020), but there is a significant lack of research and literature detailing the insects that make up part of the area's complex biodiversity (NPS, 2021). In previous years, the Ogden lab has partnered with Capitol Reef to collect insects in the Colorado Plateau area. After years of collecting specimens, the final collection has been processed, examined, and amalgamated into a field guide with the intention of creating a resource for specialists and the casual observer alike, thus filling a gap in current literature available.

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## **Effect of Acute Heat Stress on Blood Composition: Hematocrit, Hemoglobin, Plasma Volume, & Body Mass Kate Strong, Brigham Young University**

Faculty Mentor: Jayson Gifford, Brigham Young University

SESSION C (1:45-3:15PM)

POSTER C21

Blood variables such as hematocrit and hemoglobin are common indices of the oxygen carrying capacity of the blood with hematocrit being the percent of whole blood that is made up of red blood cells, and hemoglobin being the protein in the red blood cells that carries oxygen. While plasma, the other main component of whole blood, does not carry oxygen, it contributes to overall cardiac output and is sensitive to changes following chronic heat exposure resulting in improved thermoregulation. While the effect of chronic heat exposure on these blood variables has been studied, the effect of a single

bout of extreme heat (i.e., sauna) in healthy young adults is unknown. **PURPOSE:** The purpose of this study was to investigate the impact of a bout of sauna therapy on hemoglobin, hematocrit, and plasma volume. **METHODS:** Thirteen healthy young adults (ages 18-36; n=10 male, n=3 female) underwent a total of 40 min of sauna exposure in two 20 min increments. A baseline blood draw was performed pre-sauna. Participants underwent sauna exposure, and blood draws were performed directly post 40 mins of sauna, as well as after a 90-minute recovery period. Hemoglobin and hematocrit levels were measured, and total plasma volume was calculated using the Dill and Costill equation. Esophageal, muscle, and skin temperatures were recorded throughout the experiment. **RESULTS:** There was a significant increase in hemoglobin levels ( $p = 0.05$ ) pre vs. post sauna. There was no significant difference in hematocrit or plasma volume ( $p = 0.12$ ,  $p = 0.10$ , respectively). Though not statistically significant at this time, the plasma volume tended to decrease. There was also a significant increase in esophageal, muscle, and skin temperatures ( $p < 0.001$ ). **CONCLUSION:** Though acute sauna exposure does not cause a significant difference in hematocrit, there was a significant increase hemoglobin concentration, as well as in esophageal, muscle, and skin temperatures pre vs. post sauna. There are no other impacts on blood variables other than a trend for plasma volume decreasing.

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## **The Downstream Effects of Adrenergic Receptors in Beta Cells**

**Nathan Vaughan, Brigham Young**

## University

Faculty Mentor: Jeffery Tessem, Brigham Young University

SESSION C (1:45-3:15PM)

### POSTER C22

Type 2 diabetes (T2D) is a chronic condition that affects millions of people worldwide. T2D is characterized by hyperglycemia caused by inadequate pancreatic beta cell function. There are various ways to treat T2D such as insulin injections, dieting, exercise, and medication. Stimulating endogenous beta cell receptors that potentiate glucose stimulated insulin secretion (GSIS) could be harnessed as a therapy for T2D, such as is used with GLP-1. Adrenergic receptors are expressed on the beta cell, and potentiate glucose stimulated insulin secretion in vivo. Stimulation of adrenergic receptors induces cAMP. We have shown that forskolin treatment of Ins-1 beta cells increases cAMP levels and enhances Nr4a1 and Nr4a3 mRNA expression. The Nr4as have also been shown to enhance GSIS, however the relationship between the adrenergic receptors and Nr4as in relation to GSIS remains largely unexplored. In order to investigate this relationship we will conduct GSIS assays following adrenergic receptor stimulation in wild type, Nr4a1 knockout, and Nr4a3 knockout mice. Here we present our findings on the effects of adrenergic receptor potentiated GSIS in Nr4a1 and Nr4a3 knockout Ins-1 beta cells and primary mouse islets.

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## Cause of Increased Apoptotic Cell Death

## **by Infection with HIV-1 Vpr Mutation**

### **R77Q**

**Dario Villacreses, Brigham Young**

**University**

Faculty Mentor: Bradford Berges, Brigham Young University

SESSION C (1:45-3:15PM)

POSTER C23

HIV is a retrovirus that causes acquired immunodeficiency syndrome (AIDS), and even though it's one of the most studied viruses there're still many unknowns that impede developing a cure for AIDS. Viral protein R (Vpr) is an accessory protein of HIV. In this project, we will research how an HIV-1 isolate with an R77Q mutation in the Vpr gene induces apoptosis in contrast to the uncontrolled cell death that other variants produce. This will be done by analyzing the viral DNA in the nucleus and the cytoplasm. Within R77Q infection, we expect to see an increased amount of viral DNA in the cytoplasm and a fewer amount in the nucleus as opposed to other infections featuring wild-type Vpr and other Vpr mutants. When DNA is found in the cytoplasm it is normal for cells to start innate immune responses, but it has also been found that cytosolic DNA triggers biological pathways of programmed cell death.[1] In previous research performed in our lab, we have seen that the R77Q mutation causes cell death by apoptosis at higher rates compared to wild-type viruses and other mutations. This project presents an opportunity to potentiate previous research in understanding how the mutation induces apoptosis.

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## **Spear Phishing Simulation**

### **Russell Wadsworth, Utah Valley University**

Faculty Mentor: Sayeed Sajal, Utah Valley University

SESSION C (1:45-3:15PM)

POSTER C24

With more advances in technology, spear-phishing has become more prevalent and more dangerous. Spear-phishing is a specific type of phishing where a supposedly trusted individual messages the user extensively to try to grab personal information such as credit cards, social security numbers, and so on. Social media embodies this vicious attack nearly constantly: using profile photos and a similar email, attackers can create a similar profile and account and become friends with the same list of friends as their avatar. After doing so, the attacker sends messages, photos, emails, and other methods of communication to ultimately phish for this information. With further advances, what can we do to inform and prevent these attacks from further occurring? We can make the conclusion that educating users about these threats can help them take a closer look at this threat and figure out how to prepare for the attack. We will want to figure out how best to educate people over this threat, especially since this will not be as easy as sitting everyone down in a classroom and discussing the threat to them. The best practice can be found with experimenting on various ways to teach these principles: through video demonstration, static images, physical experimentation, and even trying to teach this in a classroom setting, we want to conclude on what would be the best way to let others know about spear-phishing. A premature conclusion can be made with using a video or advertisement on Google, but the hold-

up would be if people would skip it rather than actively view it. If we can figure out this method or if any other methods work better, we can help protect identities, financial futures, and personal information for millions of computer users from these criminal activities.

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## **Construction and Characterization of a Nd:YVO<sub>4</sub> laser for pumping a BaGa<sub>4</sub>Se<sub>7</sub> Nonlinear Optical System**

### **Brantson Wayman, Utah Valley University**

Faculty Mentor: York Young, Utah Valley University

SESSION C (1:45-3:15PM)

POSTER C25

Probing tissue for early signs of disease can be performed via long wave infrared spectroscopy. One technique uses wavelength dependent absorption of specific molecules which serve as early indicators of disease onset in human tissue. One reason long wave spectroscopy is not more widely used, is that long wave detectors are expensive and slow. Another deterrent is that typical long wave light sources, such as tunable quantum cascade lasers, are difficult to tune over the several-micron-wide wavelength ranges, limiting the molecule types, and thus diseases, that can be probed. We are developing a laser and non-linear optical wavelength conversion system to address these issues by using: 1. A 1064 nm laser driven, long wave, Barium Gallium Selenide (BGSe) optical parametric oscillator (OPO) as the broadly tunable optical probe and 2.

A BGSe-based sum frequency generator (SFG) to convert the tissue probing long wave light to the near infrared – where faster, lower cost, and more sensitive optical detectors can be used. In this presentation we report our progress toward developing such a laser and nonlinear optical wavelength conversion system for use in early detection of disease in human tissue. Specifically, we share our beam waist characterization and M2 beam quality measurements of the diode laser. In addition we communicate the impact of upgrading the thermal management system for the diode laser. We also report the optical performance of our newly constructed CW Nd:YVO<sub>4</sub> and discuss how that performance informs the design of the Q-switched version of this laser. And lastly, we convey some of the design specifications for the BGSe crystal that will comprise the nonlinear medium of the long wave OPO.

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## **GRIT Garden (Growing Resilience and Inclusivity Together)**

**Ryanne Welch, Utah Valley University**

Faculty Mentor: Boston Swan, Utah Valley University

SESSION C (1:45-3:15PM)

POSTER C26

Community gardens provide space for the community to come together to grow plants, often fruits and vegetables, for the benefit of the individuals in the community. At Utah Valley University we have many areas of our campus community

that benefit from the presence of a community garden. Our food pantry was having difficulty consistently providing fresh produce, our botany courses needed to leave campus for some of their classes, and we needed another way to unite with the surrounding community. To meet these needs, UVU's GRIT (Growing Resilience and Inclusivity Together) Garden was born. The garden was a dream child of committee members on the UVU sustainability committee. With the help of students, community volunteers, and UVU faculty and staff, this dream became a reality. The current garden has a 100 x 24 ft hoop house, four blocks, each containing 12 beds, two pollinator strips, and a handful of raised gardens. As for our current status in meeting our community's needs, we've donated over 2,000 lbs of produce toward the food pantry including, basil, tomatoes, kale, chard, lettuce, carrots, corn, and many other staples. Several courses have used this space for engaged learning with courses from virology to field botany totaling over 75 students. We've had volunteers from the Botany Club at UVU, the UVU Interfaith Council, students from UCAS, and friends and family of involved students and faculty. Along with weekly volunteer gardening hours. We've accomplished all of this in less than a year of having a functioning garden, and it's just the beginning. We hope to provide our food pantry with a minimum of 2,000 lbs of produce each year. Continuing community events will likely be expanded. The garden will be a continuing spark of curiosity and source to educate our community.

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## **Atmospheric Deposition of Microplastics**

**in Utah County.**

**Matthew Williams, Utah Valley University**

Faculty Mentor: Sally Rocks, Utah Valley University

SESSION C (1:45-3:15PM)

POSTER C27

Microplastics are defined as plastic particles ranging in size from 5 mm to 1  $\mu\text{m}$  and are a toxic threat to the environment and health of all living things. Primary microplastics have been defined as microplastics resulting from manufacturing. Secondary microplastics occur as a result of broken-down plastics. The plastic cycle is a biogeochemical cycle detailing the complex movement of plastics between abiotic and biotic ecosystems including humans. Important worldwide institutions have declared microplastics a priority for the future health of the planet. Past research has focused primarily on aquatic environments while plastic migration in the air has been understudied. Microplastics have been quantified in rivers and mountains. In the United States, a research project focused on microplastic levels in the Snake and Lower Columbia rivers. In Europe, atmospheric deposition of microplastics was studied in the French Pyrenees as well as urban Paris. The research objective herein was to study and quantify the abundance of atmospheric microplastic deposition through sample collection in stations located throughout Utah Valley. Atmospheric deposition is the main avenue in which microplastic transport occurs. Under the right conditions, plastics can be transported across oceans and continents either in one trip or through resuspension. Microplastic deposition in rural and suburban areas is not fully understood and wet and dry microplastic deposition rates need more study. China, France, Germany,

Ireland and the United States have all researched atmospheric deposition of microplastics. Estimates show that microplastics have a high density in cities. Rural areas such as farmland are also affected by microplastics. Utah Valley represents a unique location due to the amount of transportation, the weather and the geography.

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## **Osteoblastic Growth on 3D Surfaces**

### **Sam Wright, Salt Lake Community College**

Faculty Mentor: Lane Law, Salt Lake Community College

SESSION C (1:45-3:15PM)

POSTER C28

As part of our work on using 3d printing and cell culture, we intend to grow hFOB 1.19 cells onto 3d printed bone models. hFOB 1.19 is an osteoblast cell line used to study human osteoblast differentiation. Successful attachment and proliferation of osteoblasts onto 3d printed components would have the potential to improve bone and orthopedic injury treatments. A dual-marker labeling system using promoter specific expression of fluorescent tags, allows for positive identification of osteoblasts and facilitates imaging of cells. A dual plasmid CRISPR knock-in system was designed for insertion of markers into the hROSA26 locus of the osteoblast cells.

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## **The Reliability of the Stryd Accelerometer**

## **on an Incline and Decline**

### **Wesley Ziegler, Southern Utah University**

Faculty Mentor: Jeffrey Cowley, Southern Utah University

SESSION C (1:45-3:15PM)

POSTER C29

Modern technology has evolved to include various health and fitness trackers to help people become more aware of their physical wellbeing. However, the reliability of these technologies is not well-established. The purpose of this research was to determine the reliability of Stryd accelerometer during trail running. Participants wore one Stryd accelerometer (model 25; Stryd, Boulder, CO 80301) on the laces on each shoe (left and right), and the devices were started simultaneously. Each participant then did a self-paced out and back run on a moderate difficulty hiking trail. The trail began at approximately 6000 feet elevation and climbed approximately 200 feet/mile. After ten minutes of running up the trail, the participant turned around and returned on the same trail. After the run, the Stryd accelerometers were stopped simultaneously. The Stryd data (distance, altitude, speed, power, form power, cadence, vertical oscillation, and leg stiffness) was exported to csv files and divided into the uphill and downhill phases of the run based on the peak elevation achieved. The within-subjects coefficient of variation and the mean absolute difference for each measure during downhill and uphill trail running was calculated. Of the mentioned variables, six were considered reliable –  $CV < 0.1$  – and three were considered unreliable –  $CV > 0.1$ . The least reliable measures were form power (uphill:  $CV=0.124$ ; downhill:  $CV=0.126$ ) and power (uphill:  $CV=0.132$ ; downhill:  $CV=0.135$ ). As most of the

measured variables were statistically similar, the Stryd accelerometer can be considered reliable. However, with three sensors that were statistically unreliable, it is important for the user to know that the Stryd's advertised ability to measure power output is less reliable on inclines and declines and may provide inaccurate training advice. These findings give reason for further development of the technology.

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## **An alternative data collection method for animal populations**

**McCade Larsen, Utah Tech University**

**Hunter Gordon, Utah Tech University**

**Jace Riley, Utah Tech University**

Faculty Mentor: Aaron Davis, Utah Tech University

SESSION C (1:45-3:15PM)

POSTER 66

Tracking animal populations is key to assure that populations are healthy and thriving. Current data collection methods, such as radio tagging, manned aerial flyovers, and camera traps, are not only time-consuming and expensive but also fail to provide accurate population estimates. This interdisciplinary research project aims to produce a more accurate and less expensive data collection system for large game populations. The planned procedure for data collection is to attach a thermal imaging device to an unmanned aerial vehicle (UAV) and perform aerial transects throughout the



observation area. The imaging device will periodically take images along transects that can be stitched into a complete data set for the area. By using image processing techniques and deep learning models, the images will be processed to show location as well as population counts of the animals in the area. Results from similar experiments have shown that using UAVs to collect population data not only provides more accurate data but also requires less time overall to collect the data. This experiment expands upon those findings, of more accurate data as well as increased efficiency. By the creation of automatic image processing and analysis software to increase the ease of use allowing for more data to be collected and analyzed in the same time period.

## Comparison of PM<sub>2.5</sub> Levels in Evaporative vs Central Air Homes in Utah County Using Filter-based Sampling

Taylor Christensen, Brigham Young University

Paula Chanthakhoun, Brigham Young

University

Taylor Christensen, Brigham Young University

Faculty Mentor: Jim Johnston, Brigham Young University

SESSION C (1:45-3:15PM)

POSTER C76

Exposure to particulate matter with an aerodynamic diameter of 2.5  $\mu\text{m}$  or less (PM<sub>2.5</sub>) -is associated with varied adverse health effects such as chronic obstructive pulmonary

disease (COPD), heart disease, and lung cancer.<sup>1</sup> Housing can provide protection from outdoor air pollution, but the level of protection may vary depending on the type of air conditioning system used. In this study, indoor and outdoor air quality were compared between homes utilizing central air conditioning (AC;  $n=14$ ) and evaporative cooling (EC;  $n=7$ ). We pre-weighed 37-mm polytetrafluoroethylene (PTFE) filters (pore size 2.0  $\mu\text{m}$ ) then placed them in PM<sub>2.5</sub> Personal Environmental Monitors (PEM). To prepare the PEMs, impact plates were greased and each part wiped down with a KIM wipe. Following this, the Leland Legacy Pumps were connected to their assigned PEMs and calibrated to  $10 \pm 0.1$  liters per minute. Indoor and outdoor PM<sub>2.5</sub> samples were collected at each study home. Participants were asked to refrain from cooking, burning candles or incense, or vacuuming indoor for 24 hours during the sampling period. PTFE filters were then post-weighed and the Leland pumps were post-calibrated. The PM<sub>2.5</sub> concentration was then calculated. EC homes had more PM<sub>2.5</sub> on average than AC homes. The indoor to outdoor air pollution ratio (I/O) of AC homes was 0.95, while the I/O of evaporative cooler homes was 1.50. Our data suggest that AC homes in Utah County may not provide significant protection against outdoor air pollution during summer months. Moreover, our findings suggest that evaporative air conditioners may contribute to indoor PM<sub>2.5</sub>, although the mechanisms behind this are unknown. One explanation is that the large volume of air introduced into EC homes may stir up settled dust in the house. This, in combination with outdoor PM<sub>2.5</sub> brought into the home through the evaporative cooler, may explain the I/O ratio greater than 1.0. We are limited by a small sample size. Our next steps include comparing the outdoor PM<sub>2.5</sub> concentrations measured in our study to nearby

reference monitors operated by the Utah Division of Air Quality, and adding more homes to the study in summer 2023.

#### References

Thygersson, S. M., Beard, J. D., House, M. J., Smith, R. L., Burbidge, H. C., Andrus, K. N., Weber, F. X., Chartier, R., & Johnston, J. D. (2019). Air-quality assessment of on-site brick-kiln worker housing in Bhaktapur, Nepal: Chemical speciation of indoor and outdoor PM<sub>2.5</sub> pollution. *International Journal of Environmental Research and Public Health*, 16(21), 4114. <https://doi.org/10.3390/ijerph16214114>

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## Embrace

### Ryan Moser, Weber State University

Faculty Mentor: Kristen Arnold, Weber State University

SESSION C (1:45-3:15PM)

POSTER C79

With the design of this new building for Encircle the hopes is that not only will the people who enter and become apart of the Encircle family will help these adolescents, but the design will also make an impact. Incorporating some of the elements and attributions of biophilic design, environmental features (color, water, air, sunlight, plants, natural materials), natural shapes and forms (columnar supports, arches, shapes resisting straight lines, biomimicry), and Light and Space (Natural light, warm light, light and shadow, spatial harmony) will not only help to create that sense of connection to nature but to compliment the environmental psychology and support people's need for "nature". Some theories clarify the process by which contact

with “nature” triggers the development of physical and mental functions. Some of these theories include the Place attachment theory, Stress Recovery Theory, The Biophilia Theory, and the Attention Restoration Theory. (Zhong, Schroder, Bekkering, 2021). Another element incorporated into the design of the project will be making a conscious effort into differentiating light levels in different spaces can help with working tasks, activities that require attention and mindfulness, resting and relaxation areas (especially for therapy sessions as well as individual residential rooms), mood lighting in the restaurant so that customers can feel comfortable and at ease, and brighter lights in shopping areas that can increase alertness, excitement, happiness, and interest. (Zeng, Sun, Yu, Un, 2022). Lastly, ergonomics will play an important role. Ergonomic and anthropometric measurements can be applied so that users of all ages can enjoy their surrounding space, leisure activities and the comfort of equipment and furniture. Proportion and spacial needs will be considered and implemented to create safe, manageable and improved quality of life. (Shamailegh, 2022).

## **Active Minds at The University**

### **Sadie Wood, Weber State University**

Faculty Mentor: Kristen Arnold, Weber State University

SESSION C (1:45-3:15PM)

POSTER C80

There is a lack of affordable resources and mental health facilities for individuals in Utah. A mental health crisis is

currently occurring in the state. Evidence has shown that Utah is the number one state where citizens struggle with mental health the most, with “...just under 30% of adults in the last year suffering from the problem,” according to “The US Health Report of 2022,” completed by NiceRX. According to Utah’s Public Data Health Resource, IBIS, “The promotion of mental health involves actions that create living conditions and environments that support mental health and allow people to adopt and maintain healthy lifestyles.” Therefore, the Leroy E. Cowles Building will be transformed to support the Active Minds nonprofit organization where college-aged individuals may access mental health resources. Research has been conducted to create an evidence-based design for the adaptive reuse project involving the Cowles Building. Such evidence-based design includes providing aromatherapy in spaces to encourage physical and physiological health in occupants (Lizarraga-Valderrama, 2020). Additional evidence-based design includes biophilic aspects incorporated into spaces, such as natural shapes and forms, patterns, light, and organic materials to promote health benefits (Birrell, 2014). A third researched concept will be incorporated by using color in wayfinding to lessen stress of visitors (McLachlan, Leng, 2021). A final evidence-based design concept will be shown through providing self-care spaces with biophilic aspects to improve the lifestyles of those living with mental illness, especially depression (Huntsman, et al, 2022). Each of these evidence-based design concepts will promote the mental health of occupants visiting the Cowles building through resources provided by Active Minds and the University of Utah.

## **The Synthesis of Lysergic Acid via a Photoelectrocyclization**

**Aidan Connor, University of Utah**

Faculty Mentor: Jon Rainier, University of Utah

SESSION C (1:45-3:15PM)

POSTER C81

Cyclizations are important reactions in organic chemistry (1). They can create cyclic and polycyclic structures in a single transformation and are widely used in the chemical industry. (2,4). Electrocyclization reactions, a particular type of cyclization reaction, can be initiated using thermal or photochemical conditions (like UV light). Controlling these conditions can lead to the generation of multiple bonds, often with high diastereoselectivity. Currently, the main method to synthesize phenanthrene systems, which are polycyclic aromatic carbons, involves using heavy metal reagents, such as Grubbs catalysts for metathesis reactions (6). Since photochemical reactions use light as their reagent, they can be a useful workaround for the synthesis of these systems, which helps to minimize unnecessary reagents or hazardous waste. While photochemical reactions have been studied since the 1960s for the synthesis of phenanthrene (5), recently the Rainier group has expanded on the use of these reactions to synthesize more complex derivatives of 8,9-dihydrophenanthrenes (3). Further study could increase the current scope of photochemical electrocyclizations to cover a broad range of complex systems and potentially lead to more efficient syntheses of a variety of natural products. Additionally, the synthesis and experimentation of these more complex systems could lead to a deeper understanding of the

fundamental electrocyclization reactivity. For this research project, I specifically plan on using photochemical electrocyclizations in an attempt to synthesize Lysergic Acid. Lysergic Acid is a precursor to many important drugs that are used to treat depression, anxiety, and addiction (7). Currently, complex synthesis methods are necessary to produce Lysergic Acid, if the ability to use UV light as a reagent was discovered, the chemical process of synthesizing Lysergic Acid would be greatly simplified.

**Sciences. Session C**  
**- Oral**  
**Presentations,**  
**Dumke**  
**Conference,**  
**Alumni House**

**SESSION C (1:45-3:15PM)**  
**Location: Dumke, Alumni House**

Lithobates catesbeianus: A Study of Diet,  
Disease, and Water Chemistry in Washington



## County

Euan Andrew, Southern Utah University

Luke Alder, Southern Utah University

Faculty Mentor Carrie Jo Bucklin, Southern Utah University

SESSION C 1:45-2:00PM

Dumke, Alumni House

Sciences

*Lithobates catesbeianus* (American bullfrog) is a globally invasive amphibian species known to be detrimental to the ecosystems they invade that has been introduced into southern Utah. Up until now, the extent to which these frogs have affected the freshwater ecosystems they have invaded within Washington County, Utah has not been studied in-depth. We hypothesize that *Lithobates catesbeianus* is significantly impacting the local ecology of Washington County by outcompeting and preying upon native species and by acting as vectors of disease. In September and October of 2022, we captured 46 American bullfrogs at water bodies throughout the Virgin River basin in Washington County, UT. Currently, we are investigating their distribution through observation and capture methods and chemical testing of the aquatic habitats they inhabit. Subsequently, we will analyze their diet by means of dissection and stomach content analysis. Additionally, we will examine their roles as potential vectors of chytridiomycosis using skin swab samples amplified by polymerase chain reaction (PCR). Through collection of these data, we hope to better understand the impact of *Lithobates catesbeianus* on the indigenous species of southern Utah and what may be done to control this alien species.

## Metabotropic Glutamate Receptor 5 Mediated Long Term Depotentiation

Connor Morgan, Brigham Young University

Michael Dew, Brigham Young University

Faculty Mentor Jeff Edwards, Brigham Young University

SESSION C 2:05-2:20PM

Dumke, Alumni House

Sciences

Since its initial elucidation nearly 100 years ago, Alzheimer's disease has been associated with sharp declines in cognitive abilities ranging from memory recall and formation to rational thought. While the exact mechanism behind Alzheimer-induced dementia remains an area of active research, there is clear evidence of its deleterious effects on synaptic health and plasticity (Alzheimer's Association 2022). Synaptic plasticity refers to the ability of neurons to create or destroy synaptic connections. Creating and strengthening neural connections is mediated through the process of Long Term Potentiation (LTP) while weakening or breaking synaptic connections is thought to be mediated through the process of Long Term Depotentiation (LTD). Consequently, LTP has been associated with learning and LTD with forgetting. The exact mechanism for both processes remain unclear, but current data suggests that the metabotropic glutamate receptor 5 (mGluR5) plays an important role in the physiological basis of LTD and, by extension, forgetting (Gladding et al., 2009). This mechanism has been studied in male models but has yet to be characterized in female models; consequently, we intend to replicate recent

studies with the modification of characterizing male and female models of mGluR5-induced LTD.

## Characterization of CCRL2-V140M and its effect on CCL4, a known risk factor for Alzheimer's Disease.

Colby Hendrix, Brigham Young University

Faculty Mentor Scott Weber, Brigham Young University

SESSION C 2:25-2:40PM

Dumke, Alumni House

Alzheimer's disease (AD) is the leading cause of dementia and a top 10 cause of death in the United States. More than 6 million Americans currently suffer from AD. This complex degenerative condition is caused by both genetic and environmental risk factors. Neuroinflammation plays a critical role in the progression of AD and excessive neuroinflammation can be initiated by chemokine signaling within the brain. A genome-wide association study surveyed 59 AD-related proteins and their correlation with chemokines. One chemokine, chemokine ligand 4 (CCL4), was found at lower concentrations to correlation with the C-C chemokine receptor-like 2 variant V140M (CCRL2-V140M). Increased CCL4 levels are a risk factor for AD and CCRL2-V140M could provide insights into AD development protection. CCRL2 is a seven-transmembrane domain receptor from the atypical chemokine receptor family, receptors that modulate the inflammatory response by modifying chemokine availability. CCRL2's only known binding partner is chemerin. We

performed in-silico and in-vitro binding analyses of CCL4 and chemerin to CCRL2-WT and CCRL23-V140M and found no differences in binding affinity, suggesting a non-direct mode of action may distinguish the CCRL2 variant and WT. Further work is needed to explain the inverse association between CCRL2-V140M and CCL4.

## Non-Native Plants and Caterpillar Immune Systems

Mason Hoffman, Utah Valley University

Faculty Mentor Michael Rotter, Utah Valley University

SESSION C 2:45-3:00PM

Dumke, Alumni House

Sciences

The ability of non-native plants to successfully invade and dominate ecological communities is a central area of ecological study. Many important hypotheses such as the evolution of increased competitive ability and the novel weapons hypothesis suggest that the reason for non-native success is the ability of non-native plants to have reduced herbivore attack, allowing them a competitive advantage over native plants that are attacked by insect herbivores. The insects that “choose” the “winners and losers” of plant-plant interactions are also dealing with their own antagonistic relationships, particularly parasitoid predators. Many herbivores have been found to deal with these parasitoids by medicating themselves through their diets. We tested to see if this self-medication may help explain herbivore preference for native or non-native plant species by testing the immune responses and survivability of *Trichoplusia*

ni fed on the native *Mimulus guttatus* and the non-native *Nasturtium officinale*. We also tested the plant consumption rates for caterpillars with and without parasitoid interaction when presented with *Nasturtium officinale* and *Mimulus guttatus* together. Immune responses of 5th star *T. ni* were elevated while feeding on *N. officinale* compared to those feeding on *M. guttatus*. Further, we found that *T. ni* neonates were not able to survive on *N. officinale* while neonates survived on *M. guttatus*. Our results suggest that herbivores may alter plant-plant competition when they are faced with their own top-down pressures, while still having significant restraints on their ability to consume.

**Sciences. Session C**  
**- Oral**  
**Presentations,**  
**Henriksen, Alumni**  
**House**

**SESSION C (1:45-3:15PM)**  
**Location: Henriksen Room, Alumni House**

A catalog of nearby accelerating star  
candidates in Gaia DR3  
Joshua Hill, University of Utah

## Marc Whiting, University of Utah

Faculty Mentor Ben Bromley, University of Utah

SESSION C 1:45-2:00PM

Henriksen Room (1st floor), Alumni House

Science and Technology

We describe a new catalog of accelerating star candidates with Gaia  $G \leq 17.5$  and distances  $d \leq 100$  pc. Designated as Gaia Nearby Accelerating Star Catalog (GNASC), it contains 28,218 members identified using a supervised machine-learning algorithm trained on the Hipparcos-Gaia Catalog of Accelerations, Gaia Data Release 2, and Gaia Early Data Release 3. We take advantage of the difference in observation timelines of the two Gaia catalogs and information about the quality of the astrometric modeling based on the premise that acceleration will correlate with astrometric uncertainties. Catalog membership is based on whether constant proper motion over three decades can be ruled out at high confidence (greater than 99.9%). Test data suggests that catalog members each have a 68% likelihood of true astrometric acceleration; subsets of the catalog perform even better, with the likelihood exceeding 85%. We compare the GNASC with Gaia Data Release 3 and its table of stars for which acceleration is detected at high confidence based on precise astrometric fits. Our catalog, derived without this information, captured over 96% of sources in the table that meet our selection criteria. In addition, the GNASC contains bright, nearby candidates that were not in the original Hipparcos survey, including members of known binary systems as well as stars with companions yet to be identified. It thus extends the Hipparcos-Gaia Catalog of Accelerations and demonstrates the potential of the machine-

learning approach to discover hidden partners of nearby stars in future astrometric surveys.

## Bronco: A programming language for generating stories

Jonas Knochelmann, University of Utah

Faculty Mentor Rogelio Cardona-Rivera, University of Utah

SESSION C 2:05-2:20PM

Henriksen Room (1st floor), Alumni House

Science and Technology

We present Bronco: an in-development authoring language for Turing-complete procedural text generation. Our language emerged from a close examination of existing tools. This analysis led to our desire of supporting users in specifying yielding grammars, a formalism we invented that is more expressive than what several popular and available solutions offer. With this formalism as our basis, we detail the qualities of Bronco that expose its power in author-focused ways.

## A Review of The Use of Machine Learning in Cybersecurity and Cyber Attacks

Connor Scott, Utah Valley University

Faculty Mentor Sayeed Sajal, Utah Valley University

SESSION C 2:25-2:40PM



## Henriksen Room (1st floor), Alumni House Science and Technology

As technology has improved cyber criminals have developed newer and more sophisticated methods of attack. As a result cybersecurity professionals have needed to adapt and improve their own methods of defending against cyber threats. One technology that is increasingly being leveraged against such threats is machine learning. Machine learning is an aspect of artificial intelligence (AI) and computer science that uses data and algorithms to build models of underlying patterns allowing for the prediction of future data and classifying current data. In the context of cybersecurity machine learning can be used in a variety of ways including monitoring activity within a network in order to detect malicious or abnormal activity, monitoring background activity of individual computers in order to detect malware, as well as other uses. By collecting data and building a model of normal patterns, machine learning allows cybersecurity professionals to automate the process of monitoring systems in real time in order to immediately detect abnormal activity and rapidly respond to threats and breaches. Its use however is not limited to cybersecurity professionals but also by cyber criminals. Cyber attacks are now being executed using machine learning as well. Increasingly sophisticated machine learning models are being used to execute attacks in new ways. Some ways machine learning is being used in cyber attacks include using it to evade web filters, bypass CAPTCHA checks, and creating targeted phishing emails and messages. As the technology has evolved newer methods are being used both in offense and defense and recent trends indicate that it will continue to be an important subject in regards to the future of the cybersecurity field. In this paper I will endeavor to create a comprehensive review and

explanation of how this technology is being used both by cybersecurity professionals and cyber criminals, its strengths and weaknesses in regards to current practices and future trends

## Constructing Time in a Closed Dynamical System

Zachary Zito, Utah State University

Faculty Mentor Charles Torre, Utah State University

SESSION C 2:45-3:00PM

Henriksen Room (1st floor), Alumni House

Science and Technology

The role of a time parameter is vital to a study of Physics, yet is often taken for granted. The traditional use of a constant, immutable time variable necessarily relies upon notions that are fundamentally unmeasurable and must, therefore, be assumed. Here, a simple, classical system is canonically approached and subsequently reformulated to preclude the ideal element of assumed time, retaining only an ideal element related to space. Time is then shown to have not been vital to the formulation originally, appearing as an emergent property rather than a fundamental axiom. A one dimensional, two particle system in a timeless framework – inspired by the models developed by Barbour and Bertotti -is presented. The system's Lagrangian is defined in terms of position and momentum and the equations of motion are stated. An observable quantity  $T$ , constructed from observables in the system, serves as a relative time parameter and replaces the postulated absolute time  $\tau$ , allowing for a system fully

characterized by measurable, concrete quantities. Along with two other observables,  $T$  serves as the independent variable with respect to which relational properties of the entire system may be established. The physical and philosophic justifications and implications are expounded and examined. Time, it seems, is a concept abstracted from paths in configuration space and can be viewed as analogous to Mach's principle of universal inertial reference frames.

**Sciences. Session C**  
**- Oral**  
**Presentations,**  
**Parlor A, Union**

**SESSION C (1:45PM – 3:15PM)**  
**Location: Parlor A, A. Ray Olpin University**  
**Union**

## A Stable Numerical Scheme for a Model of Mutualism with Crowding Effects

Devan Hill, Southern Utah University

Chance Witt, Southern Utah University

Faculty Mentor Jianlong Han, Southern Utah University

SESSION C 1:45-2:00PM

Parlor A, Union

Science and Technology

We Study a Lotka-Volterra model of mutualism with crowding effects. After using nondimensionalization, we analyze the stability of the steady state solutions for the system. A nonstandard numerical scheme is proposed, and by using mathematical induction we prove that the numerical scheme is unconditionally stable. We also analyze the long term behavior of the numerical solution.

## Mathematical Models of Tone in Thai Reduplication Patterns

Casey Miller, University of Utah

Faculty Mentor Aniello De Santo, University of Utah

SESSION C 2:05-2:20PM

Parlor A, Union

Science and Technology

Studying language mathematically allows us to define language processes in explicit terms, to determine their complexity. Formal characterizations give us an understanding

of how language works in computational terms, insights into why some structures seem to be more favored than others, and insights into cognitive restrictions (Chandlee, 2017; Heinz, 2018; De Santo & Rawski, 2022). Mathematical formalization also gives us a way to model different processes with practical systems such as the Finite-State Transducer, for example, which has been used for applications such as machine translation. Recent work in the field of computational linguistics has argued that \*sub\*-regular characterizations are sufficient to model most phonological patterns-i.e., it takes significantly less computing power than previously thought to model such patterns (Chandlee, 2017; Heinz, 2018; Graf, 2019). In this work, I present a mathematical formalization of reduplication processes in Thai. Reduplication poses complications as many languages that feature reduplication patterns are also tonal, in which case tones and segments often act independently from each other. Importantly, Markowska, Heinz, & Rambow (2021) were able to model the tone reduplication patterns in Shupamen, a Bantu language, by using a synthesis of two-way finite-state transducers (Dolatian & Heinz, 2020). Thai is an interesting case because some linguists have argued that tone in Thai is a byproduct of throat position and thus is not completely independent from the segment. Additionally, tone shifts in Thai reduplication patterns ask interesting questions in regards to their complexity. The processes found in Thai provide a valuable contrast to the work done by Markowska, Heinz, & Rambow (2021). The formalization provided here adds further cross-linguistic insights to our broader understanding of how tone processes interact with reduplication patterns; such a formalization is also beneficial towards understanding more

complex phonological processes, and offers insights for the language technologies being used and developed today.

## Using Deep Reinforcement Learning To Generate Slice Surfaces from Knots in Braid Notation

Dylan Skinner, Brigham Young University

Faculty Mentor Mark Hughes, Brigham Young University

SESSION C 2:25-2:40PM

Parlor A, Union

Science and Technology

Deep reinforcement learning (DRL) has proven effective in recognizing patterns and finding solutions to problems that are difficult for humans. One problem in knot theory involves finding slice surfaces for knots with minimal genus. It is easy to find large genus slice surfaces bounded by a given knot, but in order to show that the slice genus of a knot is equal to a specified value, you must also prove that the knot does not bound a slice surface of a lesser genus. In this talk, I will outline an approach using DRL and braid notation of a knot to find small genus slice surfaces for a given knot, through a series of unknotted component addition/deletion, crossing addition/deletion, and relations in the braid group.

Ribbon Knots, Ribbon Doubles and Undoubles,

## and Symmetric Union Presentations

### Moses Samuelson-Lynn, University of Utah

Faculty Mentor Edmund Karasiewicz, University of Utah

SESSION C 2:45-3:00PM

Parlor A, Union

Science and Technology

We define a ribbon knot as a knot that can be embedded into three-dimensional space such that it bounds a ribbon disk, that is, a surface that can be deformed in any topologically valid way, as well as passing any one section of the disc through another completely, with the line of intersection that forming a slit that does not touch the edges of the disc. Let  $K$  be a knot, not necessarily a ribbon knot, with crossing number  $k$ . We define an algorithm to create a ribbon knot from  $K$  which has crossing number at most  $4k$  such that, which we call “ribbon doubling.” We also investigate the number of potential ribbon doubles for a knot, and potential restrictions on its crossing number. We propose a partial inverse operation for ribbon doubles, and show that it is not unique. Lastly, we propose a potential lower bound for the crossing number of the ribbon double of a knot. We then relate the concept of a ribbon double to that of a partial knot for symmetric union presentations, and propose a potential technique for selecting a unique ribbon double.



**Sciences. Session C**  
**- Oral Presentations,**  
**Saltair, Union**

**SESSION C (1:45PM – 3:15PM)**

**Location: East Saltair, A. Ray Olpin**  
**University Union**

Elevated Blood Glucose Levels Negatively  
Regulates Nkx6.1 Level in the Pancreatic Beta  
Cell

Kristopher Wieland, Brigham Young University

Faculty Mentor Jeffery Tessem, Brigham Young University

SESSION C 1:45-2:00PM

Saltair, Union

Science and Technology

Type 2 diabetes (T2D) cases are growing throughout the world. A key characteristic of T2D is damage to the beta cell. This damage affects the beta cell's ability to sense glucose and release insulin in response to elevated blood glucose levels. Nkx6.1 is a beta cell transcription factor essential for differentiation, proliferation, and insulin secretion. To test the effect of hyperglycemia on the beta cell, INS-1 832/13 beta cells were cultured under hyperglycemic conditions for various time durations. This treatment showed that after 12 hours, there was a decrease in Nkx6.1 protein. Even with this decrease in protein levels, there is no change in transcription, colocalization or degradation of Nkx6.1. It is likely that decreased translation at 12 hours causes Nkx6.1 protein levels to drop. Nkx6.1 protein levels remain decreased at 24 hours. Nkx6.1 mRNA decreases, with changes to translation, translocation and degradation at 24 hours. These mechanisms were also validated in rat islets. Understanding the effect of hyperglycemia on Nkx6.1 is imperative to the future development of gene therapies used to treat diabetes.

Investigating the relationships between  
microbes and their role in plant survival.

Josh Leon, Utah Valley University

Faculty Mentor Michael Rotter, Utah Valley University

SESSION C 2:05-2:20PM

Saltair, Union

## Science and Technology

The climate of the American Southwest is rapidly changing relative to other areas in the United States. Temperatures are predicted to increase by roughly 10° F (5.5° C) by the year 2100. Drought events are expected to increase in intensity and length as well. Understanding how plant communities in this region will react to these changes is an important area of research in Capitol Reef National Park (CARE). Research has provided insight into how some native species will react, for example, junipers killing off their branches under drought conditions. However, few research studies have examined how climate change will affect invasive species. This research examines an invasive plant in CARE under a variety of climate projections. We are also interested in the microbiome of the invasive plant to see if it influences the plant's response to climate disturbances. The goal of this research is to provide new insights into how invasive plants are successful under disturbed conditions. The species of interest for our research is the African mustard, *Strigosella africana*. Of the 126 listed invasive species in CARE, the African mustard is one of 12 species that is actively controlled because of the threat it poses to native communities. First, we examined whether increased heat, drought conditions and/or fertilizer affected plant survivability. We found significant differences in plant survivability under differing heat and/or whether a drought was applied. Next, to find a base 'natural' microbiome, we collected full plant samples in CARE using sterile techniques and separated them by shoots/roots, and sequenced their DNA. Plants grown from seeds collected in CARE were examined under the same climate models, excluding fertilizer, as described above. DNA sequenced from plants that survived

these trials will then be compared to the natural microbiome to spot any differences in community and/or composition.

## Birds-eye View of the Evolutionary History of Repetitive Heavy Chain Fibroin in Lepidoptera Suborder Glossata

Naomi Young, Brigham Young University

Faculty Mentor Paul Frandsen, Brigham Young University

SESSION C 2:25-2:40PM

Saltair, Union

Science and Technology

The larvae of the order Lepidoptera (moths and butterflies) produce silk in various processes including the construction of protective tunnels, pupation cocoons, and escape lines. With over 180,000 species, Lepidoptera is one of the most species diverse orders of insects and it is believed that the diversity of species is mirrored in the gene structure for the major component of silk, heavy chain fibroin (h-fibroin). Despite variation across the order, two features of h-fibroin are conserved: it is extremely long and highly repetitive; a challenge for sequencing technology that has only recently been overcome. Through high-quality, long-read sequencing by large consortia, such as the Darwin Tree of Life project, a plethora of new Lepidoptera genomes have been made available to the public. Of these available genomes, 23 families are represented, spanning more than 14 superfamilies. Here, I selected one species from each family to perform an in-depth

analysis of h-fibroin to generate a birds-eye view of the evolutionary history and composition of this important silk gene.

## In Darwin's Footsteps: A Shared Genetic Control for Beak and Toe Size in Domestic Pigeons (*Columba livia*)

Bailey Young, University of Utah

Faculty Mentor Mike Shapiro, University of Utah

SESSION C 2:45-3:00PM

Saltair, Union

Science and Technology

Domestic rock pigeons (*Columba livia*) display an incredible amount of variation among different breeds. Even though they can look and act differently, these breeds all belong to the same species. We are therefore able to breed individuals with very different traits and perform genetic mapping. For example, variation at a locus on Chromosome Z, ROR2, is linked to beak size. In *The Variation of Plants and Animals Under Domestication*, Darwin observed that the data he collected “indicate pretty plainly some kind of correlation between the length of the beak and the size of the feet”. The goal of my research is to determine whether there is a shared genetic control of foot size and beak size in domestic rock pigeons. First, I collected limb length measurements from the F2 generation of a cross between a Homer (medium beaked) and an Old German Owl (small beaked) pigeon. This cross

segregates different beak lengths so it presents an ideal opportunity to test for associations between beak and toe lengths. My data confirmed that foot and beak size are indeed associated. Next, I used quantitative trait locus (QTL) mapping and found that toe size is controlled by at least two genetic loci, one of which maps to the same genomic region that controls beak length. Therefore, it is likely that toe size and beak length have a shared genetic control or are controlled by closely linked genes. Thus, variation in one genomic region – and possibly one gene – can potentially lead to coordinated changes in seemingly unrelated anatomical structures.

**Science and Social  
Sciences. Session C  
- Oral  
Presentations.  
Sorenson, (2nd  
floor), Alumni  
House**

**SESSION C (1:45-3:15PM)**

**Location: Sorenson (2nd floor), Alumni House**

**Petal projections and open books**

## **Nathaniel Stevenson, Brigham Young University**

Faculty Mentor Mark Hughes, Brigham Young University

SESSION C 1:45-2:00PM

Sorenson, (2nd floor), Alumni House

Science

Petal projections provide a way to describe knots in the 3-sphere using combinatorial information. In this talk we will discuss a generalization of this notion to knots in arbitrary three-dimensional spaces. In order to do this we will equip our spaces with open book decompositions, which are a way of decomposing a 3-dimensional space into a collection of 2-dimensional pages and a 1-dimensional binding. We will outline a proof showing that all knots can be represented in this way, and discuss further research directions.

## **Demographic Differences in Substance Use Recovery Capital in Utah**

**Ben Martinez, Utah Tech University**

**Virginia Merrill, Utah Tech University**

Faculty Mentor Muhammad Yildiz, Utah Tech University

SESSION C 2:05-2:20PM

Sorenson, (2nd floor), Alumni House

Social Sciences

Nearly 100,000 people died in the United States from drug-involved overdoses in 2020. Although the high costs of



substance use disorders and the benefits of treatment services are well-documented, more research is needed on demographic disparities in utilization and outcomes of the treatment services, especially in Utah. Using data from a Utah-based addiction recovery organization, Utah Support Advocates for Recovery Awareness (USARA), we investigate the potential race/ethnicity, gender, sexual orientation, and veteran status differences in substance-use recovery outcomes (N=788). USARA used the 10-Item Brief Assessment Recovery Capital (BARC-10) to assess individuals' substance use recovery capital each time they visited a recovery center. A sub-portion of the sample (N=270) visited USARA facilities more than once and thus had multiple BARC scores which enabled us to investigate the changes in recovery outcomes over time as well. Results indicated that racial minorities, females, heterosexuals, and veterans had higher average BARC scores compared to whites, males, sexual minorities, and non-veterans, respectively. However, the difference between the last and first BARC scores was higher for whites, males, non-heterosexuals, and non-veterans, indicating that, on average, these groups are recovering better from substance use disorders compared to their counterparts. Future researchers should look at the demographic differences as well as the barriers that may prevent an individual from seeking and maintaining recovery from addiction. More efforts need to be made to make sure that recovery is achievable, sustainable, and long-term for minority groups in Utah.

## **Creating a Lifeboat for Deaf Women: An Analysis of the Experiences of Deaf**

## **Women in the 1988 Deaf President Now Movement**

### **Amanda Reece, Brigham Young University**

Faculty Mentor Rebecca de Schweinitz, Brigham Young University

SESSION C 2:25-2:40PM

Sorenson, (2nd floor), Alumni House

Social Sciences

In the field of historical research of Deaf history in America, the Deaf community is often minimized into an entity with a singular experience; the lives of people defined solely by their deafness. Scholars of the American Deaf community like: Harlan Lane, David Armstrong, Katherine Jankowski, and Melvia Nomeland offer scholarship on the Deaf Community; although most research does not record the Deaf community the diverse and intersectional group it is. Research on the Deaf Community has only recently begun to analyze the different experiences of the Deaf based on gender, race, sexual orientation, or socioeconomic class. My project seeks to fill the gap by introducing the experiences of Deaf women and analyzing how that experience is different from the male dominated popular narrative of the Deaf experience. This project is specifically about the role of women in the 1988 Deaf student protest and civil rights movement, “Deaf President Now.” Many of the primary source materials are the oral narratives of women who participated in the protest like Nannette Hix, Bridgetta Bourne-Firl, Carol Padden, Dr Jane Norman, Jackie Roth, Dr. Mary Keane, and Vicki Hurwitz. Other sources include: videos of the protests, rally pamphlets, tv interviews, newspaper articles, news reports, and more. I

found that female students at Gallaudet chose to protest for Deaf President Now, because it gave them an opportunity to advocate for themselves as Deaf people, the outside influence of peer culture and community, and it gave them a platform to empower themselves as women.

**Sciences and Social  
Sciences. Session C  
- Sorenson, (2nd  
floor), Alumni  
House**

Session c: 1:45PM – 3:15PM  
Sorenson, (2nd floor), Alumni House

Petal projections and open books  
Nathaniel Stevenson, Brigham Young  
University

Faculty Mentor Mark Hughes, Brigham Young University  
SESSION C (1:45-3:15PM)

Parlor A, Union

Science and Technology

Petal projections provide a way to describe knots in the 3-sphere using combinatorial information. In this talk we will discuss a generalization of this notion to knots in arbitrary three-dimensional spaces. In order to do this we will equip our spaces with open book decompositions, which are a way of decomposing a 3-dimensional space into a collection of 2-dimensional pages and a 1-dimensional binding. We will outline a proof showing that all knots can be represented in this way, and discuss further research directions.

Demographic Differences in Substance Use

Recovery Capital in Utah

**Ben Martinez, Utah Tech University**

**Virginia Merrill, Utah Tech University**

Faculty Mentor Muhammad Yildiz, Utah Tech University

SESSION C 2:05-2:20PM

Sorenson, (2nd floor), Alumni House

Social Sciences

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Amanda Reece, Brigham Young University

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**Social Sciences.  
Session C - Poster  
Presentations,  
Ballroom, Union**

SESSION C (1:45-3:15PM)

**Location: Ballroom, A. Ray Olpin University  
Union**

**“Where I Can Be Myself”: Social media and  
mental health in transgender and  
non-binary adolescents.**

**Seth Ririe, Brigham Young University**

## **Kennedy Banks, Brigham Young University**

## **Allison Weston, Brigham Young University**

Faculty Mentor: Sarah Coyne, Brigham Young University

SESSION C (1:45-3:15PM)

POSTER C30

The current study utilizes a risk and resilience approach to examine contexts of social media use on mental health among transgender, gender non-binary and cisgender adolescents. Participants included 1,231 adolescents (ages 10-17 years old) from a national quota sample from the United States (55% of the sample identified as female, 39% as male and 6% as transgender, non-binary, or other (TGNB)). In terms of race/ethnicity, 57% identified as White, 15% as Black, 9% as Asian, .3% as American Indian/Alaska Native, 15% as Hispanic/Latin, .1% as Pacific Islander, and 3.3% as mixed or other race/ethnicity. Each completed a series of online questionnaires asking about multiple contexts around social media use (time, type of use, favorite site, social comparisons, mindfulness, taking intentional breaks, cleaning and curating feeds, problematic use, and media literacy programs at their school) and mental health (depression, emotional problems, conduct problems, and body image). There was no association between time spent on social media and any developmental outcome for adolescents in our sample. However, the context of social media use was associated with adolescent mental health, often depending on gender identity. For example, active social media use was highly protective for TGNB youth as was cleaning/curating social media feeds, compared to cisgender adolescents. However, taking intentional breaks from social media was related to worse mental health for TGNB youth, but better

mental health for cisgender adolescents. Results were discussed with a focus group of gender diverse adolescents. Implications for youth, parents, educators, and policy makers are discussed.

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## **Mindfulness and Psychological Distress Among University Students**

**Alessandra Fernandez, Brigham Young  
University**

**Carla Castillo, Brigham Young University**

Faculty Mentor: Sandie Sephton, Brigham Young University

SESSION C (1:45-3:15PM)

POSTER C31

**Background.** College students experience high levels of psychological distress including anxiety and depression. Distress may be linked with cognitive impairment (i.e., deficits in working memory, attention, and cognitive flexibility) and poor college performance. Mindfulness is understood as a capacity to cultivate moment-to-moment awareness with a sense of nonjudgement, curiosity, and kindness. We hypothesized that trait mindfulness would be associated with lower distress and better cognitive performance among undergraduate students. **Methods.** We investigated relationships between trait mindfulness, distress, and cognitive functioning including memory and attention among 100 undergraduate students at a large midwestern public university. **Results.** A significant negative relationship

between mindfulness and psychological distress was noted, but no other significant relationships emerged. Conclusions. As expected, our results support those of previous studies showing that trait mindfulness is associated with lower levels of anxiety and depression. While trait mindfulness may not be associated with memory and attention in college students, we submit that further research is needed to explore the effects of mindfulness interventions on memory and attention among undergraduate student samples.

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## **Effects of Resilience on HRV Following a Stressor**

**Jared Newton, Brigham Young University**

**Joseph Rees, Brigham Young University**

**Matthew Grendell, Brigham Young  
University**

**Julia Elmer, Brigham Young University**

Faculty Mentor: Patrick Steffen, Brigham Young University

SESSION C (1:45-3:15PM)

POSTER C32

Background. Over the last 30 years, there has been an increase in stress as stressor prevalence and severity has risen (Almeida et al., 2020). This is critical due to the detrimental effects that stress can have on individuals' physical health

(Rawson et al., 1994) and mental health (Snyder et al., 2019). When studying stress, researchers often use heart rate variability (HRV) because it has been established as a measurement of one's ability to adapt to stressful stimuli (Rajendra Acharya et al., 2006). In addition, high HRV has also been shown to correlate with both better resilience and cortisol modulation (Perna et al., 2020), implying a connection to improved stress management. This study will examine the relationship between resilience and HRV using a standardized protocol and large sample. Hypothesis. If an individual has higher resilience then they will have higher HRV at baseline and will recover back to their baseline after a stressor in comparison to those with lower resilience. Methods. College students were randomly assigned to three different breathing ratio groups, each with different ratios of inhaling/exhaling-40/60, 50/50, or 60/40. Prior to participation, participants completed a battery of measures, including the Connor-Davidson Resilience Scale (CD-RISC; Connor & Davidson, 2003). During the study, participants were instructed to breathe according to their assigned breathing ratio while data was collected through an EKG, respiration belt, and blood pressure cuff. The protocol consisted of a 5 minute baseline, breathing practice for 15 minutes, a stressor, and a 10 minute recovery period. Results. We hypothesize that the data will show that those with higher resilience will have higher HRV at baseline and during the recovery period in comparison to those with lower levels of resilience.

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## **Dispositional Mindfulness: A Protective**

## **Factor in Relationships Between College Roommates?**

**Justina Ababio, Brigham Young University**

**Katie McCarty, Brigham Young University**

**Stacy Pulu, Brigham Young University**

Faculty Mentor: Sandi Sephton, Brigham Young University

SESSION C (1:45-3:15PM)

POSTER C33

Background. College students experience high levels of stress related to academic, financial, and social demands. Social transitions, including the experience of moving away from home and living with a roommate also present novel challenges for college students. Mindfulness is understood as a capacity to cultivate moment-to-moment awareness with a sense of nonjudgement, curiosity, and kindness. We hypothesized that dispositional mindfulness would be protective against dissatisfaction with roommate relationships. Methods. Fifty undergraduate roommate dyads ( $n=100$  first and second-year students) reported on dispositional mindfulness and roommate satisfaction. Regression analyses tested hypothesized relationships, and hierarchical regressions explored possible effects controls variables in these relationships. Results. Analyses revealed that dispositional mindfulness was positively associated with perceived quality of communication with a roommate. Exploratory secondary analyses revealed demographic and roommate-specific factors were associated with roommate relationship satisfaction. Conclusions. Findings provide strong support for mindfulness as a possible ameliorative factor regarding the of quality of communication

between members of a roommate dyad. This novel highlights the importance of exploring the possible benefits of mindfulness in the context of relationships. Implementation of mindfulness-based interventions on college campuses may help mitigate the negative effects of social transitions in college students.

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## **The effects of writing tutoring on perceived stress**

**Brooke Curry, Brigham Young University**

**Marinne Hammond, Brigham Young  
University**

**Brynn Pyper, Brigham Young University**

**Brooke Curry, Brigham Young University**

**Julia Elmer, Brigham Young University**

Faculty Mentor: Joyce Adams, Brigham Young University

SESSION C (1:45-3:15PM)

POSTER C34

While students communicate to writing centers that they feel less stressed following a session, there is little empirical data to support this claim. To address this gap, we conducted a survey in the Brigham Young University Family, Home, and Social Sciences Writing Lab (BYU FHSS Writing Lab). The



survey was completed before and after a writing tutoring session by undergraduate students who attended the BYU FHSS Writing Lab to measure the effects of writing tutoring on stress, a relatable emotion of college students. More specifically, we wanted to better understand perceived stress in conjunction with other variables, such as year in school, familiarity with the assigned citation style, whether the student had a plan for their paper, and whether they had visited the BYU FHSS Writing Lab in the past. We wanted to see how each of these variables were affected by a visit to the writing lab, and particularly how students' perceived stress levels were affected in turn. We discovered that visiting the BYU FHSS Writing Lab did significantly reduce perceived stress levels, and that many other factors play into this such as a student having a plan after their writing session or what year the student was in school. This research is important to writing labs across the country because by implementing our findings, writing centers may be able to maximize the help they provide to students and contribute to their stress relief.

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## **Let's Jam: Can music alter the response to a stressor?**

**Tatiana Leroy, Utah Valley University**

**Austin Booth, Utah Valley University**

**Bethany Blair, Utah Valley University**

**Ryan Coburn, Utah Valley University**

**Manuel Quijas Ornelas, Utah Valley  
University**

**Kenya Sanchez, Utah Valley University**

**Brittney Stockholm, Utah Valley University**

**Vitaliy Walker, Utah Valley University**

Faculty Mentor: Claudia Jorgensen, Utah Valley University

SESSION C (1:45-3:15PM)

POSTER C35

When exposed to stressful situations, the human nervous system reacts with the fight or flight response activation. Physiological indicators of the activation of the fight or flight response include a change in body temperature, increased heart rate, blood pressure, and sweating (Sriram et.al, 2012). There is mounting evidence implicating stress as physiologically and psychologically harmful. For example, recent research has found a correlation between chronic exposure to stress and the development of mental illnesses such as anxiety and depression. Furthermore, chronic stress has the potential to change the anatomy of the brain along the hypothalamic pituitary adrenal axis (HPA), which is an important part of the neuroendocrine system, plays a role in the release of stress hormones, and helps regulate moods, emotions, and sexual behaviorisms (Ramiz, et.al., 2013). When it comes to college students, developing healthy coping mechanisms to deal with stress could positively influence their academic performance and it might improve and maintain their psychological and physiological well-being (Skowronek, 2014). Various research studies have been conducted to reveal the therapeutic qualities of music. Music can effectively relieve nervousness, promote

mental health, and positively affect students' psychological states (Chi, 2020). Current research on stress-related outcomes shows that music interventions play a significant role in stress reduction, both on psychological and physiological levels (de Witte et. al, 2020). The present study focuses on measuring physiological responses (including heart rate, electrodermal skin response, and body temperature) to a potentially stressful situation (a mathematical calculation task) while being exposed to various music genre types (Kirschbaum et al., 1993). We hypothesize that calmer music might reduce stress response, while faster and more upbeat music might increase the stress response. The study will employ a within-subject repeated measures design; the fast-paced and slow-paced music genres will be counterbalanced. After obtaining the baseline physiological measures when no music is played, the participant will be exposed to relaxation/mediation music and fast-beat music. When exposed to different types of music, the measured differences in physiological response will be used to investigate how different genres of music that vary in tempo may affect the human stress response. Findings on the effects of music manipulation on the human nervous system can be used as additional tools for the management of stress.

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## **Using Color in Amazonian Kichwa**

**Addy Mangum, Brigham Young University**

Faculty Mentor: Gregory Thompson, Brigham Young University

## SESSION C (1:45-3:15PM)

## POSTER C36

This ethnographic thesis discusses color within Ecuadorian Amazonian Kichwa and aims to establish the ways in which color may (or may not) be abstracted, problematize the western imposition of hue as a cultural category, and propose that color is not its own category in Kichwa, but a subset of a cultural category of analogy. Data was originally collected at the Iyarina Research Station in Tena, Ecuador. Methodology included ethnographic interviews with native speakers of Kichwa, participant observation (particularly during the painting of bowls and faces), and elicitation using color wheels and color boards. Color wheels were based on HSV color space controlling for lightness to test for the role of hue and saturation in dividing color space. Color boards were based on those by Munsell (1913), though altered to account for hue, saturation, and lightness, taking an even sampling from the Natural Color System (1979). The thesis includes an overview of color terms, and use of color in communication by native speakers of the Napo and Pastaza Lowland dialects and is divided into two parts. The first part provides an updated, comprehensive list of current color terms, basic and otherwise, including physical and cultural traits with which each term is associated. The development of color terms in Kichwa is compared to the hue model proposed by Berlin and Kay (1969), which is critiqued as problematic, especially in the case of the metonymic term *ushpa*. The second part examines color in the context of Kichwa cosmology, particularly the relationships between persons, plants, and animals. Analogy is established as a predominant and highly valued cultural category. This thesis concludes that most basic terms are unnecessary and inefficient to Kichwa speakers, who prefer an analogical method to

categorize color. It challenges cross-cultural and -lingual assumptions about how color is named, abstracted, and categorized.

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## **Toward Understanding Political Charisma: Its Characteristics & Relationship w/ Political Ideology**

### **KC Cushman, University of Utah**

Faculty Mentor: James Curry, University of Utah

SESSION C (1:45-3:15PM)

POSTER C37

This research project examines how Americans perceive charisma in politics. Primarily, it aims to answer two questions. First, what characteristics make a politician charismatic? Second, how does ideological alignment between a candidate and a voter impact the voter's perception of that candidate's charisma? To answer these questions, I conducted a survey of 2000 Democratic or Democratic-leaning adults across the United States. The survey asked respondents to rate various characteristics, ranging from attractiveness to trustworthiness, and including overall charisma, of 2020 Democratic presidential primary candidates. The survey also asked participants several ideological questions regarding different policy arenas in order to establish which candidate(s) they most ideologically align with. I hypothesize that policy preferences will have an impact on voter perceptions of charisma but will

not be the only explanatory factor. Further, I hypothesize that voters will value characteristics like perceived honesty, trustworthiness, and authenticity more than other characteristics.

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## **Correlating the Cognitive Bias Blind Spot with Perseverance**

**Jordan Davidson, University of Utah**

Faculty Mentor: Frank Drews, University of Utah

SESSION C (1:45-3:15PM)

POSTER C38

While a person can generally detect the influence that cognitive bias has had in others' decision-making, the inaccessibility of bias in one's own cognition makes it harder to detect bias in their own thoughts and behaviors. This asymmetrical bias detection leads to a statistical impossibility: the large majority of people—approximately 70-80% of individuals—believe they are less biased than the average person, a psychological phenomenon known as the bias blind spot. While this type of self-enhancement can create social consequences, there may also be potential benefits. It is believed that “positive illusions,” such as overestimating one's abilities and qualities, can lead to higher ambition and perseverance. While few studies have explored benefits to the bias blind spot, we hypothesize that there may be a positive correlation between bias blind spot and perseverance in individuals. Two studies are conducted to test this hypothesis.

In the first, we investigate correlations between bias blind spot and perseverance to complete mazes. In the second, we investigate if providing feedback on the participant's performance compared to the average participant's performance while completing mazes will correlate with bias blind spot. We discuss in detail the cognitive implications for discovering potential motivating factors to the bias blind spot, how this may lead to attenuating its presence, and how this research fits into the current state of radical political ideology.

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## **Obsessive-Compulsive Symptomology in LGBTQ+ Mormons: The Role of Social Safety**

**Julia Decker, University of Utah**

Faculty Mentor: Lisa Diamond, University of Utah

SESSION C (1:45-3:15PM)

POSTER C39

Members of the Church of Jesus Christ of Latter-Day Saints (LDS) who hold LGBTQ+ or sexually-diverse/gender-diverse (SGD) identities often face prejudice, ostracization, and discouraging messages from their social communities and religious leaders. Individuals in this population have demonstrated disparities in various facets of health and well-being, including symptoms of scrupulosity related to deficits in social safety. However, there is little research on the presence/absence of social safety and further categories of obsessive-

compulsive behavior in SGD members of the LDS church. This study aims to further explore the relationship between social safety and obsessive-compulsive symptoms in this population by looking at scrupulosity and additional obsessive-compulsive subtypes, as well as seeks further insight into the behavioral responses of this population when faced with social or institutional adversity.

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## **Associations Between a Healthy**

## **Work-Family Balance and Better Health**

**Sylvia Brown, Brigham Young University**

**Nathaniel Call, Brigham Young University**

**Christine Gore, Brigham Young University**

**Anna Jorgensen, Brigham Young**

**University**

**Kelsie Minga, Brigham Young University**

**Ella Sieg, Brigham Young University**

**Abigail Williams, Brigham Young**

**University**

**Michael Thomsen**

**Abby Baker**

Faculty Mentor: Wendy Birmingham, Brigham Young University

SESSION C (1:45-3:15PM)

POSTER C40

Background: Blood pressure (BP) has been linked to stress, such that higher stress levels can result in higher BP, and higher BP has been linked to greater cardiovascular disease (CVD) risk. BP shows a circadian rhythm such that a healthy cardiovascular profile includes a blood pressure decrease of 10-15% from day to night (i.e., nocturnal dipping) (O'Brien et al., 1988). Many studies have shown nocturnal BP dipping to be a better predictor of CVD than daytime or nighttime

ambulatory BP averages. Today most husbands and wives work outside the home and may experience internal conflict when trying to balance multiple at-home responsibilities with all their work responsibilities. These conflicts can increase stress levels for both husbands and wives, which could increase risk for CVD. Balancing work and home responsibilities and reducing these internal conflicts may reduce stress and improve BP outcomes, specifically nocturnal dipping, and thus reduce CVD risks. Aims of this study: To determine if a healthy work-family balance is associated with better nocturnal BP dipping. Methods: 179 participants (mean age: 24.84, SD=4.1; range 21-46; 55.3% male) were recruited from a local university, social media, and the local community. Because physiological measures were taken, exclusion criteria included any medical conditions with a cardiovascular component, and BMI over 29.9 as obesity is correlated with hypertension. Each participant wore an ambulatory blood pressure (ABP) monitor for 24 hours, collecting readings every half hour during the day and once an hour during the night. Participants also completed a demographic questionnaire and a work/family balance questionnaire. We treated nocturnal BP dipping dichotomously (dippers classified according to a dipping ratio of BP night/day; dippers were  $\leq .90$  and non-dippers were  $> .90$ ) taking the average of the daytime BP and the average of the night-time readings. All analysis was completed through SAS version 9.4. Results: Those who exhibited less conflict between their work responsibilities and home responsibilities showed a healthy dipping profile for both systolic blood pressure ( $p < .001$ ) and diastolic blood pressure ( $p < .001$ ). Ancillary analysis showed this effect was more pronounced in women than in men for both systolic BP ( $p < .001$ ) and diastolic BP ( $p < .001$ ). Conclusions: Most individuals work outside the

home. An understanding of the necessity of balancing these responsibilities with those at-home responsibilities to reduce CVD risk can help individuals work to improve these imbalances so as to improve health now and in the future. This may be particularly important for women, who often take on more of the household and childcare responsibilities. Working to improve equity between spouses/partners can improve the health of both partners.

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## **Social Safety Among Multiracial Individuals in Utah**

### **Brendan Hatch, University of Utah**

Faculty Mentor: Lisa Diamond, University of Utah

SESSION C (1:45-3:15PM)

POSTER C41

This paper examines social safety among multiracial individuals in Utah. The concept of social safety is an aspect of minority stress that proposes even in the absence of apparent threat, people may still feel the need to be on alert or guard themselves from harms that could happen. Social safety then, is a level of personal safety felt that occurs when an individual is not actively on alert, but is able to exist in the moment. Social safety is built through environments that produce reliable sources of sense of belonging, social connection, inclusion, and protection. Individuals with multiracial identities may suffer a unique lack of social safety due to communities that they identify with not fully accepting them as a part of the

community. This lack of social safety can happen at multiple levels depending on the individual and how unpredictable they find their communities to be. A consistent lack of social safety in frequented environments can have significant negative impacts to a person's mental, emotional, and physical health. This thesis is meant to examine the multiracial portion from Dr. Diamond's research paper examining social safety within marginalized communities. This thesis hypothesizes that multiracial individuals will report experiencing lower rates of social safety within family and community settings.

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## **State Variation of Eligibility in Medicaid Waivers for Disabled Populations Sydney Kincart, University of Utah**

Faculty Mentor: Phillip Singer, University of Utah

SESSION C (1:45-3:15PM)

POSTER C42

Medicaid is the most important insurance program for individuals with disabilities as over 10 million people are eligible for Medicaid on the basis of their disability (People with disabilities). Waivers are an important policy tool, allowing states increased flexibility in their programs (National Association of Community Health Centers). The 1915(c) waiver allows states to offer home and community based services (HCBS) to certain groups of people instead of care provided in an institution (National Association of Community Health Centers). Utah has eight different HCBS waivers in place with

eligibility ranging from aging to autism (Home and Community Based Services [HCBS] Waiver Programs). However, disability can be invisible, undocumented, and undiagnosed-leaving a vulnerable population without resources for assistance. Adding to the complication of disability and eligibility is the causality dilemma inherent for these individuals. Disability is one of the categorically required eligibility criteria for Medicaid, but individuals need to have a medical diagnosis of disability to be eligible for the program. Without previous access to healthcare, such a diagnosis is unlikely. Although someone may not meet Medicaid's eligibility criteria, they continue to face disablement through institutional barriers and lack the support that Medicaid would offer. To understand how states have leveraged waivers and their Medicaid programs to provide care for individuals with disabilities, our project analyzes all Medicaid 1915(c) waivers. In our analysis, we have cataloged the current policy landscape of Medicaid waivers related to disability, capturing data on who is eligible, what types of benefits are provided, and the types of disability identified by states. Our work highlights the patchwork nature of Medicaid coverage for individuals with disabilities and disparities in accessing and being eligible for this essential public program.

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## **What Changes Voters' Perceptions of Inflation?**

**David Lee, University of Utah**

Faculty Mentor: Josh McCrain, University of Utah

SESSION C (1:45-3:15PM)

POSTER C43

Inflation is recently a salient topic among voters and policymakers. FiveThirtyEight/Ipsos conducted six polls from April to October 2022 and voters rated inflation as the country's most critical issue. Voters aren't the only individuals concerned about inflation. Policymakers are also concerned about inflation and inflation expectations. The Federal Reserve is raising interest rates at an unprecedented rate to control inflation. The Federal Reserve actively monitors long-term inflation expectations to ensure they remain anchored. Therefore, our research sets out to determine if low-cost informational nudges (narratives) on climate change have a causal effect on household inflation expectations. We investigate how households update their inflation expectations in response to low-cost informational nudges (narratives). We use economic and political narratives centered around climate change. We construct our economic narratives on the premise that climate change puts upward pressure on grocery prices. We include the political narrative because one's political affiliation, conditional on the party that controls the presidency, biases inflation expectations (Bachmann et al. 2019; Gillitzer, Prasad, and Robinson 2021). We include inflation statistics from the Survey of Professional Forecasters to control for the extremeness individuals may have when using specific prices to form their inflation expectations (Bruine de Bruin,

van der Klaauw, and Topa 2011). We apply an information provision experiment to US households using Prolific, an online survey platform. We measure their pre-treatment and post-treatment inflation expectations to determine if our narratives influence household inflation expectations. Our contribution is we seek to determine if climate change narratives influence household inflation expectation formation. We also contribute to the literature on personal experiences having a causal effect on inflation expectations. We contribute to the role that communication has on household inflation expectations. Politicians and policymakers stand to benefit from a better understanding of how voters form their inflation expectations because they can better tailor their economic messaging.

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## **The Effect of School Funding Disparities on Economic Inequality**

### **Benvin Lozada, University of Utah**

Faculty Mentor: Jing Yi Zhu, University of Utah

SESSION C (1:45-3:15PM)

POSTER C44

Since the 1980s, the United States has experienced increased income inequality, which has fueled a variety of social, economic, and political concerns regarding the state of the American Dream and the true nature of opportunities available throughout the country. The U.S. has been lagging behind almost all developed countries in this form of mobility (The

White House, 2013). One major contributor to the ability of impoverished peoples to climb up the socioeconomic ladder has been the attainability of education; however, common barriers to education exist in our society that have prevented the classroom from reaching its full potential as an enabler of equity. As a result, it becomes significant to study these barriers in order to understand how to create a fairer system. While many of the inputs of education are important to consider, one of the most critical ones is the methods which schools are funded with; this may not only have an effect on the status of the schools but have lasting ramifications on the life outcomes of the students that learn there. As a result, this research project tackles the following topic: what is the effect of school funding policies on economic inequality? The project employs an instrumental variable method approach to infer causality, utilizing a multitude of datasets on Census information, school district funding, and economic mobility spanning the last 4 decades. This is combined with innovative machine learning models to best model the relationship that is being investigated in this project. While this approach has been worked on in abstract papers for some time, this has not often been practically implemented into studying real-world datasets and issues (Pech and Laloe, 1997) (Xu, Chen, Srinivasan, de Freitas, Doucet, Gretton 2021). I hypothesize that there is a statistically significant relationship between certain school funding policies and the rates of economic mobility in their corresponding communities. If the hypothesis proves to be true, we will be able to ascertain this relationship and make detailed policy recommendations in order to help remedy this source of inequality.

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

**Marin Macfarlane, University of Utah**

Faculty Mentor: Amy McDonnell, University of Utah

SESSION C (1:45-3:15PM)

POSTER C45

Attention Restoration Theory (ART) proposes that urban environments deplete our attentional resources and natural environments counteract this depletion by allowing our attentional system to rest and recuperate (Kaplan, 1995). Previous research supports the cognitive and physiological benefits of immersion in nature as well as viewing nature imagery, but little research has utilized brain-imaging to investigate the neural mechanisms underlying these benefits. In the present study, we use electroencephalography (EEG) to investigate the effects of viewing nature imagery in comparison to urban imagery on the Error-Related Negativity (ERN), a component of the Event-Related Potential (ERP) related to cognitive control and attention network (AN) activity. Previous research has shown an increase in the ERN amplitude during immersion in nature compared to immersion in an urban environment, indicative of an increase in cognitive control capacity during immersion in nature. We similarly used EEG to measure amplitude of the ERN elicited by a Flanker task after participants viewed either nature or urban imagery to see if just images of nature would have the same effect. We predicted an increase in the ERN amplitude for the nature imagery condition compared to the urban imagery condition. We found no statistically significant difference in ERN amplitude between the nature and urban imagery conditions,

suggesting that the benefits of viewing nature imagery may not have the same neural mechanisms as immersion in nature. Future research could investigate whether viewing nature imagery for longer periods of time may be necessary to significantly influence the ERN.

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## **A geospatial and climatic analysis of the rise and fall of the Aksumite Empire on the Tigray Plateau, Ethiopia**

**Talon Roberts, University of Utah**

Faculty Mentor: Mitchell Power, University of Utah

SESSION C (1:45-3:15PM)

POSTER C46

Ethiopia and the horn of Africa are well known for their vast history of human activity. This history includes some of the oldest hominid remains ever found, as well as many ancient civilizations that have come and gone through time, including the Aksumite Empire. This research strives to understand the environmental and anthropogenic history of the Aksumite Empire through developing a modern baseline with recent climate and geospatial data in the horn of Africa and comparing that data with long-term paleoclimate archives. This research will explore linkages among climate drivers and long-term fire reconstructions from sedimentary charcoal research from samples collected in 2019 near the city of Adigrat, Ethiopia. Specifically, to investigate what factors may have ultimately led to the collapse of the Aksumite Empire around

700 A.D. The sediment core sample location is documented as once hosting ancient Aksumite farmlands, where intentional burning likely occurred. Through examining current climatic data in the horn of Africa and comparing it with long-term paleoclimate reconstructions (e.g., Lamb et al. 2007; Terwilliger et al. 2011) and a newly created sedimentary-charcoal fire history, this research aims to better understand factors that contributed to the decline of the Aksumite Empire. Specifically, this research explores whether natural environmental factors, anthropogenic factors (e.g., over-exploitation of resources), or potentially a combination of several factors contributed to the demise of the Aksumites.

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## **Parental Involvement in Restorative Justice Programs: Examining Salt Lake Peer Court**

### **Melissa Tyszko, University of Utah**

Faculty Mentor: Rebecca Owen, University of Utah

SESSION C (1:45-3:15PM)

POSTER C47

Since the early 2000s, social scientists have observed growing contact between youth-especially marginalized youth-and the juvenile justice system in the United States. Diversion programs, such as youth courts, have been used in an attempt to curtail the growing population of court-involved youth by providing an alternative to formal juvenile justice involvement. Salt Lake Peer Court (SLPC) is a restorative-justice based youth

court program. SLPC incorporates community service, skill building, and accountability practices to address the offenses of youth participants and reconnect them to their communities. Research on diversion programs like SLPC has shown a promising link between family-involved sentencing and youth success. For example, the use of family therapy can address some factors which are correlated with criminal behavior, by building family relationships and helping youth develop strategies to improve family functioning, which can be extended to other areas of their life. It is difficult, however, to generalize existing research to all diversion programs, due to variations across program structures and approaches. The heterogeneity of diversion programs necessitates a focused examination of SLPC, in order to determine the importance of parental involvement on the success of its participants. This study analyzes transcripts of previously conducted interviews with stakeholders in SLPC—including program directors, adult advisors, peer mentors, and school administration—in order to identify patterns related to parental involvement, family-involved sentencing, and youth success in the program. This analysis will be supplemented with observations conducted during Salt Lake Peer Court hearings in the 2022-2023 school year, and will allow for a greater understanding of how parental involvement may influence the effectiveness of SLPC for youth participants.

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## **Measuring Heart Rate Variability, Stress, and Psychological Symptoms using**

# **Biofeedback, CCAPS, and DASS**

## **Emily Hepworth, Brigham Young University**

Faculty Mentor: Patrick Steffen, Brigham Young University

SESSION C (1:45-3:15PM)

POSTER C48

As levels of distress increase around the world due to a variety of global issues, college students are no exception to the resulting mental health crisis. This has especially been the case since the outbreak of the COVID-19 pandemic in early 2020. Recent studies show that levels of depression, anxiety, and psychopathology are currently rising among college students (Buizza & Ghilardi, 2022). With these increasing levels of mental health issues, new measures have arisen to evaluate the specific stressors of college students. This study combines the use of many of these measures to more comprehensively evaluate stressors and mental health symptoms in college students. This includes the Depression, Anxiety and Stress Scale (DASS), which measures stress and arousal in a summative and dimensional model (Lovibond & Lovibond, 1995), as well as the Counseling Center Assessment of Psychological Symptoms (CCAPS-34), which is designed specifically to measure psychological symptoms and distress in college students (Center for Collegiate Mental Health, 2015). To further measure the effects of stress, we measured heart rate variability (HRV) to capture the somatic response to stressors. HRV captures the body's physical response to stress, as well as being a predictor for anxiety disorders (de la Torre-Luque et al., 2017). We anticipated those with greater psychological distress and symptoms, as captured by the DASS and CCAPS, will

also show a significant reduction in HRV as a response to the stressors in the experiment. We administered the CCAPS and DASS as well as tracked HRV via biofeedback to best measure self-reported and somatic manifestations of stress and anxiety. In addition, we used the Paced Auditory Serial Addition Test (PASAT) to induce a controlled stressor within the experiment to establish the relationship between stress and HRV. We anticipate lower HRV for those participants whose CCAPS and DASS scores indicate significant mental health symptoms.

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## **Laughing All the While: Race, Gender, and Recreational Violence in the Mechanisms Fanwork**

**Katelyn Allred, Utah State University**

Faculty Mentor: Joyce Kinkead, Utah State University

SESSION C (1:45-3:15PM)

POSTER C49

From 1960s housewives exchanging Star Trek zines, to early-internet Harry Potter message boards, to small pockets of community on modern social media, fans have been connecting over their shared love of a source material for decades, and the Internet has made creating and finding both original and fan content more accessible around the globe. This kind of worldwide connection brings people into contact with people they might not meet otherwise, and can foster an awareness of others' lives and perspectives. Though fandom has always been at least subtextually political, the last few years have brought

more and more conscious use of fan spaces as a vehicle for discussion of social issues. Even in spaces that pride themselves on diversity and inclusivity, though, unconscious bias still underlies the conversation. I studied the fandom for the Mechanisms, a queer storytelling folk punk band, to look for how these biases manifest in treatment of canon-typical actions in fanworks about characters based on race and gender, including transness. By surveying fans on their views of characters and analyzing fanfiction for frequency, severity, and treatment of violence perpetrated by canon characters, I found patterns in how characters with different identities were treated, and how these treatments interacted with dominant narratives surrounding people with those identities. While the kind of egregious mischaracterization that started this discussion within the fandom seems to be an outlier and did not appear in my sample, more subtle inequalities do exist. My research offers a snapshot into one fandom, and how in discussions of racial and gender inequality, public conversations, self-reported attitudes, and created content are not necessarily consistent.

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## **The Impact of Adverse Childhood Experiences on Participation in College**

### **Nicole Carter, Utah Valley University**

Faculty Mentor: Chris Anderson, Utah Valley University

SESSION C (1:45-3:15PM)

POSTER C50

The purpose of this research is to find out if college students with higher Adverse Childhood Experiences (ACEs) are less likely to participate in events in college. Previous research shows that students with higher ACEs struggle academically and are less likely to participate in school. Students are more likely to drop out of school as a result. Research also shows that education can mitigate some of the effects of ACEs. A survey was completed by 400 UVU alumni that asks about the ACEs they have experienced and what events they have participated in while in college. These events include being a research or teaching assistant, publishing in a student journal, meeting with advisors, and attending conferences. Statistically significant results would suggest universities should target students with high ACEs in order to increase their participation in college.

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## **Sovereignty and the Great Salt Lake**

### **Maggie Christianson, Brigham Young University**

Faculty Mentor: April Reber, Brigham Young University

SESSION C (1:45-3:15PM)

POSTER C51

Starting in the summer of 1847 Utah's Great Salt Lake has steadily shrunk leading it to reach a historic low in July of 2022 at 4,190.1ft. 170 years of water level records show that continued diversions from waterways that feed the lake, increased temperatures, and drought have all contributed to



the lake's current suboptimal condition. Fears over the outright disappearance of the lake, mimicking the environmental and economic catastrophes that occurred at other drying lakes, have caused Utah residents, researchers, and legislators to open discussions over what can be done to preserve the lake. Our research questions center on recent legislation passed to protect the lake, specifically HB33 which designates water flowing to sovereign lands as a "beneficial use." Our questions include: How does HB33 contribute to establish sovereign rights for the Great Salt Lake? How does the Great Salt Lake become a sovereign entity? How do multispecies rights become legalized through the aridification of the Great Salt Lake? Employing an interdisciplinary approach, our project seeks to understand the relationship between environmental crises such as the aridification of the Great Salt Lake, the scientific communication with broader publics about this environmental crisis, and the public's response to that communication. This project's methods include surveying, interviewing relevant stakeholders, analyzing legislative measures and laws, and using GIS modeling to understand how scientific communication translates to broader audiences.

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## **How Childhood Experiences Affect College Dropout and Success Rates**

**Deborah Colimon, Utah Valley University**

Faculty Mentor: Chris Anderson, Utah Valley University

## SESSION C (1:45-3:15PM)

## POSTER C52

The college experience can be a great aid in personal development. College can foster feelings of belonging and growth and be an incredible time for many. However, the transition to college life can be a difficult experience, especially for students who have dealt with a great deal of Adverse Childhood Experiences. Adverse Childhood Experiences (ACEs) are various forms of physical and emotional abuse, neglect, and household dysfunction a child may experience. Most people have experienced at least one type of Adverse Childhood Experience (ACE) before age 18, and nearly 1 in 6 people have experienced four or more types of ACEs. Research has shown that children who have dealt with a high number of ACEs have more challenges in adulthood than those who did not. This study aims to examine whether there is an association between poor academic behaviors and the dropout prediction of students based off of their reported ACEs and Positive Childhood Experiences (PACEs). We will assess the surveyed responses (n=401) of recent Utah Valley University (UVU) alumni on their experience and success during their undergraduate years, as well as the ACEs and PACEs they have experienced. This data was obtained following IRB approval (protocol #939). We predict that the higher the ACEs the more likely it is that a student struggled academically and or dropped out of UVU or another institution at some point before graduating. The data found from this study can help in navigating how institutions of higher education can most effectively support students in their first semesters at their colleges or universities.

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## **Connections for Success: Social Networking in Virtual University Clara Cook, Utah State University**

Faculty Mentor: Jason Twede, Utah State University

SESSION C (1:45-3:15PM)

POSTER C53

How have online classes affected university students' abilities to network and connect, and how has that impacted their feelings towards their university experience and graduation preparation? This poster will explore the answer to this question based on surveys administered to students at Utah State University evaluating their online connection experience and success. It will include an analysis of trends relating to factors influencing the strength of student connections with both instructors and other students in online classrooms as well as overall attitudes and perceptions of success.

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## **Now Growing Grapes: The Post-2012 Political Realignment of Orange County from Red to Purple**

### **Kyle Davis, Brigham Young University**

Faculty Mentor: Samuel Otterstrom, Brigham Young University  
SESSION C (1:45-3:15PM)

POSTER C54

For decades, Orange County has been known for being politically conservative. Even as the rest of California phased through increasingly darker shades of blue in the 1990s and 2000s, the county remained reliably red in elections. Yet in 2016, it supported a Democratic presidential candidate for the first time in 80 years, and by 2019, Democrats overtook Republicans in voter registration. Orange County can now best be described as “purple”. This transformation can be attributed to three factors: 1) a declining pool of available Republican votes, 2) recent diversification and in-migration from liberal areas, and 3) conservative and moderate backlash against Trumpism.

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## **Women, Weight, and the Workplace: The Effects of Economic Weight Bias Against Women**

### **Niko Dawson, Weber State University**

Faculty Mentor: Brandon Koford, Weber State University

## SESSION C (1:45-3:15PM)

## POSTER C55

Women experience different treatment within the workforce, influenced by remnants of a patriarchal society. Extensive effort has gone into researching the gender pay gap and what forces could be responsible for this societal disadvantage. Meanwhile, studies have shown an overall negative relationship between income and resulting weight, concluding that obesity rates are higher at lower levels of income. However, not much research has been conducted to analyze the likelihood that weight bias at the workplace causes this relationship to be significant when reversed. Using the most recent quantitative data from the National Health and Nutrition Examination Survey, this paper uses an ordinary least squares regression model of income on weight with additional control variables to examine the effect of weight bias on income for men and women. Additionally, I will explore the consequences of this relationship and how it fits into the overarching issue of the gender pay gap.

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**Investigating the Potential for EM38 data  
to Detect Changes in Spatial Patterns in  
Soil Moisture for Turf Grass Management  
Abigail Henrie, Brigham Young University**

Faculty Mentor: Ruth Kerry, Brigham Young University

## SESSION C (1:45-3:15PM)

## POSTER C56

The Western United States, including Utah is currently experiencing a “mega drought”. Therefore, the need to limit water use in an efficient way has become essential. Turfgrass, a major vegetation type in urban areas, is the largest irrigated crop in the United States. It performs important ecosystem services such as cooling through evapotranspiration, fixing carbon from the atmosphere, and reducing wild-fire risk. Most residential turfgrass is irrigated using uniform protocols: for example, 20-30 minutes of irrigation every other day. However, more than 50% of irrigated water used on turfgrass is wasted by temporal and spatial misapplications. There are some solutions to this waste of water. Smart sprinklers reduce temporal misapplication by considering the weather of a particular area. Valve-in-head sprinklers can reduce wasted water through reducing spatial misapplications. In addition, sensors can help determine exactly how much water to apply in a certain area. The drawback to sensors is that they are expensive, and one needs ways to extrapolate rates to apply to zones. While spatial zones can be determined in several ways, some are more labor intensive than others. Traditionally, a ground survey would be performed using theta probes, NDVI readers, and infrared thermometers. However, we propose that using the EM38 takes less time and resources to get the similar information. Furthermore, this research works to link sensor measurements from four locations in two fields on the Brigham Young University campus using ground survey, drone survey, and EM38 maps, to determine how irrigation amounts should be varied between existing zones, or zones determined for valve-in-head sprinklers.

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**Are students entering as scientists?**  
**Pre-course Assessment of Undergraduate**  
**Student Science Identity**  
**Steven Hughes, Utah Valley University**

Faculty Mentor: Britt Wyatt, Utah Valley University

SESSION C (1:45-3:15PM)

POSTER C57

The promotion of a more diverse and accessible environment in science classrooms is a goal espoused by many major educational institutions, and in keeping with that goal, many efforts have been made at an institutional level to introduce more resources for traditionally underserved student populations. At the classroom level, science instructors are responsible for adopting more inclusive pedagogy, modifying their methodologies to best engage students of all backgrounds (Wyatt et al., 2021). One way instructors can support students is by providing experiences that enable them to engage meaningfully with the scientific community in some capacity, allowing opportunities for the development and exploration of their science identity, that is, their perception of themselves as a “science person” (Carlone and Johnson, 2007). Although investigation into student science identity is not a novel concept, most previous research on the subject has focused primarily on science majors at research-focused institutions using purely quantitative measures. The current study aims to incorporate both quantitative and qualitative data regarding student science identity collected from a wider, more diverse

population of science students. Current data consists of 1268 student responses, collected from pre-course surveys, which were distributed in 14 classes taught by 16 different instructors, spanning introductory and general education science courses to advanced, upper-division courses. Qualitative coding of responses collected regarding student perceptions of what it means to be a scientist, their self-identification as a scientist, as well as their perceived connectedness to the scientific community at large, reveal notable differences between different student groups while also highlighting relevant consistencies across different courses. For instance, all surveyed courses have students who report feeling disconnected from the scientific community and struggle to understand what it means to have such a connection, meanwhile those that do report feelings of connectedness tend to attribute that feeling as being due to their own native interest in the community at similar rates regardless of their status as a non-major, introductory-major or advanced-major student. We also see shifts in the types of language used to describe scientists as students progress in science majors, incorporating fewer stereotypical examples in their descriptions and emphasizing the role of continual learning as a defining characteristic, while also self-identifying as scientists at higher rates than their non-major or introductory-major fellows. The potential connections of these codes to other aspects of student science motivation and engagement will be explored, and discussion of potential implications of these findings will be discussed along with the benefits of pre-course assessments and other evidence-based approaches in the promotion of in-classroom student science identity formation.

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# **Minority Ethnic Centrality, Affirmation, and Attitudes Toward Mental Health Care**

## **Chandler Peterson, Weber State University**

Faculty Mentor: Xin Zhao, Weber State University

SESSION C (1:45-3:15PM)

POSTER C58

In recent years, there have been dramatic improvements in our ability to seek, utilize, and receive mental health care. Despite these improvements, research has shown that many individuals, especially those belonging to ethnic minority communities still experience difficulty seeking mental health treatment. Previous studies indicate that those who have strong ethnic centrality are more likely to utilize mental health resources than those who do not. Racial discrimination in the health care system, along with associated stigma within their communities surrounding mental health care, establish barriers in pursuing treatment for those who desire the help. The current study seeks to further investigate the relationship between ethnic identity and affirmation, and attitudes toward seeking mental health care. Namely, we assess relationships between participant anxiety, depression, psychological distress, and ethnic identity, as well as attitudes toward seeking mental health treatment and about mental health in general. We hypothesize that participants who have strong ethnic centrality and affirmation will be more willing and less ashamed to seek mental health treatment, as well as having a less stigmatized view of mental health care.

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## **Investigating the Bioavailability of Toxic Heavy Metals in the Soil of Urban Parks in Salt Lake City, Utah**

**Kirsten Sanders, Brigham Young University**

Faculty Mentor: Ruth Kerry, Brigham Young University

SESSION C (1:45-3:15PM)

POSTER C59

Bingham Copper Mine, Salt Lake Valley, Utah releases toxic heavy metals (copper, lead, zinc and arsenic) into the environment that can have adverse health impacts such as respiratory illness, cancer, heart disease, violent behavior and depression. Uptake of metals by plants can indicate their bioavailability. Soil and grass samples were collected throughout the Salt Lake valley from public parks. A 1 km grid was overlaid on a map of the Salt Lake Valley and parks were chosen from every other grid square resulting in 58 parks. Samples were cut from the turfgrass and topsoil samples (0-10cm) were collected at each park. For large parks two samples were collected at opposite sides of the park. Coordinates were recorded at each sample location. The metal content of the soil samples was determined using a portable X-ray fluorescence analysis and ICP-OES was used to determine the metal content of grass samples. A hyperspectral radiometer was also used to analyze the grass samples. The wavelengths sensitive to enrichment with the heavy metals of interest were determined using separability indices. Correlation analysis was performed to determine the strength of relationships between reflectance values of grass samples in these key wavelengths

and heavy metal concentrations in the grass measured using ICP-OES. The correlations between soil heavy metal and grass heavy metal correlations were also used as a measure of bioavailability of the metals. Contamination risk zones are determined through interpolating soil and grass heavy metal contents throughout the Salt Lake valley. Determining the wavelengths that are sensitive to heavy metals in this research suggests that hyperspectral surveys by drone could help identify areas with a high risk of contamination and high degree of heavy metal bioavailability. Drone survey could greatly reduce the cost of sampling and analysis for risk assessment.

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## **Guadalupe Monroy: “Mujer virtuosa, ¿quién la hallará?”**

**Sarai Silva, Brigham Young University**

Faculty Mentor: Ignacio Garcia, Brigham Young University  
SESSION C (1:45-3:15PM)

POSTER C60

Mormon historians have written various accounts relating to early Mormon white women such as Emma Smith, Eliza R. Snow, and Lucy Mack Smith. Only recently have scholars started to look at women such as Jane James Manning and Chieko Okazaki. They have furthered created new historical narratives such as Saints. This shift in inclusive and diverse scholarship in Mormon history will obligate Mormon

historians to rethink and relearn not only how to write history, but how to interpret it. This paradigm shift in scholarship will require new methodological frameworks, so as to not recolonize the “other.” Historiography has shown that white interpretation dominates the way church history is looked at, especially when it comes to writing about the “other.” Although unintentional, this sometimes leads scholars to further marginalize and victimize non-white people. This disservice needs to stop, and scholars need to become aware that the “other” can offer us more than a historical tragedy. My presentation will demonstrate how to look at the “other” through a case study using Guadalupe Monroy, a Mexican pioneer, and historian. This case study will focus on the intersection of being Mexican, a woman, and a member of the church through this new paradigm. More importantly, this presentation will show how to include colored women in church history without further colonizing, victimizing, or marginalizing them.

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## **Main and Interactive Effects of Mental Health, Parent Ethnic Socialization, Discrimination on BIPOC Teens’ Ethnic Identity**

### **Emily Takamasa, Brigham Young University**

Faculty Mentor: Ashley Fraser, Brigham Young University

## SESSION C (1:45-3:15PM)

## POSTER C61

Because racism and discrimination are still prevalent in the U.S., major research organizations for child development have called for research that details Black, Indigenous, and People of Colors' (BIPOC) developmental experiences and promotes social change. One developmental task relevant to BIPOC teens is ethnic identity formation, which concerns how an individual mediates the meaning of their ethnicity for themselves and within society. This study investigated whether discrimination, internalizing symptomology, parent socialization, and/or interactions of these variables influenced teen ethnic identity, specifically in exploration, resolution, and affirmation to illuminate nuanced ways BIPOC youth can achieve positive ethnic identity. Surveyed participants were adolescents ( $n = 353$ ,  $M_{age} = 15.28$ ,  $SD = 1.68$ ; 51.6% male) of diverse racial/ethnic groups and socioeconomic backgrounds from all regions of the U.S. Using linear regression, results showed a negative relation between internalizing symptomology and exploration, a positive relation between parent socialization and exploration, a positive relation between parent socialization and resolution, and a negative relation between internalizing symptomology and affirmation. There were also two significant interactive effects such that (1) discrimination had a more negative relation with affirmation under condition of high internalizing, and (2) parent socialization had a more positive relation with affirmation under condition of high internalizing. Results evidence development of ethnic identity in adolescence is subject to multiple interactive influences. Findings highlight an at-risk group of adolescents with higher internalizing symptomology that may need special consideration as they navigate their ethnic identity and experience discrimination.

Results also suggest that parents significantly impact their child's ethnic identity outcomes.

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## **Overlooked and Underdiagnosed: Eating Disorders and Male Athletes**

### **Miles Yablonovsky, Utah Tech University**

Faculty Mentor: Dannelle Larsen-Rife, Utah Tech University

SESSION C (1:45-3:15PM)

POSTER C62

Eating disorders may be overlooked and underdiagnosed in male athletes. Classification of eating disorders primarily focuses on symptoms experienced by females (American Psychiatric Association, 2013). Male athletes are more likely to be diagnosed with anorexia athletica and non-specific eating disorders compared to male non-athletes (Karrer et al., 2020). Symptoms of eating disorders are frequently dismissed by male athletes, parents, and coaches. However, early detection is critical for preventing eating disorders. Practices within some sports promote unhealthy relationships with food, exercise, and the body (Compte et al., 2018). Athletes may have a biological predisposition to body and eating-related disorders. These environments and specific stressors in weight-sensitive sports may cause vulnerable athletes to exhibit eating- and body-disorders in an attempt to attain ideal standards (Firoozjah et al., 2022). Coaches and parents pressure athletes to perform at a competitive level. Which may result in athletes developing an eating disorder, to gain a sense of control over their athletic performance (Bratland-Sanda & Sundgot-Borgen,

2013). Eating disorders in male athletes are often accompanied by previous anxiety and depression. Anxiety and depression are risk factors associated with eating- and body-related disorders in male athletes (Liu & Cao, 2022). Recognizing male athletes who have an eating disorder is challenging, but is necessary for recovery. This paper will review the literature on male athletes and eating and body-related disorders, propose a revision to the classification of eating and body-disorders, and provide targets for prevention and intervention. Prevention and intervention should raise awareness about male athletes' eating and body-related disorders. Athletes, families, and athletic coaches should be educated about warning signs of eating disorders as well as effective comprehensive therapeutic interventions. Athletes and their families may be required to make personal sacrifices to promote recovery and focus on their overall health.

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## **Firearm laws by state and severe family violence**

**Nancy Pasillas, University of Utah**

Faculty Mentor: Sonia Salari , University of Utah

SESSION C (1:45-3:15PM)

POSTER C67

A vast majority of cases involving family violence, intimate partner homicide suicide (IPHS) and involve perpetrators who are males and have access to a firearm. I will use hundreds of IPHS events from across the nation and compare the State Firearm Law Database from Boston University to

examine patterns across states and how restrictive their gun laws for the years examined are. The mentors on this project have found that the regions of the country (e.g. northeast) have more restrictions on their gun laws thus they have fewer IPHS events, per capita, compared to the southern and western states. My work dives more deeply into the specific states with a particular problem of high incidence of IPHS and familicide, and how the firearm restrictions for that state compare to areas with lower rates of fatal family violence.

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## **Ethnic Status and Type 1 Diabetes Management in Young Adulthood**

### **Julia Martin, University of Utah**

Faculty Mentor: Cynthia Berg, University of Utah

SESSION C (1:45-3:15PM)

POSTER C68

Objective: Young adulthood is often characterized as a “high-risk period” for young adults (YA) with T1D as they have higher HbA1c (a metric of glucose control across the last 3-4 months) and poorer self-management compared to other age groups. Disparities along racial/ethnic dimensions can further exacerbate the challenges in maintaining target HbA1c and self-management for YA. However, recent theoretical work argues that racial/ethnic differences could be due to differences in socioeconomic status differences among racial/ethnic groups (Mello & Wiebe, 2020). The present study represents a unique opportunity to examine racial/ethnic differences in HbA1c and self-management in YA while controlling for a number of



measures of socioeconomic status (self-reported socioeconomic status, neighborhood disorder based on census code data). In addition, I will examine the differences and disparities that exist in insurance status (public, private, uninsured) and how these relate to HbA1c. Methods: The data come from the READY (REgulating Adherence to Diabetes as Young Adults; Berg et al., 2019) longitudinal study of young adults with T1D recruited at two clinical sites, Utah and Texas. Two-hundred and forty-seven individuals were recruited in their final year of high school, lived with a parent and had no condition that would prohibit study completion. The present sample includes individuals who completed baseline measures and for whom census data were available. Due to changes in Census tracts or non-inclusion in the American Community Survey (ACS), neighborhood characteristic data were not available for 21 participants. The sample included 59.6% female, 15% Hispanic, 70% non-Hispanic White, 4% Black, 2% Asian, 3% other or multiple race, and age 17.8 (SD-.39 years). The distribution of ethnic/minority status is representative of the clinics as well as national samples, where T1D is more frequent among non-Hispanic Whites. HbA1c was indexed from HbA1c assay kits obtained from CoreMedical Laboratories. Socioeconomic status was measured with MacArthur's subjective social status measure where YA indicated on a ladder where they stand relative to others in their community. YA home addresses were used to determine their census tract code using the percent of the population living in the area achieving less than a high school, education under 18 living in poverty, and unemployed. Self-management was measured with the Diabetes Behavior Rating Scale (DBRS) and Self-care Inventory. The primary analysis will involve two multiple regressions (one for HbA1c, one for self-management) with indicators of socioeconomic

status entered on the first step and ethnic and minority indicators on the second step. A second set of analyses will explore through Chi-square whether there are ethnic and minority differences in insurance status. Results: in process. Conclusions: Understanding the racial/ethnic differences in HbA1c and self-management while controlling for socioeconomic status will offer tremendous insight into potential policy implications. I will be able to offer accurate insight and recommendations from a public health perspective.

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## **Impact of Ethnic Studies in K-12 Education in Utah**

**Haley Tetzlaff, University of Utah**

Faculty Mentor: Thomas Swensen, University of Utah

SESSION C (1:45-3:15PM)

POSTER C69

A study to investigate the impact of ethnic studies courses on students, alumni, and teachers in K-12 education in Utah. With UROP funding we will study the impact of K-12 ethnic studies education in Utah. In May of 2022 Utah passed bill SB244 stating the requirement of ethnic studies education in K-12 institutions. Because of this, we plan to conduct a series of oral history interviews with a mix of current students, alumni, and teachers. With this mix we believe we can get a broader range of experiences. Through these interviews we will get an inside look on the substance which ethnic studies instills in our younger generations. Through these interviews we will understand the benefits and/or the disadvantages these courses

offer. Interviews will gain insight on the desires of the students and teachers versus what is allowed by the student board and other institutional bodies in Utah. We really want to dive into the growth and the positivity that K-12 ethnic studies courses produce not only in individuals but on a larger societal scale as well. Interviews will be transcribed and submitted at the University of Utah library with findings and final thoughts.

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## **Migration trends across the United States from the 1860's to present analyzed through Multi-Generational Pull and Ancestral Ties**

### **Jane Selander, Brigham Young University**

Faculty Mentor: Samuel Otterstrom, Brigham Young University

SESSION C (1:45-3:15PM)

POSTER C78

Generational migration across the United States over the past three centuries has contributed to the spread of peoples across the country and the growth in population across the United States. Cultural characteristics and generational pull have followed these people and diffused and coalesced into the American landscape over the generations following individual and family migration throughout the United States. My research uses queries of genealogical data from the FamilySearch database, which has over one billion names, and is owned by the Church of Jesus Christ of Latter-day Saints. I

illustrate a four generational imprint of Americans across the United States, by querying various base cities in the 1860's and 1870's for births of people and then tracing their lineage moving forward in time through generational mapping to the present day. From this analysis I illustrate the movement of generations from a central city and the cultural differences that impact the movement of generations across the United States. From this I am able to analyze the overall generational pull and influence of ancestral ties that exist in the different cities I study.

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**Social Sciences.**  
**Session C - Oral**  
**Presentations.**  
**Collegiate Room,**  
**Union**

SESSION C (1:45-3:15PM)  
COLLEGIATE ROOM, **A. Ray Olpin University**  
**Union**

Marriage, Divorce and Suicide Rates after the  
Great Recession

Seth Driggs, Brigham Young University

Olivia Black, Brigham Young University

Kathryn Grendell, Brigham Young University

Kimalie Nye, Brigham Young University

Samantha Bailey, Brigham Young University

Faculty Mentor Spencer James, Brigham Young University

SESSION C 1:45-2:00PM

Collegiate, Union

Social Sciences

The economic recession between 2008-2010 impacted many facets of life across the globe. For instance, marriage rates declined slightly while suicide rates rose as a result of the economic recession. We predicted that because of this change, during the recession in several Western countries, divorce and suicide rates would both increase. After the Great Recession, we predicted that marriage and divorce rates would be correlated among several Western countries. Using data from the Global Families Research Initiative at Brigham Young University, collated from different data sources such as the United Nations, the individual country's department of statistics, and through correspondence with international statistics bureaus, our results suggest that while divorce and suicide had a significant correlation between the years 2008-2019, marriage and divorce only were significantly correlated between 2013-2019. Marriage and suicide had no correlation for any of the years between 2008-2019. These findings suggest that as divorce rates rose, marriage rates fell during the few years during and after the recession. It was not until 2013 that marriage and divorce began to stabilize

together. Additionally, suicide and divorce appeared to rise in conjunction with one another and then fall and stabilize, and this is a pattern that has continued to present itself over the last decade.

## Residential Energy Use and Marriage

Olivia Black, Brigham Young University

Seth Driggs, Brigham Young University

Kimalee Nye, Brigham Young University

Kathryn Grendell, Brigham Young University

Samantha Bailey, Brigham Young University

Faculty Mentor Spencer James, Brigham Young University

SESSION C 2:05-2:20PM

Collegiate, Union

Social Sciences

The push for cleaner and smaller energy consumption grows ever stronger. While ideologies on which types of energy are best suited for preserving our planet while still sustaining a high standard of living is a lively debate, it might also be worthwhile to examine the impact that current social trends, specifically marriage, have on energy consumption. Using data collected from databases such as the United Nations, IEA, and individual national departments of statistics by the Global Family Research Initiative at Brigham Young University, we will examine global energy consumption and marriage rates to determine if marriage patterns coincide with energy

consumption patterns. The publicly available data from Western countries has led us to hypothesize that as marriage rates have declined in the past few years, energy consumption has increased. We plan on testing this hypothesis through regression analysis between marriage rates and energy consumption. Our results will be limited by the lack of data concerning cohabitation, roommates, or other forms of group living. Future studies could include more types of living arrangements and could split the study into regions to compare trends intra-regionally.

## Using the Health Belief Model to Understand Minority Families' Health Behaviors During the COVID-19 Pandemic

Max Buck, Utah State University

Faculty Mentor Sydney O'Shay, Utah State University

SESSION C 2:25-2:40PM

Collegiate, Union

Social Sciences

The ongoing COVID-19 pandemic has created significant stressors for families in all life circumstances and belonging to all different communities. With that being recognized, families belonging to minority racial and ethnic groups are impacted the most (CDC, 2020). Within those heavily impacted families, women tend to take on the most responsibility for education and protection of other family members (Lachlan et al., 2009; Seeger, 2019; Spence et al., 2008; 2011). Extant literature does



not fully capture the experience of individuals in this situation. This study takes a qualitative approach to better understand how mothers belonging to racial and ethnic minorities make decisions for their families about how to be safe and healthy during the COVID-19 pandemic. Our inquiry includes an investigation into how mothers of color negotiate varying expectations regarding safety precautions such as masking, social distancing, and vaccinations with other family members and with people outside of the family and how this relates to family identity. Twenty-three in-depth one-on-one interviews have been conducted with mothers who have identified as belonging to a racial or ethnic minority group and have at least one child 2-11 years old. Interviews cover participants' definition of what it means for their family to be safe and healthy, communication with others about their identity as a safe and healthy family, beliefs about COVID-19, and communication about protective actions that will be taken to avoid COVID spreading within the family. Interviews were transcribed and have been analyzed using Tracy's (2020) iterative approach. Preliminary analysis affirms the utility of HBM in better understanding the health attitudes and behaviors of mothers of color and their families during COVID-19. We are currently in the process of writing up our findings and will have complete findings ready for UCUR in February. Findings are expected to provide nuanced insight into health decision-making in families of color during COVID-19 and will be of interest to public health, crisis, and risk communication scholars as well as health practitioners.

## The Results of Depression on Motor Function

## Jasmine Jacobo, University of Utah

Faculty Mentor vincent koppelmans, University of Utah

SESSION C 2:45-3:00PM

Collegiate, Union

Social Sciences

There are over 350 million people suffering from major depressive disorder (MDD) worldwide. Roughly half of all these patients are resistant to first-line antidepressants [1]. While nearly all existing research in MDD has focused on cognitive and emotional domains, the research being conducted at the University of Utah research park is investigating motor function amongst individuals with depression along with the other characteristic. Depression is a common and serious medical illness that negatively affects mood, and one's actions. "Depression causes feelings of sadness and/or a loss of interest in activities you once enjoyed. It can lead to a variety of emotional and physical problems and can decrease your ability to function at work and at home" [2]. With the data collected from the investigation, we can find what treatment is best for the individual going further into diagnosis by looking at their neuro-motor responses and the correlation to accuracy. We hypothesize that depression amongst adults affects their motor skills over time and thus will lead to better approaches to treatment for mental disorders and the subtypes that follow. We propose to build models based on motor composite scores that reflect performance across all motor domains. Based on these data of MDD and control subjects, we expect to detect a significant difference in the following motor measures: 1) grip strength of the dominant and nondominant hand; 2) spiral tracing, 3) 4-meter walk test; and 4) errors made during the walking-while-talking test. In order to test whether these

variables are significant, we will furthermore analyze if motor behavioral measures measured while depressed patients are in their treatment phase are predictive of subtypes using statistical analysis. As for our future research, by integrating neurobiological measures obtained using MRI, we will be able to gain important insight into MDD etiology and the role of motor dysfunction in MDD [4]. This will also enable us to develop a better understanding of whether motor dysfunction among various MDD subtypes is transient, or permanent, and the degree to which it can be used as a valid biomarker.

**Social Work.**  
**Session C - Poster**  
**Presentations,**  
**Ballroom, Union**

SESSION C (1:45-3:15PM)

Location: **Ballroom, A. Ray Olpin University**  
**Union**

**New Leadership Academy's Effect on**  
**Leadership**  
**Andrew Koenig, University of Utah**

Faculty Mentor: Paton Roden, University of Utah

## SESSION C (1:45-3:15PM)

## POSTER C63

The New Leadership Academy (NLA) Fellows Program changes the expectations that surround leaders, leadership and leadership development across higher education. The learning strategies in forming the program's curriculum are premised on a recognition that the demographic, democratic, and discursive foundations on which modern higher education has been built are changing. As colleges and universities respond to these environments, leaders will require specialized knowledge and tools, as well as the personal and professional courage to be effective in what are clearly complex and highly contested environments. NLA began at University of Michigan and has since transferred to University of Utah, where it continues to advance the EDI work in higher education today. There are over 150 current NLA Alumni, who work at higher education and non profit organizations around the globe. This study hopes to help NLA understand its Alumni's experience and growth during and since they went through the leadership program, in the categories of leadership, application and self image, as well as equity, diversity and inclusion. This study will be mixed methods. We will engage in interviews, focus groups, and survey data collection in order to paint a picture of what the NLA experience looks like as a fellow. Results of this study will illustrate how NLA is helping training in equity-based leadership, as well as a categorical overview of the program. With these results we will be able to better understand the NLA experience, tailor our program to meet participants needs, and share the NLA story.

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## **Factors that Enhance the Nonprofit Board-Executive Relationship Jaxon Didericksen, Utah State University**

Faculty Mentor: Jayme Walters, Utah State University

SESSION C (1:45-3:15PM)

POSTER C64

**Background:** Literature on nonprofit leadership shows that the executive director (ED) and board relationship is crucial to the organization's success (1,8,10,14). The literature seeks to develop nonprofit governance models and define roles (2,3,4-5,7,11-13). The ED-board relationship has scant empirical evidence, including how to maintain it. **Purpose:** The present study targets youth-serving nonprofits in Utah and seeks to describe factors that enhance the ED-board relationship by answering the question, "What factors positively enhance the relationship between the executive director and the board?" **Methods:** The study applied a mixed-methods design, employing surveys and semi-structured interviews from March 2022-July 2022. Participants were EDs and board chairs from 6 organizations. Descriptive statistics were generated. First, descriptive coding and then pattern coding were used by two investigators to analyze transcripts (9). **Findings:** Six executive director-board chair pairs participated in the study. The average age of EDs was 42.5 years (range: 28 to 61). Board chairs were, on average, 54.8 years old (range: 43 to 66). Board chairs ( $\bar{x}$  = 1.97 years, range: 4 months to 4 years) had been in their positions less on average than EDs ( $\bar{x}$  = 6.7 years, range: 5.5 months to 25 years). The qualitative analysis revealed three patterns to understand factors that enhanced the executive-board relationship: Background, Roles, and Management.

Background is who a person is, including character traits; training and education; past professional experiences; and leadership skills. Roles regard what they do, including legal expectations; goals; board capacity needs; and level of engagement. Management refers to a board or executive director's decision-making processes, interactions with each other, task initiation, and ED autonomy. Conclusion: The data suggest that the ED's ability to engage and involve the board is critical to developing and maintaining a positive executive-board relationship. These findings can help EDs engage their boards and drive organizational success.

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# **Rural Community Sex Education: What does the Literature Tell Us About Evidence- Based Programming and Practices?**

**Brittany Hansen, Utah State University**

Faculty Mentor: Cris Meier, Utah State University

SESSION C (1:45-3:15PM)

POSTER C65

Background: Adolescence is an important time in life where youth establish health behaviors that persist as they age (Wiium, Breivik, & Wold, 2015). Some adolescents engage in risky health behaviors, such as participating in unprotected sexual activity (e.g., Amma & Martinez, 2017), which is associated with an increased (CDC), 2020). School (e.g., Daley et al., 2019) and community-based prevention programming (e.g., Cornelius et al., 2013) are ways to address risk-taking behaviors. As of 2018, the Utah State Board of Education requires “instruction in: community and personal health, physiology, personal hygiene, prevention of communicable disease, refusal skills, and the harmful effects of pornography” in a health classroom setting (Utah State Board of Education, 24 Jan 2018). However, Utah statute only requires that local education agencies adopt a curriculum of these skills or less. This is especially problematic as results from a recent study found that youth would like more sex education (Meier et al., 2022). Community sex education provides an opportunity to meet the needs of youth, however anecdotal information from the Utah Department of Health suggests that there are large gaps in community sex education-especially among rural areas.

USU Extension is uniquely situated to provide community sex education as they operate in all 29 counties. However, there is no sex education programming being provided by USU Extension at this time. Purpose: The purpose of this project was to conduct a comprehensive review of the community sex education literature to identify: (a) programs being used in rural communities; (b) brief intervention strategies that are supported by evidence; and (c) topics or preferred types of information to include in rural community sex education. Method: To examine the areas above, a systematic and comprehensive review of the literature was conducted utilizing the following search terms: (a) community sex education programs/practices; (b) effective community-based sex education; (c) sex education in rural school/communities; (d) sex education brief interventions; and (d) best practices for brief interventions in sex education. Results: The results of the comprehensive literature review fell within three areas. The first was sex education practices and included cultural competency, community trust building and partnerships, role playing, use of social learning theory, parent education and inclusion, counseling, and the use of peer educators. The second area was sex education content which included decision making, contraceptives, communication, peer pressure, and sense of self/self-confidence. Finally, the third area was brief interventions and included impacts of using a brief intervention strategy and examples of programming. Implications: This project has potential to impact the future of community sex education programming. These findings can be used to create more comprehensive courses for youth in rural communities.

# **Session D: 3:30PM - 5PM**



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**Engineering.  
Session D - Poster  
Presentations,  
Ballroom, Union**

SESSION D (3:30-5:00PM)

**Location: Ballroom, A. Ray Olpin University  
Union**

Intra-Sensor Variability and the Effects of  
Carbon Monoxide Concentration, Temperature,  
and Relative Humidity on Low-Cost Carbon  
Monoxide Sensors

## Evan Blanchard, University of Utah

Faculty Mentor: Kerry Kelly, University of Utah

SESSION D (3:30-5:00PM)

### POSTER D78

Poor air quality is linked to numerous adverse health effects, including heart attacks and premature death. Microclimates of poor air quality can occur in areas with concentrated vehicle emissions, such as pickup/drop off zones. Air quality monitoring in these microclimates can provide helpful insight about environmental, health, and safety concerns. However, these monitors can be costly and require specialized training. The purpose of this research is to characterize low-cost sensor performance with an emphasis on identifying emissions from idling vehicles. Specifically, we examined inter-sensor variability and the effects of temperature and relative humidity on the Alphasense CO-B4 carbon monoxide (CO) sensors. We designed and conducted laboratory testing to analyze each sensor's response to varying levels of carbon monoxide concentration, as well as atmospherically relevant temperatures and relative humidity levels. We found that there was low inter-sensor variability among twelve sensors. The average R-squared value from our linear regression of all sensors versus a reference measurement of carbon monoxide was 0.933. The average root mean square error (RMSE) was 118,979 microVolts. We also found that the temperature and relative humidity both affected sensor readings (in microVolts) and adding these two parameters improved the linear regression fit of the low-cost CO sensors compared to reference CO measurements. This research shows that we can measure CO concentration relatively accurately at \$138 per sensor. Cost effective, accurate air quality measurements can allow

individuals, communities, and policy makers to make informed decisions about exposure levels.

## Characterization of fluorine-free ski waxes

Lorenz Cushman, University of Utah

Faculty Mentor: Jeffrey Bates, University of Utah

SESSION D (3:30-5:00PM)

POSTER D80

Fluorocarbon-based ski waxes are known sources of per- and polyfluoroalkyl substances, which accumulate in both the human body and watershed during the application and use of many high-performance ski waxes. Fluorine is used to enhance the performance of the ski wax by altering its material properties. This project studies how to scientifically measure waxes' standard of performance and how this standard can be achieved with sustainable, fluorine free ski wax. By comparing commercial fluorine free waxes, we report which material properties are responsible for ski wax's performance and how materials characterization techniques can be utilized to quantitatively compare the performance properties of commercial ski waxes. Additionally, we demonstrate how these characterization techniques can be modified to account for the temperature dependence of the wax and its performance in a variety of snow conditions. Finally, we investigate how the addition of colloidal metals can impact the specific material properties of ski wax. Overall, this project will aid industry face the challenge of creating a sustainable, high performance ski wax by introducing quantitative, rather than qualitative, scientific testing and analysis.

## Colorimetric Assay for Pneumonia Screening Via the Volatile Organic Breath Biomarker, Heptane

Bailey Doucette, University of Utah

Faculty Mentor: Swomitra Mohanty, University of Utah

SESSION D (3:30-5:00PM)

POSTER D82

Pneumonia is the single largest infectious cause of death in children worldwide. Diagnosing pneumonia through a rapid and proactive method would increase the speed at which patients are treated and can recover. Volatile organic biomarkers (VOBs) are present in the breath of patients infected with pneumonia. One such VOB is heptane, which has been proven to be present in the breath of pneumonia patients. Pneumonia is usually diagnosed via chest X-ray, an expensive method of examination. This method of diagnosis is done after patients begin to exhibit symptoms. By engineering an inexpensive device that would detect heptane from the breath in an efficient way through colorimetry, patients could be diagnosed before symptom onset and treatments could start before damage could be done. To confirm the presence of heptane as one of the VOBs associated with pneumonia, *staphylococcus aureus* was cultured in our laboratory and the released VOBs were measured using GCMS. Heptane is of particular interest as it reacts with water bromine when exposed to UV light in a halogenation reaction. The water



bromine loses its characteristic orange-red color during the reaction. Thus, this reaction can detect heptane in patients' breaths in a point-of-care Pneumonia screening device. Colorimetric methods are used to analyze the concentrations of compounds. The concentration of a colored compound can be determined with a spectrophotometer. Utilizing a blue LED and an OPT101 monolithic photodiode, the concentration over time of water bromine within the water bromine heptane reaction was attained in a spectrophotometer. The engineered spectrophotometer in the initial part of this project was designed to run the heptane water bromine reaction within a cuvette between a blue LED and OPT101 monolithic photodiode. The spectrophotometer was characterized via calibration and used to detect concentration changes from the water bromine and heptane reaction.

## Developing Vibrotactile Sensory Feedback for TetraSki Adaptive Sport Equipment Jeremi Godbout, University of Utah

Faculty Mentor: Monika Buczak, University of Utah

SESSION D (3:30-5:00PM)

POSTER D84

The long-term goal of this research is to develop a wearable vibrotactile device to provide individuals with tetraplegia real-time haptic feedback from adaptive sports equipment. Tetraplegia affects 1.4 million Americans, and the number grows by thousands every year [1], [2]. Individuals with tetraplegia currently control adaptive sports equipment, such as an adaptive ski, with a "sip-and-puff" device; breathing into

a tube (sipping) command the ski to move left and breathing out (puffing) commands the ski to move right. A key limitation of the “sip-and-puff” controller is that there is no immediate feedback to indicate if the command was registered. Here we present the design and development a wearable vibrotactile array. The vibrotactile array uses six vibrating motors integrated into a wearable fabric that fits around the neck of an individual. Each vibrating motor is a 10-mm-by-2.7-mm disc. The six vibrating motors are arranged with a vertical pair along the spine and two horizontal pairs to the right and left of the spine. The vibrating motors can be controlled wirelessly through a central embedded microcontroller. Tactile feedback can be convey based on which motors are vibrating, or by increasing the intensity of the vibration. Future work will validate this device while the participants are actively skiing with adaptive sports equipment. This wearable vibrotactile feedback could be broadened to other mobility devices such as wheelchairs.

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## Efficient Computation of Grobner Bases for Partial Logic Synthesis of Arithmetic Circuits

## Bailey Martin, University of Utah

Faculty Mentor: Priyank Kalla, University of Utah

SESSION D (3:30-5:00PM)

POSTER D86

Digital circuits are custom-designed, which increases the likelihood of bugs. Despite efforts taken by engineers, a variety of unforeseen errors can occur. Formal verification is an approach that applies mathematical models and algorithms to prove or disprove that a design works as intended. An alternative to these methods is Symbolic Computer Algebra (SCA), which is a polynomial algebra-based model that can be used for arithmetic circuit verification. Computing a Grobner Basis utilizing these polynomials for ideal membership testing for verification has been found to work well for arithmetic circuits. Rectification for arithmetic circuits may be able possible by creating a modified Grobner Basis, which will be explored by this project.

## Real-Time Hand Pose Reconstruction using Flex Sensors

Mathias Schoen, University of Utah

Faculty Mentor: Edoardo Battaglia, University of Utah

SESSION D (3:30-5:00PM)

POSTER D88

The field of Human-Computer Interactions is one which grows in importance each and every year, due to the increasing

demand from medical, robotic, and tech industries for more streamlined methods of communicating with computer systems. While a variety of research and proposed solutions have gone into the field, this paper will focus on one specific aspect of the discipline: hand pose reconstruction. Many papers published in this field focus on the use of cameras – including depth, RGB, and others – to capture data and reconstruct specific hand poses. While this method has shown a fair level of success, a few prominent issues continue to exist, namely finger occlusion (where certain joints become hidden behind the hand) and the non-ergonomic design of fixed camera systems. In this paper we instead choose to explore a hardware-oriented approach, using a minimal suite of mounted flex sensors to gather data about the current joint angles at specific locations in the hand. Once this glove has been constructed and tested, the gathered data will be fed into a trained deep learning model in the hopes of accurately reconstructing various hand poses from minimal hardware data. Finally, to verify the collected data and results, the reconstructed hand poses will be compared with data acquired from a high-precision motion capture system.

## Does Angular Acceleration Provide New Insight into Functional Performance of Athletes?

Vincent Veibell, University of Utah

Faculty Mentor: Peter Fino, University of Utah

SESSION D (3:30-5:00PM)

POSTER D90

Returning from Injury: Current return to play (RTP) protocols after concussion assess an athlete's progress towards full recovery using self-reported symptoms without measurements of on-field performance. There is no consideration of one's functional performance, in part, because capturing objective measures of functional performance obtained on the field is difficult. The Catapult inertial measurement units (IMUs) system collects on-field kinematics which can be analyzed in external software after collection. However, the commercial system and pre-defined metrics do not quantify all features that are relevant to concussion recovery, such as angular motion. Before applying the system to RTP after concussion, the purpose of the study was to validate the Catapult player load metric, which is focused on linear motion, and construct additional metrics based on angular motion. Methods: To conduct a preliminary investigation, example Catapult data from one practice was obtained for one athlete. Predefined metrics at 10 Hz and raw IMU data at 100 Hz were extracted. Linear and angular jerk were calculated by taking the first and second derivatives of the acceleration and angular velocity data, respectively. To validate the commercial output of Player Load, the coefficient of determination ( $R^2$ ) compared the cumulative magnitude of linear jerk to Player Load at each instant in time.  $R^2$  values compared instantaneous jerk and angular jerk to determine if angular jerk provides additional information. Results: Our calculated linear jerk accurately reflected the Catapult player load metric ( $R^2=1.000$ ). Linear jerk explained 48.9% of the variance in angular jerk ( $R^2=0.489$ ). Discussion: Measures of linear and angular on-field motion can be captured using commercial systems currently being used in competitive athletics. As over 50% of the variance is not captured by

commercial standard input, angular jerk may provide new insight into assessing on-field movements and functional performance. Future work will implement existing linear and new angular metrics to investigate RTP after concussion.

## Design, Fabrication, and Optimization of 3D Printed Pressure Sensors

Derrick Wong, University of Utah

Faculty Mentor: Yong Lin Kong, University of Utah

SESSION D (3:30-5:00PM)

### POSTER D91

Total joint arthroplasty (TJA) remains as the only viable option for many arthritis patients no longer responding to non-surgical treatment. However, failure rates for TJA joint implants as reported by the American Association of Hip and Knee Surgeons have been found to be 5-10% 10 years post-operatively. Common factors for failure include fracturing, implant instability, and biocompatibility concerns. However, there is currently no viable solution for implantable devices that allows for monitoring in vivo. Here we show that wireless pressure sensors can be fabricated using additive manufacturing (3D printing), and that printed sensors yield a measurable signal in frequency space that may be effectively characterized for future application with implantable devices. To perform this project, we designed sensors using SOLIDWORKS, simulated them to better understand their characteristics, and measured successful prints using a network analyzer for comparison with simulated values. In the span

of this project, we performed five design cycles to iteratively optimize the sensor design. Each design involved adjustments to the inherent geometry of the previous design, in which we changed the intrinsic sensor properties to improve sensitivity and the observed frequency range. The findings from our design optimizations provide significant insight into improving the sensing ability of 3D printed pressure sensors, while also serving as a foundation for a finalized design that may be printed and further tested. We anticipate that the integration of 3D printed wireless pressure sensors has potential for future use in internal monitoring and improving clinical outcomes. The use of additive manufacturing for pressure sensors offers significant flexibility in fabrication and design geometry, which may be greatly useful in various biomedical device settings such as the previously mentioned implantable devices for joints.

## A Biodegradable and Conductive Ink as the Basis for Transient Electronics Sammi Yu, University of Utah

Faculty Mentor: Yong Lin Kong, University of Utah

SESSION D (3:30-5:00PM)

POSTER D92

The risk of infection from implants is compounded in cases with permanent implants because a second removal surgery is required. With second surgery, unwanted risks and infections are introduced which can then lengthen the hospital stay, increase healthcare costs, and endanger patients' lives. To

address this risk of second surgery infections, transient electronics are a potential solution by mitigating retrieval surgery completely. Transient electronics are defined by the ability to break down into non-toxic elements and dissolve, resorb, or physically disappear in physiological environments in a controlled manner. Many materials have these properties of biodegradability and non-toxicity however, they have not been discovered or synthesized before. Here we show the combination of a polymer called PBTPA and molybdenum (Mo) to create a biodegradable and conductive ink. We determined a synthesis process to mix specific ratios of Mo to PBTPA to optimize the ratio for conductivity and printability. By printing the ink using additive manufacturing, it allows us to create personalized electronics. Future applications of this ink may be used to print sensors that monitor the healing process of joints after surgery.

## Development of an accessible electrospinning process for distributed fabrication of high-efficacy masks

Hyunook Kim, Brigham Young University

Paul Walker, Brigham Young University

Faculty Mentor: David Fullwood, Brigham Young University

SESSION D (3:30-5:00PM)

POSTER D93

Mask filters are important for the protection of



the community in the event of a pandemic or to protect people from pollutants endemic to our major cities. N95 has been the standard for an effective filter in the medical industry, but such masks were not readily available as the COVID 19 pandemic unfolded. Our goal is to develop a filter production method that could be fabricated by a cottage industry, if necessary, using a method designed to be both accessible and inexpensive. Electrospinning is the process of using an electronic force to pull polymers out of solution and make nanofibers. Layering these fibers on top of each other creates membranes that can be used as filters in masks. To develop a robust process based upon this method, we explored the effects of different environmental and process variables on the resultant membrane. Specifically, we study how process parameters can be changed to optimize the membrane's performance as a filter and thereby create a reliable, replicable process for creating membranes. This study focused on a range of influential process parameters, including the distance of the electrospinning needle from the membrane surface, the needle gauge, the flow rate, and the mass concentration of the solution. The influence of these parameters on the resultant fiber diameter and effective filtration of the membrane was quantified. The results of the study lead to the design of a robust, effective and accessible process

for spinning N95-compliant membranes that may benefit communities in all quarters of the world.

**Engineering.  
Session D - Oral  
Presentations,  
Dumke  
Conference,  
Alumni House**

**SESSION D (3:30PM – 5PM)**

**Location: Dumke, Alumni House**

Effects of Gas Flow Rates and Sample Position  
on Carbon Nanotube Growth

Grant Ogilvie, Brigham Young University

Isaac Harriman, Brigham Young University

Faculty Mentor Brian Jensen, Brigham Young University

SESSION D 3:30-3:45PM

Dumke, Alumni House

Engineering

The goal of this experiment was to better characterize the effects of gas flow rate and sample position on carbon-infiltrated carbon nanotubes (CICNTs) grown via chemical vapor deposition (CVD) on a silicon substrate. Methods: 18 batches of 3 samples each (52 samples) were prepared by CVD coating silicon wafer substrates with alumina (400nm) and iron (4nm). Standard processes were generated for creating CICNT samples, with carbon nanotube (CNT) growth at 750C and subsequent carbon infiltration at 900C. In each batch, samples were positioned linearly with samples located centrally, downstream, and upstream in the furnace. Three batches had -20% gas flows (both hydrogen and ethylene), three batches had standard gas flows, and three batches had +20% gas flows. The experiment was then repeated with hydrogen flow held constant (only the ethylene was varied). Results: At all gas flow rates for both experiments, samples that were located further forward in the tube furnace had larger CICNT diameters and increased CICNT heights. Increasing the flow rate of both gases increased the nanotube diameter on average, but the average height of the nanotubes was greatest at standard flow rates. Preliminary results from the second experiment indicated that varying only the ethylene concentration had a negligible effect on CICNT diameter. We saw clear correlations between sample position in the furnace and CICNT diameter and height. Our

results also indicated that variation in hydrogen flow rate has a greater effect on nanotube growth than the ethylene flow rate.

## Increasing Infiltration Time During Carbon-Infiltrated Carbon Nanotube Growth Results in Increased Nanotube Diameter Michelle Arias, Brigham Young University

Faculty Mentor Brian Jensen, Brigham Young University

SESSION D 3:50-4:05PM

Dumke, Alumni House

Engineering

Carbon-infiltrated carbon nanotube (CICNT) surfaces are cylindrical sheets of carbon atoms with a honeycomb molecular structure. CICNT possess structural anti-biofilm activity against bacteria. Their ability to prevent the formation of these biofilms depends on specific parameters, including the average nanotube diameter. Nanotube growth occurs when carbon-rich gas flows over certain surfaces in a high temperature furnace. This study develops a growth method for CICNT diameter changes on Ti6Al4V, a titanium alloy commonly used as a medical implant material due to its strong biomechanical properties. For this experiment, we analyzed the effect of carbon infiltration times on average nanotube diameter. Ti6Al4V samples were cleaned and prepared for nanotube growth by the deposition of a barrier layer of alumina, followed by a catalyst layer of iron. The prepared samples were then placed in a furnace with hydrogen gas flowing. A nanotube growth step was performed at 750 degrees

Celsius for 1 minute with ethylene and hydrogen gasses flowing. During this phase the nanotubes gain their height. Following the growth step, an infiltration step was performed at 900 degrees Celsius at times ranging from 2 to 16 minutes, with three samples in each group. During this phase the nanotubes grow in diameter. Once the CICNT samples were completed they were imaged in a scanning electron microscope (SEM) to determine the average diameter of each sample. These diameters were correlated with infiltration time, and it was found that there was a strong positive linear correlation between infiltration time and CICNT diameter,  $d = 18.8833t - 30.8409$  where  $d$  represents the diameter in nanometers and  $t$  is the time in minutes. These results illustrate that the CICNT infiltration time can be fine-tuned to control nanotube diameter, which will allow us to better investigate the mechanism behind the way they affect bacterial biofilms.

## Data Aggregation for Discrete Equipment

Damon Gale, Brigham Young University

Faculty Mentor Yuri Hovanski, Brigham Young University

SESSION D 4:10-4:25PM

Dumke, Alumni House

Engineering

Industry 4.0 is a new initiative in manufacturing to apply modern, cutting-edge technologies on the manufacturing floor with the goal of accessing real-time data monitoring, gain performance insights, facilitate informed decision-making, reduce waste, and enhance market agility. Some of the Industry 4.0 technologies being developed include industrial internet

of things (IIOT), augmented reality, big data analytics, and machine learning predictions; all of which rely on a foundation of unified connection throughout the factory. The unique challenge facing manufacturers is the aggregation of data from the wide range of equipment utilizing disparate machine protocols present in their factory. This research demonstrates how to connect to several discrete pieces of equipment and aggregate that data in one location. This is done using PTC Inc. Kepware and ThingWorx software products. Kepware is a connectivity platform that can translate disparate protocols and tunnel data to ThingWorx, an industrial data solution platform, which then aggregates the data. To validate the use of Kepware and ThingWorx in a diverse industrial hardware setting, connections between Kepware and an Allen-Bradley PLC, a Siemens PLC, Fanuc Robot (GE open), UR Robot (Modbus), Manual Mill (Toshiba Motor Controller), Manual Lathe (via Lab View OPC UA), and Haas CNC mill (MT Connect) were established. Then data points from each piece of equipment were defined in ThingWorx. Resulting in unified connectivity with aggregated data from discrete industrial equipment. Setting the foundation for further Industry 4.0 implementation across the factory.

## Stabilizing Wireless Communication for a Tissue Bioimpedance Diagnostic Device

Nathan Hansen, University of Utah

Faculty Mentor Benjamin Sanchez, University of Utah  
SESSION D 4:30-4:45PM

Dumke, Alumni House  
Engineering

The purpose of this research is to develop further The User Tongue Electronic System, a Bluetooth-based device capable of measuring volume conduction properties of the tongue. These electrical properties can be used to detect changes in tongue composition and quantify the progression of dysphagia and dysarthria, common symptoms of neurological diseases such as Amyotrophic Lateral Sclerosis (ALS, a.k.a. Lou Gehrig's Disease). The device combines the convenience of a non-invasive measurement approach with the repeatability of quantitative data. The device currently uses Bluetooth communication to send tongue bioimpedance information to an Android application, but the application experiences frequent crashes, and Bluetooth communication has been unreliable. The first phase of this project replaces the current Bluetooth communication hardware with a WiFi-based communication system, which will potentially provide increased stability and robustness to the device. The app interface will be redesigned based on Human Factors Engineering practices. Measurements made with the WiFi device will be compared with Bluetooth device measurements and statistically analyzed for repeatability. All measurements will be made using printed circuit board devices that simulate tongue electrical impedance. If proven robust, the WiFi-based device will be prepared for deployment in future clinical trials. This presentation will highlight the physical underpinnings of the device and how the WiFi device performs compared to the Bluetooth device.



**Engineering.  
Session D - Oral  
Presentations,  
Ballroom,  
Henriksen, Alumni  
House**

**SESSION D (3:20-5:00PM)  
Location: Henriksen Room, Alumni House**

## Post-Aggregation Data Visualization

Todd Lainhart, Brigham Young University

Faculty Mentor Yuri Hovanski, Brigham Young University

SESSION D 3:30-3:45PM

Henriksen Room (1st floor), Alumni House

Engineering

Industry 4.0 is the current initiative being implemented in manufacturing lines. Part of the initiative is to connect the different systems and protocols of the factory together into a single connection that can communicate with all of them. This connection allows for data from various machines and systems to be stored together. This communication includes the aggregation, visualization, and implementation of data. Only through visualization and implementation does data become valuable. As manufacturing lines collect data, the volume of it can quickly become hard to decipher and collate by hand. Thus, a system of visualization is needed to enable workers and managers to gain value from the data stored. The research describes a possible solution and use for collected data through visualization and implementation. This study is done using PTC Inc. products, specifically through an established ThingWorx server with Kepware connections to Allen-Bradley and Siemens PLCs. Kepware is a system-connection software that translates different machine protocols and sends the collected data to ThingWorx, a web-based platform that aggregates the information sent to it. The data was visualized on a single platform called a dashboard in various formats such as tables, graphs, current value displays, and state-based displays. As there are several different formats of data continuously being collected, different implementations

included a table that kept track of information from current and previous orders, a pareto chart that keeps track of defect type counts, and graphs that depict uptime and throughput. Because these visualizations are all contained within the same platform, a user can quickly use each capability without needing to move between screens or locations. This allows for greater efficiency and a faster response to errors and problems.

## Neuromorphic Computing with Randomly Assembled Nanowire Networks

### David Reinhardt, Brigham Young University

Faculty Mentor David Wingate, Brigham Young University

SESSION D 3:50-4:05PM

Henriksen Room (1st floor), Alumni House

Engineering

Neuromorphic computing utilizes analog electrical circuits that mimic biologic neural networks. This form of computing shows promise of outperforming classical computers at a fraction of the power draw. Recently, metallic nanowire networks have been investigated as potential neuromorphic computing devices, often composed of polymer-coated silver nanowires deposited onto a flat surface. Due to their 2D geometry, these nanowire networks are unable to accurately reflect the complexity of 3D biological neural networks. 3D nanowire networks have a higher concentration of interconnections than 2D networks which could allow for the training of more complex computational functions. We have manufactured large 3D Nickel Nanostrand networks and

trained them to perform similarly to an XOR logic gate. The networks are manufactured by suspending nickel nano strands in a resin matrix which is then trained iteratively using a combination of low and high electrical currents. We are currently refining the training algorithm for the networks and are simultaneously working to identify the physical changes that occur in the network as it is trained.

## Thermal Management of Embedded Electric Vehicle Wireless Charging Systems

Conner Sabin, Utah State University

Faculty Mentor Abhilash Kamineni, Utah State University

SESSION D 4:10-4:25PM

Henriksen Room (1st floor), Alumni House

### Engineering

High-powered wireless charging systems for heavy-duty vehicles such as semi-trucks encounter large temperature increases in high-power circuitry. The lack of knowledge regarding heat dissipation between roadway material and wireless charging systems is a research gap that has previously limited cost-effective and durable designs. Multi-physics simulation can determine power loss and heat rise within the system but is insufficient at determining heat transfer between the wireless charging system and the roadway due to nonlinear parameters and lack of traditional cooling methods. This simulation deficiency leads to results that approximate heat transfer to the roadway with low accuracy. Some researchers have improved simulation results by experimentally measuring

thermal effects. Testing wireless charging systems embedded in concrete improves simulation results, but experiments are time intensive and costly. The purpose of this research was to utilize a novel testbed and simulation process for rapidly optimizing the thermal management of high-power wireless charging systems. This technique uses timely experimental results from a “fluidized bed” to refine nonlinear simulation results. A fluidized bed uses pressurized airflow to cause solid particles like grain, iron ore, or sand to behave like a fluid. This fluidization process is used to easily insert and remove wireless charging systems from a fluidized bed of sand as shown in figure 1. This process will allow researchers to obtain experimental thermal results between wireless charging systems and sand in a few days rather than the concrete-embedded time of two to three months. A fluidized bed is used for rapid prototyping of thermal management designs and results of sand-embedded tests are used in simulation to predict more accurate performance of concrete-embedded systems. This novel testbed and simulation technique will increase the speed with which accurate concrete-embedded thermal simulation can be created.

## Demonstration and analysis of thin-cell electrochemical measurements in molten LiCl-KCl eutectic

Cameron Vann, Brigham Young University

Faculty Mentor Devin Rappleye, Brigham Young University

SESSION D 4:30-4:45PM

Henriksen Room (1st floor), Alumni House

### Engineering

Analyte concentration in traditional low temperature electrochemistry is solvation limited, but in molten salts solvation limits can be much higher. However, voltammetry measurements, which are predominately used in molten salt, are bounded to diffusion-limited ranges ( $<5\text{-}10\text{wt}\%$ ). Advanced nuclear technologies such as electrorefining and molten salt reactors require sensors that can measure analyte concentrations  $>10\text{wt}\%$ . Thin-cell electrochemistry is not limited in concentration as other electrochemical measurements, and thus is a promising option for measuring these higher ( $>10\text{wt}\%$ ) concentrations. For this reason, thin-cell apparatuses and techniques have been developed for use in molten salts. These apparatuses can take low-latency measurements and have been tested in concentrations from  $1\text{-}50\text{wt}\%$ .

**Engineering.  
Session D - Oral  
Presentations.  
Sorenson, (2nd  
floor), Alumni  
House**

**SESSION D (3:30-5:00PM)**

**Location: Sorenson (2nd floor), Alumni House**

**Evaluating and Comparing the Effects of  
Domain Resolution in WRF**

## **Hans Klomp, Brigham Young University**

Faculty Mentor Bradley Adams, Brigham Young University

SESSION D 3:30-3:45PM

Sorenson, (2nd floor), Alumni House

### **Engineering**

With the greater Salt Lake area (GSLA) growing rapidly every year, it is important to understand how metropolitan growth can affect local meteorology. The physical layout and anthropogenic heating in urban environments can cause an increase in temperature up to 7° C relative to a comparable rural area, which often leads to higher levels of PM2.5 and ozone. The Weather Research and Forecasting Model (WRF) can predict meteorological behavior of the GSLA. The use of modeling techniques like an Urban Canopy Model (UCM), and Local Climate Zones (LCZ) can improve the representation of urban characteristics. These tools give specific classifications to different parts of the GSLA and allow us to compute data regarding temperature, wind speed, humidity, and an array of other variables. A more accurate representation of the urban environment allows for better simulation results. To assess the impacts of future growth scenarios, a baseline model of current urban properties and meteorological conditions must be established. Part of this process is to assess model sensitivities to discretization parameters. In this case computational domain resolution. Resolution is determined by how many grid cells of uniform size can reside within the domain. More grid cells with smaller areas within the domain give a higher resolution and more precise results but take longer to calculate. Fewer grid cells per domain result in lower resolution which saves time and allows for more simulations, but at the cost of precision.



This presentation discusses how grid resolution was changed and the resulting differences in predicted meteorological properties. Results showed that predicted temperatures varied based on grid size for a downtown location.

## **Micro-DIC as a method to measure through-thickness strain in CBT specimens**

### **Addison McClure, Brigham Young University**

Faculty Mentor David Fullwood, Brigham Young University

SESSION D 3:50-4:05PM

Sorenson, (2nd floor), Alumni House

Engineering

Continuous bending under tension (CBT) is a sheet metal forming process during which a material is repeatedly passed through a series of rollers. CBT has been observed to significantly increase a material's elongation to failure (ETF), meaning the material will stretch further before breaking. This process ultimately improves the formability of sheet metal at room temperature, making metals stronger and lighter without the need for more expensive heating processes. Digital image correlation (DIC) is a non-contact optical method used to measure the deformation of a material subjected to a load. This research aims to determine if DIC can be used to measure through-thickness strain in CBT specimens at the microscale. Micro-DIC was used to measure strain in titanium samples. To do this, a DIC pattern was applied to the edge of each sample using a microstamp. Pictures were taken of the stamped

region throughout the CBT process using a variety of imaging methods, including cameras and optical microscopes. The strain in the sample was then calculated by tracking the displacement of the pattern across images. From initial testing, we can conclude that microstamping for through-thickness DIC can be used to successfully measure the strain of CBT specimens at the microscale. This new methodology can be used in a wide variety of applications. In CBT experiments, micro-DIC allows us to study local deformation, which is critical in determining how CBT increases a material's ETF. More generally, micro-DIC is a relatively accessible method that can obtain extremely detailed strain data.

## **Surrogate Fold Hinges: Replacing Paper Folds in Origami**

### **Phebe Ramsdell, Brigham Young University**

Faculty Mentor Spencer Magleby, Brigham Young University

SESSION D 4:10-4:25PM

Sorenson, (2nd floor), Alumni House

Engineering

Origami has been practiced for generations, but only recently have we seen relevant usage of this art form emerge in technological applications. These applications have been found in space arrays for a compact design during space travel, uses in the biomedical world for surgical technology, and can even be utilized in safety products such as a Kevlar ballistic barrier, an easy set up bullet proof shield for police officers. With

applications, comes the need for designers and manufacturers to consider specific hinges used for unique origami-based mechanisms. A traditional hinge will come with complications as enhanced complex mechanisms come into play. Therefore, compliant hinges are most advantageous concerning problems such as thickness accommodation and fabrication. Differing materials create difficulty because it may add flexibility or stiffness in the mechanism which will affect how the surrogate folds bend. With the help of current technology, we have researched existing surrogate fold joints that could be used as compliant hinges. Using this research, we are creating a surrogate fold characterization database. This tool will give designers the chance to consider the properties of their origami-based mechanism during the design stage, then use the database to select hinges that will fit their specific criteria. This surrogate fold characterization database will cut out time spent testing folding motion with a prototype. It will grant the engineer an efficient tool of determination, in which they can choose a compliant hinge that optimizes the function of their origami-based mechanism.

## **Refining a WRF-Based Urban Canopy Model for the Greater Salt Lake Area Natalie White, Brigham Young University**

Faculty Mentor Bradley Adams, Brigham Young University

SESSION D 4:30-4:45PM

Sorenson, (2nd floor), Alumni House

Engineering

The greater Salt Lake area (GSLA) has experienced

significant urban growth in recent years, which is expected to continue. This urbanization is contributing to the development of an urban canopy. An urban canopy describes the effects of urban land cover characteristics on meteorological conditions, including temperature, humidity, and wind speeds. Urban canopies are associated with increased temperatures and greater concentrations of pollutants such as ozone. The Weather Research and Forecasting (WRF) model, when used with an urban canopy model (UCM), can provide valuable information on the effects of future urban growth scenarios. The research conducted focused on two aspects of model development, including the implementation of local climate zones (LCZs) and the selection of a land surface model (LSM). Local climate zones allow for a greater number of land cover categories, more precise mapping of said categories, and the customization of urban parameters for each category. LCZs affect WRF outputs such as temperature, humidity, and wind speeds. Their proper use has been shown to increase the accuracy of the model and has potential to create more accurate predictions for future urban growth scenarios. Land surface models control the representation of different physical processes, such as surface flux. The Noah Scheme (the unified NCEP/NCAR/AFWA scheme) was compared with a 5-layer thermal diffusion scheme and the more advanced Noah multi-physics scheme. The effects of these different methodologies on WRF outputs, including temperature, were evaluated to determine which LSM can most accurately represent the GSLA in the WRF-based UCM model. Development of an accurate WRF-based Urban Canopy model for the GSLA will provide more reliable information on the effects of future urban growth scenarios for the Greater Salt Lake Area specifically. Findings

from this research and the resultant model can be used for the same purposes in other locations.

**Health and  
Medicine. Session  
D - Poster  
Presentations,  
Ballroom, Union**

**SESSION D (3:30-5:00PM)  
Location:Ballroom, A. Ray Olpin University  
Union**

**Change of Motion: The Revolutionary  
Shoulder Brace  
Ryland Day, Utah Tech University**

Adam Dimaio, Utah Tech University

Justin LeClair, Utah Tech University

Syrus Miner, Utah Tech University

Faculty Mentor: Vinodh Chellamuthu, Utah Tech University

SESSION D (3:30-5:00PM)

POSTER D1

The majority of physical therapy patients do not achieve their desired outcomes. Due to the recent global pandemic, many physical therapy patients were unable to attend appointments and the communication between physical therapists and patients was negatively impacted. This led to patients not knowing what they should be doing to get better or even maintain their progress without the correct equipment. New and improved remote and virtual meeting technologies have the potential to make physical therapy more convenient and accessible. We plan to develop a method to increase the number of patients reaching a positive result with their physical therapy through modern technologies; a smart at home physical therapy product that is paired with an app along with a box of equipment and supplements specific to the needs of the patient's area of focus. Each part of this product will give patients the necessary aids to achieve their long-term physical therapy goals. Advances in technology can bring the physical therapists and the patients closer together with the ability to click on an assigned exercise and learn how it needs to be done with a video or recording would be a game changer for a lot of recovering patients. Having access to the right equipment or supplements to help the healing process advance would be very beneficial as well. This is a preliminary idea within our

interdisciplinary group of a mechanical engineer, biomedical science, and computer science background.

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## **A Transcriptomic Analysis of Triple Negative Breast Cancer Revealing Alternative Drug Therapeutics**

### **Mauri Dobbs, Brigham Young University**

Faculty Mentor: Brett Pickett, Brigham Young University

SESSION D (3:30-5:00PM)

POSTER D2

Breast cancer is the most common tumor type in men and women combined; this year the National Cancer Institute estimates there will be 290,560 new cases in the United States and 43,780 deaths (2022). Triple Negative Breast Cancer (TNBC) lacks three typical surface markers of breast cancer-estrogen receptor (ER), progesterone receptor (PR), and human epidermal growth factor receptor 2 (HER-2)-which are common targets for endocrine or drug therapy, severely limiting TNBC treatment options. 40% of TNBC patients will die within five years of diagnosis (Yin 2020). Additionally, it has heightened risk for metastasis after neoadjuvant chemotherapy (defined as chemotherapy followed by surgical extraction of the tumor) compared to non-TNBC (Liedtke 2014) and the post-surgical recurrence rate of TNBC is as much as 25% (Yin 2020). The poor prognosis and low success rate of surgical treatment



and chemotherapy underline the necessity of new treatment options. Discovery of new drugs would enable better treatment of TNBC and could greatly improve patient survival. Using a computational workflow, Automated Reproducible MODular Workflow for Preprocessing and Differential Analysis of RNA-seq Data (ARMOR), we identified differentially expressed genes in TNBC cells. Publicly available RNA-sequencing files were obtained from the National Center for Biotechnology Information (NCBI) Gene Expression Omnibus (GEO) database. ARMOR used RNA-sequencing data from high-throughput sequencing and massively parallel computing to map and quantify the sequencing reads from each clinical sample to the human transcriptome. We determined genes that are overexpressed or underexpressed compared to healthy cells. We then contextualized the genes identified by ARMOR into signaling pathways using SPIA (Signaling Pathway Impact Analysis). Our third software, Pathways2Targets contains a drug database and elucidates drugs that have known interactions with these enriched signaling pathways, ranking them based on how many pathways they can target. Our findings predicted existing, FDA-approved drugs that could be relevant therapeutics for TNBC, which can then be evaluated in future experiments and clinical trials. These results could improve survival rates and quality of life for patients with TNBC.

#### Literature Cited:

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## Potential role of multivitamins in down-regulation of acyl peptide enzyme hydrolase

Brenen Halliday, Weber State University

Faculty Mentor: Tracy Covey, Weber State University

SESSION D (3:30-5:00PM)

POSTER D3

Acyl peptide enzyme hydrolase, abbreviated as APEH, is a cytosolic protease with both exopeptidase and endopeptidase activities. APEH is primarily responsible for the removal of N-terminal acetylated amino acids from its peptide substrates; however, APEH can also internally cleave proteins that have become oxidized (hence is also called Oxidized Protein Hydrolase). APEH appears to play a cytoprotective role since it has been reported to have reduced activity in type-two diabetes, Alzheimer's disease, and various cancers. One mechanism of APEH's reduced activity comes from enzyme inhibition by inflammatory mediators, suggesting that diseases associated with chronic inflammation would have reduced APEH activity. A recent paper showed that APEH enzyme can be activated with various tea extracts and this activation of APEH may be included among the many health benefits of drinking tea. For this project, we are building on that work by investigating other potential activators of APEH. To start, a

selection of vitamins has been considered and is being tested to identify activators of APEH using enzyme kinetics. Finding additional activators with known chemical structures is beneficial to elucidating how APEH is regulated in the cell. Understanding how APEH can be activated may be therapeutically-desired in diseases associated with APEH down-regulation and chronic inflammation.

## **Vascularization of Renal Organoids Using Chorioallantoic Membrane**

### **Hayden Johns, Utah State University**

Faculty Mentor: Justin Jones, Utah State University

SESSION D (3:30-5:00PM)

POSTER D4

The incidence of chronic kidney disease is growing globally, including in regions unable to provide the appropriate infrastructure to care for patients. Furthermore, while the standard therapies of dialysis and kidney transplantation are life-saving, these are costly, pose health risks, and leave patients with a decreased quality of life. Thus, it is imperative to develop new therapies to accommodate the increasing number of renal failure patients. To this end, cell-based tissue engineering and regenerative medicine approaches have provided viable avenues toward alternative treatment opportunities. Previous work in our lab and others showed that renal organoids possess different nephron cell populations, including proximal tubule, loop of Henle, distal tubule, and glomeruli-presenting an excellent opportunity to

use these organoids for therapeutic development. Although utilizing the renal organoids to generate kidney tissues is a potential solution, in vitro development of large tissues greater than 200 $\mu$ m in diameter is challenging due to a diffusion limitation, leading to necrosis. Establishing vascularization of organoids would avoid necrosis and permit continued maturation of renal tissue. To demonstrate this hypothesis, we explored the possibility of vascularizing renal tissue organoids using a chorioallantoic membrane (CAM) model to promote tissue growth and maturation. Renal organoids were derived from induced pluripotent stem cells using differentiation factors (CHIR and FGF9). After differentiation, cells were aggregated and matured into organoids for five days in vitro. A subset of these organoids was encapsulated in a collagen hydrogel and incubated for culture, while the remainder were cultured as free organoids for three weeks. The organoids were implanted onto the CAM of 5-day chick eggs, and images were taken daily with a stereoscope to evaluate morphological changes. After seven days in ovo, the organoid samples were embedded in paraffin, sectioned, and stained with hematoxylin and eosin (H&E) stain to assess tissue morphology. Alcian blue and picrosirius red stains were performed to detect off-target differentiation, such as chondrogenesis. Immunohistochemistry (IHC) was performed to identify the early and mature vascular markers, MCAM and CD31, respectively. After analysis we found that endothelial cells were not present within the organoids- suggesting no vascularization had occurred-but unencapsulated organoids implanted onto the CAM did grow into larger tissues. However, all groups of organoids showed evidence of off-target chondrogenesis, likely due to the hypoxic conditions generated by this lack of vascularization

and integration. This finding demonstrates that the CAM may have supported the organoids enough to delay severe hypoxia. Although the CAM was unable to vascularize the organoids in this experiment, future studies in supplementing growth factors such as VEGF into hydrogel constructs or implantation onto a better controlled in vitro vascular bed may provide better outcomes for organoid-derived tissue growth and maturation.

## Characterization of Potent Antibiotic Compounds Produced by Bacteria Found in the Soil Around BYU Campus Michael Moran, Brigham Young University Hogan Turner

Faculty Mentor: Richard Robison, Brigham Young University  
SESSION D (3:30-5:00PM)

### POSTER D5

With the threat of antibiotic-resistant bacteria on the rise, the need for new antibiotics has never been greater. This is especially true when it comes to Gram-negative bacteria, against which relatively few antibiotics are effective. While the soil and its microbes have historically been a goldmine of antibiotics, researchers have come up empty-handed in recent years. *Bacillus* is one such microbial genus found in the soil that is known to produce a variety of antimicrobial agents. This genus produces a variety of antimicrobial agents, of which bacitracin and polymyxin are two of the most well-known. In this study, we isolated *Bacillus* species from the dirt around BYU campus and screened them against four target strains

(*Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Mycobacterium phlei*) to observe their antimicrobial activity. Interestingly, we found that seven of our isolates demonstrated broad-spectrum activity against all four of our target strains. We screened these seven isolates against nine clinical strains of methicillin-resistant *Staphylococcus aureus* (MRSA) and 31 carbapenem-resistant *Enterobacterales* (CRE) strains, and found that four of our isolates had activity against the vast majority of these target strains. While the exact identity of our isolates remains unknown, we are working to isolate and characterize the potent antibiotic compounds being produced by our isolates. Additionally, we hope to annotate our isolate's genomes to discover what genes encode the antibiotic compounds.

## Generation of Point Mutants in the ETV6 gene in Primary Human Megakaryocytes

Puja Batchu, University of Utah

Faculty Mentor: Jesse Rowley, University of Utah

SESSION D (3:30-5:00PM)

POSTER D6

The ETV6 gene encodes a protein transcription factor (TF) that represses gene activity. Mutant ETV6 function is linked to predisposition to leukemia, lower platelet counts, and functional platelet defects. We generate pathogenic ETV6 mutations in megakaryocytes (MK), the precursor cell of platelets, to test mutation effects on ETV6 function and MK development. Since the ETV6 TF is a repressor, we predict

that mutations will cause overexpression of ETV6 responsive genes involved in platelet function and hematological disease. Platelets are anucleate and cannot be directly edited. Instead, CRIMSON (CRISpr edited MKs for rapid Screening of platelet gene functiONs) edits primary human CD34+ cell derived MKs. CRIMSON uses the CRISPR Cas-9 system, coupled with single stranded DNA (ssDNA) donors and inhibitors of nonhomologous end joining to promote homologous directed repair (HDR) in MKs. This system incorporates a single strand of DNA harboring the mutation of interest. Literature review identified mutations that affect platelets including R339C, R418G, P214L, and R396Q. Multiple CRISPR guide RNAs and ssDNA donors were made using a CRISPR HDR Design Tool that computes the number of base pairs to cut site and predicted accuracy. Each guide was transfected into MKs to test efficiency (data quantified and analyzed with sanger sequencing). Transfections were successful at all 4 sites, but cutting efficiencies were low, except for 2 guides targeting the R339C mutation, which had a cutting efficiency up to 83.8%. Next, the 2 guides and different ssDNA homologous donors harboring the R399C mutation were tested for HDR efficiency, and we identified a ssDNA/guide combination that yielded efficient generation of the R399C mutation in MKs. Genetically edited MKs will be used to create platelets that will be tested for RNA expression changes, and changes in platelet function. This will provide insights on how ETV6 mutations affect platelet function in hematological diseases.

## **Fetal hematopoietic stem cell metabolism in response to varying prenatal folate**

## **status**

### **Victoria Chiou, University of Utah**

Faculty Mentor: Anna Beaudin, University of Utah

SESSION D (3:30-5:00PM)

#### **POSTER D7**

Folate-mediated one carbon metabolism is essential for de novo nucleotide synthesis, cellular methylation, regulation of mitochondrial metabolism. These processes are critical to the maintenance and development of hematopoietic stem cells (HSCs). HSCs are generated during fetal development and are responsible for generation of all blood cells across the lifespan. Universal folic acid supplementation of the population is currently utilized for the prevention of common birth defects, but there are currently no known studies on the influence of prenatal folic acid supplementation on the development of HSCs. To examine the effects of prenatal folic acid supplementation on HSC function, wild type C57BL/6 female mice were weaned onto one of three diets, 0mg/kg (folate deficient, FD), 2mg/kg (folate control, FC), or 8mg/kg (folate supplemented, FS), and mice were timed mated to generate litters under each condition. Both FD and FS significantly decreased fetal weights at embryonic day (E)14.5 as compared to FC offspring. Despite growth restriction, profiling of the developing hematopoietic compartment using flow cytometry at E14.5 revealed overall expansion of all blood cells in response to FD as compared to FC offspring, whereas all blood cells were significantly reduced in FS offspring. Increased blood cells in FD offspring were driven by expansion of HSCs and all downstream progenitor and mature cells. In contrast, FS caused decreased mature myeloid and lymphoid cells at E14.5, whereas



hematopoietic stem and progenitor cells (HSPCs) were unaffected. To determine the underlying mechanisms of varying prenatal folate on hematopoietic output, we metabolically profiled E14.5 HSPCs to determine OXPHOS (oxidative phosphorylation) and glycolytic activity. Preliminary results show that FS offspring exhibited higher rates of glycolytic activity as compared to FC offspring. Additionally, FS offspring had higher OXPHOS activity per cell as compared to FC offspring. These data reveal that prenatal folate alters HSPC metabolism during fetal life.

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## **Renal Dendritic Cells are Necessary for Salt-Sensitive Hypertension**

### **Sami Davis Glad, University of Utah**

Faculty Mentor: Brandi Wynne, University of Utah

SESSION D (3:30-5:00PM)

POSTER D8

Hypertension is a cardiovascular condition that affects 1.4 billion people worldwide, and in one year, is either the primary or contributing cause of death for more than half a million people in the United States alone. The kidneys play a crucial role in the maintenance of electrolytes, such as sodium, and regulate blood pressure. Considerable studies have also shown that hypertension has an immune component. Cytokines are produced by innate immune cells and studies in both animal models and humans have demonstrated increased levels of interleukin 6, (IL-6) correlates with hypertension. Our

laboratory recently showed that IL-6 can increase activation of distal sodium transporters in the kidney, leading to reduced sodium excretion. We hypothesize that mice without renal-specific dendritic cells will have reduced sodium transporter expression and lower blood pressure. To test our hypothesis, we implanted radiotelemetry devices in C57Bl6 (Wt) and mice lacking renal dendritic cells (rDCs) (CX3CR1-eGFP<sup>+/+</sup>) to measure blood pressure (BP) at baseline and following induction of salt-sensitive hypertension (SS-HTN) with a nitric oxide synthase inhibitor (L-NAME) and high salt (HS, 4%). Kidneys were removed and cryosectioned, and then stained for sodium-glucocorticoid kinase (SGK1), the sodium-chloride cotransporter (NCC) and the epithelial sodium channel, (ENaC $\gamma$ ) using immunofluorescence. SGK-1 is a regulatory kinase for ENaC and NCC, which then regulate sodium balance, thus also affecting blood pressure. Slides were imaged and total fluorescence was analyzed using FIJI. Our data showed no differences in baseline BP between Wt and rDC-depleted mice; however, we found a reduced SS-HTN response in rDC-depleted mice. Our preliminary data suggest an increase in SGK-1 expression with HS diet, which was reduced in mice without rDCs. This suggests that rDCs may contribute to SS-HTN, possible through increases in regulation of sodium channels. These studies will help us to better understand the role dendritic cells play in the retention of sodium during hypertension, and develop better treatments for SS-HTN.

## **International Trade Networks and the Prediction of Trade Mediated Pathogens**

## Eliza Diggins, University of Utah

Faculty Mentor: Melodie Weller, University of Utah

SESSION D (3:30-5:00PM)

POSTER D9

The emergence the COVID-19 pandemic and its continued prevalence in the human population has illustrated significant obstacles to infectious disease surveillance and prevention on a global scale. While a great deal of research has been done on the impact of globalization on human-human transmission of pathogens, significantly less focus has been placed on the role that the international trade of food commodities might play in the spread of pathogens. Additionally, the rising threat of climate change poses significant challenges to both the stability of the global food supply, and to the resilience of staple crops to pathogens capable of impacting humans. A model was designed to improve surveillance of these pathogens by analyzing their associated epidemiological data to determine country and commodity of origin. To that end, in this work we illustrate a method for constructing directed trade-networks (DTNs) of the specific trade routes employed by countries when importing a specific commodity. This methodology utilizes the unparalleled accuracy of the UN Comtrade Database to provide the underlying data for the network construction process. We then consider the properties of these networks and describe how to use our analysis framework to identify potential source commodities and countries of a given pathogen. This is done through comparison of network topology and international infectious disease datasets. Two main approaches are explored, namely correlation measures and structural break methods between the networks and the pathogen related dataset of interest. The analyses described will

support future evaluation of trade-related, infectious disease events in their ability to identify the likely source of a particular pathogen. Furthermore, the application of this approach to model commodity-linked pathogens could be a versatile tool for informing policymakers on the potential epidemiological threats posed by trade policies.

## Fully Magnetically Levitated Continuous Flow Left Ventricular Assist Device: Are We There Yet?

Tanner Frahm, University of Utah

Faculty Mentor: Rami Alharethi, University of Utah

SESSION D (3:30-5:00PM)

### POSTER D10

Purpose: Despite improvements in the continuous flow (CF) durable left ventricular assist device (LVAD), hemocompatibility complications are still the major contributor to morbidity and mortality post implant. The Abbott Heartmate 3 (HM3) is the only FDA approved LVAD as bridge to transplantation (BTT), bridge to decision (BTD) and destination therapy (DT). The purpose of this study is to compare the survival and rate of neurological and hemocompatibility complications including mucosal bleed and pump thrombosis in patients (pts) from our center supported with the HM3 to previous generations of LVADs: the Abbott HeartMate II (HM II) and the Medtronic HeartWare (HW). Methods: The Utah Artificial Heart Program database

was queried for pts supported with CF LVADs from 2004-2022. Patient hemocompatibility outcomes were retrospectively quantified. Rate ratios, confidence intervals, and significance testing were calculated with Poisson Tests for independence. Post-implant survival was calculated with Kaplan-Meier estimation. Survival was compared with log rank tests. 23 pts were excluded from adverse event analysis due to lack of follow-up. P-values <0.05 were considered significant. Results: 231 pts were implanted with CF LVADs at our center, HM3 n = 36, HM II n = 85, HW n = 103 with average age  $56 \pm 13.8$  yrs, 22% female and INTERMACS profile 3 being similar across all devices. The intent of therapy was comparable across the three devices. In comparison to both HM II and HW, the HM 3 was associated with statistically significant lower occurrence of almost all hemocompatibility complications and superior survival rates (Table). Conclusion: In this large single-center study, the fully magnetically levitated CF LVAD (HM3) outperformed the other generations of CF LVAD (HM II and HW) in both post-implant survival and rate of hemocompatibility complications. These results imply that the HM3 takes us a step closer towards the goal “there”.

## **Control of Isolation Induced Aggression through Activation of Medial Prefrontal Cortex Pyramidal Neurons**

**Jordyn Gagon, University of Utah**

Faculty Mentor: Moriel Zelikowsky, University of Utah

## SESSION D (3:30-5:00PM)

## POSTER D11

The effects of social isolation are felt deeply throughout many populations. One example is prison inmates who have been placed in solitary confinement are more likely to experience suicidal ideology, irritability, and aggression. Furthermore, mouse models have shown social isolation in mice increases aggression in comparison to group-housed animals. Previous work has established that mPFC pyramidal neurons project to multiple subcortical aggression centers, and that activation of such neurons in mPFC reduces aggression. Despite this, no work has focused on how this population of neurons may regulate social isolation-induced aggression nor have these neurons been studied in females. Here, we expand on previous work by examining whether activation of mPFC pyramidal neurons reduces aggression in socially isolated female mice. To this end, we infused a virus encoding the excitatory DREADD, hM3D, fused to mCherry, under control of the CaMKII promoter into the mPFC of female C57Bl6/N mice (N=8). A virus expressing mCherry without the hM3D DREADD under the control of the CaMKII promoter was used as a control (N=9). Following surgery, all mice were socially isolated for 4 weeks to induce aggression. After isolation, a within subject's design was used to examine the impact of DREADD-mediated activation on aggression. Each animal was tested twice on the resident intruder assay- once in which the DREADD ligand, Deschloroclozapine (DCZ) administered via i.p. injection and once with vehicle- 48 hours apart. The viral conditions were counterbalanced such that half the animals in each viral condition received DCZ on the first test day and half received an injection of the vehicle. Activation of mPFC pyramidal neurons significantly decreased aggression

in isolated mice (Repeated Measures ANOVA,  $p < .05$ ). These results support the hypothesis that the mPFC plays an inhibitory role in aggressive behavior, and mPFC pyramidal neurons are essential to this inhibitory control.

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## **Estimating the Impact of COVID-19**

### **Interventions on the Effective**

### **Reproduction Number**

### **Alicia Horn, University of Utah**

Faculty Mentor: Lindsay Keegan, University of Utah

SESSION D (3:30-5:00PM)

POSTER D12

There have been many different attempts to measure the efficacy of mask mandates on the spread of airborne diseases, many of which focus on different aspects of disease transmission and prevention. One such method described by Britton is by comparing the relative reduction in reproductive number ( $E_{fm}$ ) pre- and post-intervention. We used the methods outlined in Britton to calculate the  $E_{fm}$ , following three key dates: June 28th, 2020 the date of the Salt Lake and Summit County mask mandates, November 9th, 2020 the date of the Utah State-wide mask mandate and April 10th, 2021 the date when all mandates were lifted except in Salt Lake City. The  $E_{fm}$  was calculated for each county in the state, 28 days before and after each mandate. Our results showed that most counties had a reduction in the growth rate of cases after the county wide and state wide mandates were put into

place. There was a greater reduction in reproductive numbers after the introduction of the Salt Lake and Summit County mandates compared to the change in Efm after the statewide mandate. This could be a result of county level mask mandates already being in effect across the state at the time of the introduction of the statewide mandate, leading to a reduced reduction in cases because of the mandates already in place. When the mask mandates were lifted, the Efm rose across the state in several counties, indicating that the reproductive number grew after the mandate was lifted. By studying the interventions that were used for this pandemic, we can be better prepared for future pandemics.

Citation: Britton, Tom. "Quantifying the preventive effect of wearing face masks." *Proceedings. Mathematical, physical, and engineering sciences* vol. 477,2251 (2021): 20210151. doi:10.1098/rspa.2021.0151

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## **Challenges to the ability of EMS systems to locate an emergency in low-resource settings: a qualitative study**

### **McKenna Hunt, University of Utah**

Faculty Mentor: Sudha Jayaraman, University of Utah

SESSION D (3:30-5:00PM)

POSTER D13

Efficient pre-hospital emergency care can significantly improve healthcare outcomes. Difficulty locating the



emergency is a significant challenge, contributing to inefficiency in pre-hospital care. The goal of this study was to describe challenges emergency medical response (EMS) teams face in Rwanda locating emergencies & to explore potential opportunities for improvement. We conducted 21 in-depth interviews with 4 stakeholder groups representing the EMS response system in Rwanda: ambulance dispatchers, ambulance field staff, receiving hospital staff, & policymakers. Interviews covered participants' perspectives on the challenges related to locating an emergency, how challenges impact quality of pre-hospital care, & what opportunities exist for process/tool development. Audio recorded interviews lasted 30-90 minutes each. Transcripts were coded using NVivo into 3 domains: the process of locating an emergency, impacts of challenges, & opportunities for processes/tools.

The current process of locating an emergency was hampered by lack of supportive technology, dependence on individual's local knowledge to describe the location, & inefficient communication channels for sharing location (e.g., between caller, dispatch, ambulance). Challenges in locating an emergency led to longer response times, inconsistencies in rapid response based on an individual's knowledge of the area, & communication difficulties. Interviews also revealed 3 types of opportunities to improve the location of emergencies: technology to geolocate an emergency accurately & better time response, improvements in communication to allow for ambulance access to real-time interaction between the caller & dispatch, & better location data from the public. Timely EMS response is essential for optimal clinical outcomes, but significant challenges exist in locating emergencies. There is an urgent need to implement locally relevant solutions to improve the efficient location of emergencies in Kigali, Rwanda.

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## **Characterization and Stability of Fluorescent Ultrasmall Porous Silica Nanoparticles for Use in Image-Guided Treatment of Peritoneal Metastasis**

**Kylee McManus, University of Utah**

Faculty Mentor: Shreya Goel, University of Utah

SESSION D (3:30-5:00PM)

POSTER D14

Peritoneal metastases are growths that arise from the shedding and implantation of cancerous cells from ovarian, gastric, colorectal or extraperitoneal (breast, lung) origin in the peritoneal cavity [1]. These metastases are typically treated through combination therapies such as surgery and chemotherapy. However, full tumor resection is challenging, and the incomplete removal of cancerous tissue can lead to recurrence in the patient. Thus, there is a need for fluorescent guided probes for use in tumor resection as they offer high specificity and real-time capabilities [2]. Nanocarriers have the potential to deliver drugs and imaging tracers to tumor sites and accumulate at targeted locations, allowing for improved diagnosis and therapy. Ultrasmall Porous Silica Nanoparticles (UPSNs) (hydrodynamic diameter (HD)  $\sim 15$  nm) have demonstrated enhanced tumor uptake, evasion and timely hepatobiliary clearance profile [3]. We synthesized the UPSNs and evaluated them for size, surface charge, and morphology using Dynamic Light scattering and Transmission electron

microscopy. Surface modification of UPSN with polyethylene glycol (PEG) allowed long blood circulation and amine groups provide facile chemistry for conjugation. Stability of UPSNs were monitored at 4°C and 25°C to assess the shelf life under different storage conditions. UPSNs were tested in animal models of cancer metastasis. Results: UPSNs maintain stability for up to 90 days at both 4°C (HD:  $17.65 \pm 2.82$  nm, PDI  $0.026 \pm 0.0056$ ) and 25°C (HD:  $12.81 \pm 3.46$ , PDI  $0.078 \pm 0.02$ ). Biodistribution assessment of Cy5 conjugated particles (UPSN-Cy5) in mouse models of peritoneal metastasis of gastric cancer using optical imaging suggested the selective uptake of UPSN-Cy5 in tumors with improved specificity compared to ICG, an FDA-approved fluorescent probe, allowing for complete resection of metastatic tumor nodules in all mice tested. Overall, UPSN have the potential to serve as a powerful tool for localized and precise treatment of cancer through fluorescent molecular-guided surgery.

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## **Barriers with Recruitment and Retention of Diverse Populations in Psychological Research**

**Melika Moeinvaziri, University of Utah**

Faculty Mentor: Scott Langenecker, University of Utah

SESSION D (3:30-5:00PM)

POSTER D15

Psychological Research has struggled to recruit and retain individuals of more diverse populations. While diverse

populations contribute valuable information to research, many individuals of these backgrounds do not participate in research. Many of these research lab participants are white and wealthy, which does not match up with the average population's demographics. Participants in research should reflect the diversity of our culture and conditions, taking into account race, ethnicity, gender, age, etc. The lack of diversity among research participants has serious ethical and research consequences (Palmer & Burchard (2022)). Research demographics should reflect the diverse population that we have in the United States and all over the world. The purpose of this study is to examine the barriers to the recruitment and retention of diverse populations in psychological research. This study will examine how these barriers affect psychological research and how we can improve access and retention of more diverse populations

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## **Structural Patterns in ON Cone Bipolar Synapses of Mammalian Retina**

### **Taylor Otterness, University of Utah**

Faculty Mentor: Crystal Sigulinsky, University of Utah

SESSION D (3:30-5:00PM)

POSTER D16

Purpose: Connectivity within the nervous system is precise and disruptions lead to disease, yet the rules governing this connectivity remain unknown. Recent efforts have shown that different types of ON cone bipolar cells in the neural retina

show preferences in the selection and frequency of presynaptic structure types used for signal transmission. However, it is not yet known if these differences are related to the quantity and type of postsynaptic partner. The goal of this study was to analyze the synaptic output of CBb6 cells, a type of ON cone bipolar cell with diverse presynaptic structure types to identify patterns in how ON cone bipolar cells interact with their postsynaptic partners. Methods: The rabbit connectome dataset (RC1) used in the study was sampled from a 0.25mm diameter patch of mid-peripheral retina from a healthy 13 month old female Dutch-Belted rabbit and serially sectioned at 70 nm. The resulting sections were imaged at ultrastructural resolution (2nm/px) using transmission electron microscopy. Postsynaptic partners of CBb6 cell 6156's bipolar-specific presynaptic structures (multi-ribbons, single ribbons, and ribbonless synapses) were annotated to classification using the Viking Viewer for Connectomics. Statistical analyses were conducted in Microsoft Excel and investigated further with 3D rendering and graph visualization of connectivity. The factors tracked for comparison were presynaptic structure type, target number, and postsynaptic partner type. Results: Although the ribbonless presynapses of 6156 were restricted to single postsynaptic partners, both single and multiribbon presynapses showed one or two partners, but only single ribbons exhibited more than two postsynaptic partners, despite some multiribbon synapses containing up to 6 ribbon structures. As the different presynaptic structure types are thought to differ in neurotransmitter release (ribbonless < single ribbon < multiribbon), these findings are inconsistent with scaling of presynaptic structure type with the number of postsynaptic targets. Preliminary partner classification reveals that amacrine and ganglion cells were both found postsynaptic to all

presynaptic structure types and some cells received input from 6156 by multiple presynaptic structure types. More detailed analyses of partner type are ongoing. Conclusion: The preliminary findings from this study suggest that the presynaptic structure type may not correlate with either the number or type of postsynaptic targets for this particular cell type. Ongoing efforts aim to further classify the partner cells and analyze more CBB6 cells. Future efforts will look at ribbon size and cumulative postsynaptic area to determine if those measures are better predictors. If and how these findings extend across other ON cone bipolar cell types will be important for understanding why these cell types differentially utilize these presynaptic structure types and together will inform our understanding of the connectivity rules driving synapse formation in the retina and possibly the brain.

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## **An optogenetic model of hemispatial neglect permits real-time induction of rightward spatial bias**

**Claire Park, University of Utah**

Faculty Mentor: Nick Frost, University of Utah

SESSION D (3:30-5:00PM)

POSTER D17

Hemispatial neglect is a disorder of spatial processing characterized by inability to attend to stimuli situated contralateral to lesions affecting the parietal cortex.

Hemispatial neglect is a poor prognostic indicator following stroke. Critically, while neglect is often marked by loss of attention to visual or somatosensory stimuli, clinical tests in which patients replicate simple figures or draw from memory reveal that neglect is a disorder not of information storage or attainment, but of spatial processing. Specifically, while spatial information may be stored or represented on an allocentric coordinate system, it must be mapped onto egocentric coordinates in a process which depends on the posterior parietal cortex. Indeed, lesion studies in humans as well as in rodents have revealed the importance of this region in the expression of neglect. However, more recent work has revealed that spatial processing requires a distributed network and a number of connected regions are also implicated in neglect. Lesion studies by their nature are limited by the static permanence of the lesions. We sought to create an inducible model of hemispatial neglect using stereotactic delivery of AAV-halorhodopsin to the posterior parietal cortex in mice, permitting the reversible optical silencing of this region by light. We show that in the presence of green light delivered via an optic fiber, mice develop a rightward bias. We will next utilize this inducible model of neglect while recording from large numbers of neurons in the dorsal hippocampus or prefrontal cortex to understand how the PPC influences spatial processing during goal-directed navigation.

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## **Examining the Relationship between Air Quality Trends and Glycemic Outcomes Among Patients With Type 2 Diabetes**

## **Mellitus.**

### **Catherine Petersen, University of Utah**

Faculty Mentor: Ramkiran Gouripeddi, University of Utah

SESSION D (3:30-5:00PM)

POSTER D18

Type 2 diabetes mellitus (T2DM) is a chronic condition caused by insulin resistance and metabolic dysfunction. T2DM is associated with many diabetes related complications, including heart disease, vision loss, and kidney disease. Long term exposure to ultrafine components of particulate matter with an aerodynamic diameter  $\leq 2.5 \mu\text{m}$  (PM<sub>2.5</sub>) can cross the pulmonary alveolar membrane and direct inflammatory effects on target organs, leading to oxidative stress and increased insulin resistance. While several studies have identified a relationship between PM<sub>2.5</sub> concentrations and onset of T2DM, few have examined the role of air pollution on glycemic outcomes after T2DM diagnosis. Continued exposure to PM<sub>2.5</sub> may worsen glycemic control and metabolic dysfunction, contributing to poor glycemic outcomes and increased morbidity/mortality in individuals with T2DM. Thus, 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 for 143,434 individuals with an eligible ICD-10 diagnosis code for T2DM from 2010-2022 were selected for analysis. PM<sub>2.5</sub> concentrations were extracted from the Environmental Protection Agency's (EPA) Air Quality System in Davis, Utah, and Salt Lake counties. Air pollution exposure profiles were created for one year after the date of a patient's initial



diagnosis. Preliminary analysis was performed using a kShape time-series clustering with 12 clusters, creating a visual representation of individual exposure for one year following diagnosis, making patterns in air pollution exposure more apparent. Analysis is ongoing and it is hopeful that the results of this study will elucidate the role of PM<sub>2.5</sub> 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.

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

**Jessica Venegas, University of Utah**

Faculty Mentor: Arabella Young, University of Utah

SESSION D (3:30-5:00PM)

POSTER D19

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 across 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

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 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. 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.

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# **The Effect of Concussion on Speech**

## **Production**

**Shu Yang, University of Utah**

Faculty Mentor: Peter Fino, University of Utah

SESSION D (3:30-5:00PM)

POSTER D20

Concussions can affect mobility and cognitive performance, and these impairments can interfere when tasks are completed concurrently (e.g., dual-tasking). As impaired speech fluency is a co-existing symptom of brain damage (ASHA, 2022), and walking while talking is a common daily dual task, this study aimed to examine how concussion alters speech fluency when sitting and walking. Our primary hypothesis was that concussion would impair speech fluency when combined with a mobility task. Specifically, longer and more frequent pauses during the speech were expected to indicate cognitive impairment (Bobba et al, 2019). The secondary hypothesis predicts both groups would exhibit a decline in speech fluency when walking compared to sitting. A total of 22 participants with a recent mTBI and 19 healthy individuals were provided informed written consent for this IRB-approved study. Participants completed two one-minute talking tasks: talking while sitting down (single-task) and talking while walking back and forth in a hallway (dual-task). Participants selected two topics from a predefined list and were instructed to speak for the entire minute while audio was recorded. The number and total duration of pauses during the speech were measured and compared between groups using independent t-tests. The control group showed significantly longer and more frequent pauses in dual-task (pause number  $p=0.0107$ ; pause duration

$p=0.0289$ ); while the mTBI group conveyed similar pause frequency for both single-task and dual-task yet longer pause duration in the dual-task (pause number  $p=0.8344$ ; pause duration  $p=0.0197$ ). A between-group comparison indicated the differences between the control and mTBI groups were not statistically significant. These results suggest that speech fluency is affected by walking. But the primary hypothesis cannot be rejected because subject differences for pre-mTBI speech fluency cannot be determined and speech fluency, in general, varies from person to person.

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## **Characterization of GJA1-20k Expression in the AC16 Proliferating Cardiomyocyte Cell Line**

**Zane Zobell, University of Utah**

Faculty Mentor: Joseph Palatinus, University of Utah

SESSION D (3:30-5:00PM)

POSTER D21

Connexin 43 (Cx43) is the main gap junction protein found in the heart. Previous studies have shown that the gene that codes for Cx43 (GJA1) produces multiple alternatively translated proteins, the most abundant product of this alternative translation is 20kd in size and is named GJA1-20k (20k). Recent work has identified GJA1-20k as a stress response protein and its expression in the setting of ischemic injury reduces infarction size and oxygen demand in the heart. The AC16 cell line is a human cardiomyocyte derived cell line that

readily divides in culture, making it an ideal cell model for myocardial cell signaling studies. The purpose of this study is to characterize GJA1-20k expression in this cell line to facilitate mechanistic understanding of the pathways regulating GJA1-20k signaling. We performed western blotting to determine that GJA1-20k is present in the AC16 cell line and this was confirmed with GJA1 siRNA knockdown. When compared to other cell types, the GJA1-20k band in AC16 cells appears as a doublet which disappears with phosphatase treatment indicating that GJA1-20k is phosphorylated in the AC16 cell line. As GJA1-20k has been established as a stress response protein, we treated AC16 cells with Ionomycin and TPA to induce oxidative stress and determine whether 1) endogenous GJA1-20k expression increased and 2) whether exogenous GJA1-20k expression reduces the degree of cell injury death in response to oxidative stress in this cell line. The ultimate goal of this project is to determine whether the AC16 cell line recapitulates the phenotype observed in vivo in response to GJA1-20k expression.

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## **Developing a Novel Fluorogenic-Based Assay to Measure Chaperone Mediated Autophagy Degradation Capacity in Cells and Tissues**

**Anila Jonnavithula, University of Utah**

Faculty Mentor: Rajeshwary Ghosh, University of Utah

## SESSION D (3:30-5:00PM)

## POSTER D22

Pathologies including cancer, neurodegenerative, and cardiovascular diseases, are caused by the accumulation of misfolded/damaged proteins. Intracellular protein degradation mechanisms play a critical role in the clearance of these disease-causing proteins. Chaperone mediated autophagy (CMA) is a protein degradation pathway that employs chaperones to bind proteins, bearing a unique KFERQ-like motif, for delivery to a CMA-specific Lysosome Associated Membrane Protein 2a (LAMP2a) receptor for lysosomal degradation. To date, steady-state CMA function has been assessed by measuring LAMP2a protein expression. However, this does not provide information regarding CMA degradation activity. To fill this dearth of tools / assays to measure CMA activity in cells and tissues from preclinical models, we generated a CMA-specific fluorogenic substrate assay. Methods: A KFERQ-AMC [Lys-Phe-Asp-Arg-Gln-AMC(7-amino-4-methylcoumarin)] fluorogenic CMA substrate was synthesized from Solid-Phase Peptide Synthesis. KFERQ-AMC when cleaved via lysosomal hydrolysis causes AMC to release and fluoresce (Excitation:355 nm, Emission:460 nm). Using an inhibitor of lysosomal proteases, i.e., E64D [L-trans-Epoxy-succinyl-leucylamido(4-guanidino)butane)], responsible for cleaving CMA substrates, the actual CMA activity was determined. Essentially, CMA activity = (substrate)fluorescence - (substrate+E64D) fluorescence. To confirm specificity of the KFERQ sequence for CMA, scrambled peptides served as negative controls. Results: Heart, liver, and kidney lysates containing intact lysosomes were obtained from 4-month-old adult male mice (n=6 tissue samples/group). First, lysates incubated with KFERQ-AMC displayed a time

dependent (0-5 hour) increase in AMC fluorescence vs. lysates incubated with scrambled peptides. These data validate the specificity of KFERQ for CMA. Of note, liver exhibited the highest CMA (6-fold;  $p < 0.05$ ) > kidney (2.4-fold) > heart (0.4-fold) at 5-hour. Second, E64D prevented KFERQ-AMC degradation, substantiating that KFERQ-AMC is degraded via lysosomes. Third, cleavage of KFERQ-AMC and resulting AMC fluorescence was inhibited in H9c2 cardiac cells transfected with LAMP2a vs. control siRNA. These data suggest LAMP2a is required for KFERQ degradation. Conclusion: We have generated a novel CMA activity assay for use in cells and tissues in a variety of experimental contexts.

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## **Proopiomelanocortin Deficiency and Effect on Sexual Behavior in Mice**

Kimberly Argyle, Utah Valley University

**Lauren Guerrero Silva, Utah Valley University**

Faculty Mentor: Zoe Thompson, Utah Valley University

SESSION D (3:30-5:00PM)

POSTER D23

Proopiomelanocortin (Pomc) is a gene expressed primarily in the arcuate nucleus (ARC) of the hypothalamus. The products of this gene include melanocyte stimulating hormone, adrenocorticotropin hormone (ACTH), and beta-endorphin.

Alpha-MSH is involved in both sexual behavior and appetite regulation. ACTH is a peptide hormone that plays a role in glucocorticoid secretion from the adrenal cortex, and beta-endorphin is an opioid peptide that is closely linked to pain management and reward signaling. This makes Pomc a powerful influence on overall health, particularly in relation to body weight and fertility. Mutations in the Pomc gene result in significant deficiency of Pomc expression. In humans, this translates to extreme hyperphagia, early onset (and extreme) obesity, hypocortisolism, light skin, and red hair pigmentation. It also seems to affect pubertal development. Several of these effects are also apparent in a mouse model of Pomc-deficiency. We are interested in using this mouse model to help us determine the cause for the observed infertility experienced by Pomc-deficient mice, and potentially Pomc-deficient individuals as well. We plan to specifically evaluate the differences between wild-type (control) mice and affected POMC-deficient mice in precursor sexual behavior, libido, adherence to copulatory norms, and ultrasonic communication. We will capture both video and audio recording of the sexual behavior interactions between Pomc-deficient male mice with wildtype female mice, as well as with Pomc-deficient female mice with wildtype male mice. We will compare these recordings to the interactions observed between male and female wildtype mice. These results will help us to understand whether Pomc-deficient exhibit normal sexual behavior, and how that may affect their reproductive success. This will also help us learn more about the relationship between Pomc expression and overall reproductive function that may exist in humans as well.

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## **Staying Hydrated – A Comparative Analysis of Humectants in Human Skeletal Muscle Tissue**

**Rachel Prince, Brigham Young University**

**Joseph Monsen, Brigham Young University**

Faculty Mentor: Jason Adams, Brigham Young University

SESSION D (3:30-5:00PM)

POSTER D24

Humectants are an important class of compounds that attract and retain water within a cell. These substances are commonly used in skincare products to prevent the outer layers of the skin from drying out. Humectants also serve a similar purpose in tissue preservation and prevention of decomposition of cadaveric specimens. As there have been few comparative studies analyzing the effects of different chemicals on the preservation of cadaveric tissue, we designed an assay consisting of wet-dry analysis to compare the effects of three common humectants (glycerol, propylene glycol, and ethylene glycol) on water retention in skeletal muscle tissue. We submerged equally sized sections of human skeletal muscle tissue in differing concentrations of each of the three humectants for 24 hours. Subsequently, we placed the tissues in an incubator at 60°C weighing the tissue after 12 hours. Finally, we calculated the percent difference between the original tissue mass and the tissue mass after drying in the incubator. We created a concentration gradient for each humectant to identify the optimal concentration of each compound for water absorption and retention in the tissue. We then performed a second set of experiments to compare the ideal concentrations

of the humectants under the same conditions. With our preliminary experiments we found that tissue submerged in 15% volume/volume propylene glycol absorbed and retained the most moisture. We plan to carry out similar studies centered around other human tissues to create a tissue library as well as to provide an evidence-based standard for wetting solutions used in anatomy labs.

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## **Cost-Effectiveness of Addressing Retinopathy of Prematurity in Rwanda**

**Connor Alder, Brigham Young University**

Faculty Mentor: Mike Brown, Brigham Young University

SESSION D (3:30-5:00PM)

### **POSTER D25**

Introduction. With the expansion of neonatal care in sub-Saharan Africa (SSA), an increasing number of premature babies are at risk of retinopathy of prematurity (ROP).<sup>1,2</sup> Many neonatal intensive care units in SSA are unable to provide adequate care for these infants due to problems such as nursing shortages and a lack of oxygen supplementation equipment. Previous studies have quantified the cost-effectiveness of addressing ROP in middle-income countries<sup>3</sup>, but few have focused on SSA. This study estimates the cost of ROP screening and anti-VEGF injection treatment in Rwanda compared to the economic burden of untreated ROP. Methods. Medical cost data were collected from King Faisal Hospital in Kigali, Rwanda during July 2022. The financial burden of blindness included the increased costs of education and lost income (with inflation adjustment). Published data on the epidemiology and natural

history of ROP were used to estimate the annual burden and sequelae of ROP in Rwanda.<sup>1</sup> The country-level cost of screening and treating a one-year birth cohort was compared to the lifetime cost of not addressing ROP for the same cohort (US dollar). Results. The cost of ROP treatment is \$736 per infant. The lifetime cost of blindness amounts to \$200,339 per infant. The total country-level cost of screening and treating ROP for a one-year birth cohort is \$2,084,122, with the burden of blindness despite adequate treatment being \$29,650,172. Not treating the same cohort results in a lifetime cost of blindness of \$69,918,311. Conclusion. The cost of anti-VEGF treatment for ROP is substantially less than the indirect cost of blindness due to ROP. Allocating additional funding towards expansion of ROP screening and treatment would be an effective means of reducing the economic burden of blindness due to ROP.

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## **Biomarker discovery in triple negative breast cancer using RNA-sequencing**

## analysis

Jenna Birchall, Brigham Young University

Faculty Mentor: Brett Pickett, Brigham Young University

SESSION D (3:30-5:00PM)

POSTER D26

Breast cancer is the most common form of cancer, and afflicted over 2.2 million people in 2020. The sheer volume of patients that are afflicted with breast cancer warrants the need to continue research and discovery efforts to improve treatment options. Triple negative breast cancer (TNBC) affects 10-15% of breast cancer patients. Unlike other forms of breast cancer, TNBC does not have estrogen or progesterone receptors and makes little to none of the HER2 protein. Due to the lack of these biomarkers that are typical treatment targets for other kinds of breast cancers, hormone therapy and drugs that target other breast cancers are generally ineffective against TNBC. This leaves chemotherapy and radiation therapy as the main treatment options. Although chemotherapy and radiation have treatment benefits, the recurrence rate after treatment is around 40%. Furthermore, these treatment options are very detrimental to the body, resulting in a weaker patient and a necessary recovery time between treatments. In this study, we analyzed publicly available RNA-sequencing data to identify the upregulated and downregulated transcriptional mechanism(s) that play a role in TNBC compared to healthy breast tissue. The analysis of the RNAseq data was completed with the Automated Reproducible Modular Workflow for Preprocessing and Differential Analysis of RNA-seq Data (ARMOR), which identified differentially expressed genes. The ARMOR program trims, maps, and quantifies the mRNA

sequencing reads to the human transcriptome for each sample. We then applied a Random Forest algorithm, which is an artificial intelligence-based classification method to identify new biomarkers that best differentiate TNBC cells from healthy cells, which may expand the treatment options for TNBC. We identified specific transcriptional biomarkers for TNBC that could be used as therapeutic targets. These novel targets may broaden the efficacy of treatments for patients with TNBC.

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## **Increased Intake of Alpha-Linolenic Acid is Associated with Higher Exam Scores**

**Jazmin Vilches, Weber State University**

Daniel Christensen, Weber State University

Jonah Christensen

Faculty Mentor: Joanna Gautney, Weber State University

SESSION D (3:30-5:00PM)

POSTER D27

Roughly 60% of the human brain is fat. Essential fatty acids (EFAs) Linoleic and alpha-linolenic acids are critical for building the brain's structure, synthesis of neurotransmitters, and developing the visual cortex, among other important functions. This study investigates how EFAs intake may affect brain function, and if these effects are reflected in student exam performance. We hypothesize that increased consumption EFAs will be associated with higher test scores. An analysis of cognitive function based on exam scores was conducted on 463

student participants attending Weber State University. Two-day diet records were collected. Grams as well as percentages of recommendation consumed based on required calories of linoleic and alpha-linolenic EFAs were calculated from the diet record using Diet and Wellness Plus software. The data analysis was completed using RStudio. Models were created using linear regression and variables were removed based on p-value using backward elimination. The best model created included the following variables: LinoleicCal% (the fraction of the total calories required provided by linoleic fatty acid),  $\alpha$ -LinolenicCal% (the fraction of the total calories required provided by alpha-linolenic fatty acid), and the interaction between the previous two variables. Exam scores increased by 8.37 times, for each additional  $\alpha$ -LinolenicCal% percentage increase ( $p = .001$ ). For each percentage increase on both LinoleicCal% and  $\alpha$ -LinolenicCal%, exam scores decreased by 0.39 times ( $p = 0.002$ ). Our results show that it is not only the amount but also the ratio in which these two fatty acids are consumed that influences exam score performance. This is in accordance with previous studies showing that intake of omega-3 polyunsaturated fatty acids are inversely related with risk of impaired memory and flexibility in middle aged adults.

## **Differences in Bone Data Between Sexes despite Similar BMI for University Club Sport Athletes**

**Tate Burch, Utah State University**

Faculty Mentor: Dale Wagner, Utah State University

## SESSION D (3:30-5:00PM)

## POSTER D28

The body mass index (BMI) is a useful tool to measure weight adjusted for height ( $\text{kg/m}^2$ ) but has a limited ability to identify other variables specific to the individual's unique composition, which can lead to misconceived inferences about the body composition of individuals with similar BMI values. One way to ascertain these variables is through dual-energy x-ray absorptiometry (DXA) which measures bone mineral content (BMC) and bone mineral density (BMD), among other variables. PURPOSE: The objective of this study was to analyze some of the qualities of bones, specifically BMC and BMD, and their relation to the measured BMI of university club sport athletes. METHODS: DXA and BMI data from a larger study of university club sport athletes were utilized. BMI information was calculated using the measured values of height and weight, while BMC and BMD were measured via a whole-body DXA scan (Hologic's Horizon-W) following the manufacturer's instructions. Independent t-tests were used to analyze the information between sexes. RESULTS: Data from 119 club sport athletes (45 female, 74 male) across 15 sports revealed statistically significant differences in BMD ( $p < .001$ ) and BMC ( $p < .001$ ) between men and women, despite their BMI being similar ( $p = 0.471$ ). The BMI for females ( $24.3 \pm 3.7 \text{ kg/m}^2$ ) and males ( $24.7 \pm 3.2 \text{ kg/m}^2$ ) were similar even though women had a smaller mass ( $66.0 \pm 13.5 \text{ kg}$ ) than men ( $79.2 \pm 11.8 \text{ kg}$ ;  $p < .001$ ). Males had significantly greater ( $p < .001$ ) BMC ( $2.97 \pm 0.37 \text{ kg}$  vs  $2.25 \pm 0.37 \text{ kg}$ ) and BMD ( $1.28 \pm 0.09 \text{ g/cc}$  vs  $1.17 \pm 0.08 \text{ g/cc}$ ) compared to females. Interestingly, the lowest and highest team BMD values occurred in the same sport; female gymnasts had the lowest team BMD ( $1.13 \pm 0.06 \text{ g/cc}$ ) while male gymnasts had the highest team BMD ( $1.32$

$\pm 0.09$  g/cc). CONCLUSION: BMI can be a practical tool for identifying weight categories; however, it should not be used to make inferences about BMD and BMC, regardless of similarities between the BMI results of individuals of opposite sexes.

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## **Prenatal Folate Status Influences Hematopoietic Stem Cell Function Kamarie Dalton, Southern Utah University**

Faculty Mentor: Anna Beaudin, University of Utah

SESSION D (3:30-5:00PM)

POSTER D29

Folate is an essential B vitamin (B9) that programs risk for developmental diseases such as neural tube defects, neural crest migration, and heart 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 for disease prevention. Folic acid intake can vary from deficiency to over supplementation in different populations due to socioeconomic 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 from weaning through birth 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 through weaning. In a competitive transplantation assay, rare HSCs are isolated from the bone marrow (BM) of “donors” and purified by fluorescence-activated cell sorting (FACS) and transplanted into irradiated “recipients” along with whole BM competitor cells. We measured chimerism—the contribution of transplanted HSCs to all mature peripheral blood lineages—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 were increased in FS offspring as compared to FC, indicating there was a lasting effect of folate supplementation on HSC function. Furthermore, both lymphoid-biased progenitors and B-cells in the BM compartment were expanded in the BM of FS offspring as compared to FC offspring. These preliminary data shows that prenatal folate supplementation can have lasting effects on the adult hematopoietic system and 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.

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## Efficacy of Cryotherapy Modalities

## Hannah Dickinson, Weber State University

Faculty Mentor: Valerie Herzog, Weber State

SESSION D (3:30-5:00PM)

### POSTER D30

Cryotherapy and compression are frequently used treatments for acute injury and post-operative healing, but the pricing of these treatments are a major concern in today's healthcare world. A common cryotherapy modality used following orthopedic surgeries or injuries is the GameReady which circulates ice water through a sleeve while compressing the area, however, it is quite expensive (~\$4000). A relatively new option for cooling and compression is a device called Hyperice, which is a sleeve that has fans attached to blow cold air, and is less expensive (~\$400). In this study, we compared the two modalities for effectiveness in reducing intramuscular temperature. We inserted a thermocouple into the largest girth of the subject's lower leg (1 cm deep to the layer of subcutaneous fat) and measured the decrease in temperature due during a 30-minute treatment and during 25 minutes of rewarming after the treatment was removed. 20 subjects volunteered to participate in this randomized, cross-over trial (10 males, 10 females, age= $24.65 \pm 2.7$  years, height=  $173.86 \pm 9.83$  cm, weight=  $78.22 \pm 16.17$  kg). There was a statistically significant difference between the two treatments over time,  $F(11,209)=9.08$ ,  $p=0.001$ , observed power= 0.947. By 5 minutes into the treatment, there were statistically significant differences between the devices, which continued throughout the entire treatment and rewarming phase, with the GameReady causing larger decreases in intramuscular temperatures. We also saw a clinically significant difference ( $2.1^{\circ}\text{C}$ ) between the two treatments at most of the time points.

The GameReady lowered the intramuscular temperature more than the hyperice did, indicating that it is more effective, but it is also more expensive. Future research should evaluate the cost-effectiveness of other cryotherapy/compression modalities.

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## **Acute Effects of Aerobic Activity Compared to Sauna Exposure on Plasma Uric Acid Concentration.**

**Sara Mejia, Weber State University**

**Menglu Jiang, Weber State University**

Faculty Mentor: David Aguilar-Alvarez, Weber State University

SESSION D (3:30-5:00PM)

POSTER D31

Aerobic exercise provides multiple health benefits, some of these benefits are modulated by increased body temperature, vasodilation, sweating, and others. Previous studies have shown that exercising results in plasma uric acid (UA) increased concentrations. In this study, we sought to investigate if a 30-minute session of sauna-induced heat therapy has similar effects as exercising aerobically for the same amount of time on plasma UA. We hypothesize that heat therapy and exercise will increase concentrations of plasma UA. Plasma from fourteen participants (age  $23 \pm 2$  y, ht  $1.74 \pm 0.08$  m, wt  $80.9 \pm 19.7$ , BMI  $26.5 \pm 5.5$  kg/m<sup>2</sup>) was collected and tested. Each participant completed a randomized crossover, counterbalanced control study. This trial consisted of a

20-minute resting period lying supine that was followed by 30 minutes of either sauna heat therapy (SAU:  $\sim 132^{\circ}\text{F}/\sim 56^{\circ}\text{C}$ ), cycling exercise (EXER:  $\sim 40\text{-}50\%$  HRR), or upright sitting that served as the control (CON: control). At the completion of the trial, participants completed a 60-minute recovery period lying supine. Plasma samples were taken both pre- and post-completion of each activity for research evaluation. Cycling exercise was the only treatment to increase UA concentration, EXER (pre  $3.52 \pm 0.16$  vs post  $3.67 \pm 0.15$ ;  $P = 0.03$ ), SAU (pre  $3.70 \pm 0.17$  vs post  $3.73 \pm 0.15$ ;  $P = 0.85$ ), CON (pre  $3.90 \pm 0.18$  vs post  $3.74 \pm 0.14$ ;  $P = 0.11$ ). Cycling for 30 minutes ( $40\text{-}50\%$  HRR) was enough to increase UA levels. This is in accordance with previous studies showing that exercise increases vasopressin which concentrates plasma UA; in addition exercise results in lactic acid build up that prevents plasma UA excretion. Sauna heat therapy for 30 min at  $\sim 132^{\circ}\text{F}/\sim 56^{\circ}\text{C}$  did not affect plasma UA levels. Longer exposure or/and intensity may be required to observe noticeable changes in this marker.

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## **Validity and Reliability of Heart Rate Measurements and Energy Expenditure by Bicep Worn Polar Verity During Light Resistance Training**

**Brynlie Ellingford, Southern Utah University**

Faculty Mentor: Marcus Lawrence, Southern Utah University

## SESSION D (3:30-5:00PM)

## POSTER D32

Despite the prevalence of wearable technology devices that claim to track various aspects of exercise, like heart rate (HR) or energy expenditure (EE), few companies have independently had their products tested. Thus, there is a need to measure validity and reliability of wearable technology devices in any situation a consumer may use them, like aerobic or resistance exercise training. PURPOSE: To determine the validity and reliability of the bicep worn Polar Verity in measuring average and maximal HR and estimated EE during light circuit resistance training. METHODS: Twenty subjects ( $n=10$  female and male; age:  $23.2 \pm 7.7$  years; height:  $169.7 \pm 11.1$ ; weight:  $76.3 \pm 15.7$  kg) completed this study. Bicep worn Polar Verity device was evaluated, along with the Polar H10 chest strap and Cosmed K5 portable metabolic unit as the criterion devices for average HR and EE, respectively. Subjects completed 4 circuits of 4 exercises (front squat, reverse lunge, push-ups, and shoulder press) using dumbbells at a light intensity with 1 set of 10 repetitions per exercise, 30 seconds rest between exercises, and 1-1.5 min. rest between circuits. Data were analyzed for validity (Mean Absolute Percent Error [MAPE] and Lin's Concordance Coefficient [CCC]) and reliability (Coefficient of Variation [CV]), with predetermined thresholds of  $\text{MAPE} < 10\%$ ,  $\text{CCC} > 0.70$ , and  $\text{CV} < 10\%$ . A paired t-test was used to determine differences ( $p < 0.05$ ). RESULTS: Polar Verity was significantly ( $p < 0.0001$ ) different than the Cosmed K5 for EE in kcals ( $46.4 \pm 16.5$  versus  $20.3 \pm 5.5$  kcals, respectively) with a MAPE of 503.7%, Lin's Concordance of -0.00, and CV of 12.2%. Conversely, the Polar Verity was not significantly ( $p > 0.05$ ) different than the Polar H10 for either average HR ( $127.4 \pm 19.2$  versus  $128.9 \pm 19.0$  bpm,

respectively) or maximal HR ( $145.7 \pm 19.1$  versus  $145.8 \pm 18.2$  bpm, respectively). Further, for average HR and maximal HR the Polar Verity MAPE was 7.0% and 5.7%, respectively, Lin's Concordance was 0.98 and 0.98, respectively, and CV was 0.6% and 0.5%, respectively. CONCLUSION: The bicep-worn Polar Verity was valid and reliable for average HR and maximal HR, but was neither valid or reliable for estimated EE during light resistance training. Consumers should be aware of the energy expenditure limitation of this bicep worn device when performing resistance training.

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## **Fat-Free Mass Index (FFMI) of University Club Sport Athletes**

### **Alyssa Evans, Utah State University**

Faculty Mentor: Dale Wagner, Utah State University

SESSION D (3:30-5:00PM)

POSTER D33

ALYSSA EVANS, DALE R. WAGNER, SARA HARPER, STEVEN SPENCER, EDWARD M. HEATH USU Body Composition Laboratory; Kinesiology and Health Science; Utah State University; Logan, UTAH Category: Undergraduate. Fat-free mass includes the body's water, organs, bone, and muscle content. Fat-free mass index (FFMI) is calculated as FFM/height<sup>2</sup>, and it helps indicate the body's muscle development and can help prevent injury. PURPOSE: The objective of this study was to compare measured FFMI between university club

athletes within their sport. METHODS: Multicomponent (4C) model body composition using the Bod Pod to measure body volume, dual-energy x-ray absorptiometry (DXA) to measure bone mineral content, and bioimpedance spectroscopy (BIS) to measure total body water was used. Multicomponent methods: evaluation of new and traditional soft tissue mineral models by in vivo neutron activation analysis. RESULTS: Data from 118 club sport athletes (45 female, 73 male) revealed a statistically significant difference ( $p < .001$ ) between men's and women's FFMI. Men ( $21.2 \pm 2.0 \text{ kg/m}^2$ ) had a significantly greater FFMI ( $p < .001$ ) compared to women ( $17.9 \pm 1.7 \text{ kg/m}^2$ ). For sports with more than 1 participant tested, women's lacrosse had the lowest FFMI ( $16.7 \pm 1.0 \text{ kg/m}^2$ ) and powerlifting had the greatest FFMI ( $20.3 \pm 0.2 \text{ kg/m}^2$ ). For both men and women, the difference in FFMI was significant across sports ( $p = .001$ ). CONCLUSION: FFMI values generally fell in the same range for athletes within each sport. This can be used to form a database of average FFMI values for university club sports athletes.

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## **Brain Circuit Causing Acquired Primary Insomnia: A Lesion Network Mapping Analysis**

### **Keaton Helquist, Brigham Young University**

Faculty Mentor: Jared Nielsen, Brigham Young University

SESSION D (3:30-5:00PM)

POSTER D34

**BACKGROUND.** In patients of a tertiary-level mental healthcare facilities, symptoms of insomnia are prevalent in 78.2% of the population. Additionally, among those who suffer from acquired brain injury, few symptoms are as generally pervasive as that of primary insomnia. Meta-analyses of insomnia patients with fMRI data have failed to identify consistently affected brain regions. Individual studies have suggested several brain regions are involved in insomnia, including the anterior cingulum, orbitofrontal cortex, the insula, caudate nucleus, and the anterior capsula interna. However, few regions have consistently been implicated in the pathophysiology of insomnia. Moreover, little is known regarding the collective brain networks involving insomnia. **METHODS.** We performed a literature review for case studies of patients presenting with acquired-brain-injury-induced insomnia (N=12). Lesion network mapping analysis (Fox et al., 2018) was performed on the 12 lesions with a large cohort of healthy control resting-state scans (N=1000). **RESULTS.** Upon completion of lesion network mapping analysis, all 12 lesions were functionally connected to the medio-dorsal thalamus, which is cortically connected to both the primary (~50%) and premotor cortices (~50%) (Oxford Thalamic Connectivity Probability Atlas). In an analysis comparing the 12 analyzed lesions to a normative database of stroke lesions with a variety of different neurological symptoms, we confirmed that the insomnia patients have a statistically significant difference in functional connectivity to the thalamus. **CONCLUSION.** Our suggested functional network connectivity of the thalamus in insomnia appears to hint towards a deeper-rooted mechanism in the onset of primary insomnia in addition to previously suggested hyperarousal within cortical regions, and subcortical



neuropathologies. Further research regarding thalamic activity in psychiatric patients suffering from insomnia is required.

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**Tapering Before NCAA Division I  
Cross-Country Competition Reduces  
Plasma HDL-C but Has No Effect on  
Structural HDL Apolipoproteins  
Kamryn Shapiro, Weber State University  
Marlene Stephani**

Faculty Mentor: David Alvarez, Weber State University

SESSION D (3:30-5:00PM)

POSTER D35

Exercising has shown to increase HDL-C levels in most populations, however it is uncertain if it has an effect in structural apolipoproteins such as apolipoprotein A1( Apo-A1) expression and secretion. Cross-country athletes undergo a period of tapering before competition resulting in reduced physical activity. The purpose of this study was to determine if the changes in physical activity that cross country athletes experience during the season and in preparation for competition affects their HDL-C. We hypothesize that the tapering period will result in reduced HDL-C and its structural apolipoproteins. Twenty seven D-I cross-country athletes, ages 19 to 25 years old, were followed for one season (four months). Blood was collected at the beginning of the season and analyzed for HDL-C levels through enzymatic

spectrophotometry using the Alfa Wasserman Ace Axccl® biochemistry analyzer. Apo-A1 and Apo-CIII were measured through Luminex® MAGPIX® multiplex assays. Paired-samples t-test comparing the preseason (pre) vs postseason (post) values was performed using IBM® SPSS Statistics 25. HDL-C levels decreased significantly from pre =  $64.2 \pm 2.7$ , vs post =  $60.7 \pm 2.5$  mg/dL  $p = 0.03$ . Apo-A1,  $92.3 \pm 6.5$  vs  $88.8 \pm 6.8$ ,  $p = 0.23$  and Apo-CIII  $13.8 \pm 0.1$  vs  $13.3 \pm 0.5$ ,  $p = 0.37$  showed no statistical difference from pre vs post. Our study shows that HDL-C levels are decreased by a period of time as short as 4 months. However, we did not observe a change on apolipoproteins A1 or CIII. These findings suggest that although exercise can modulate lipidation of the HDL particle through the process of cholesterol esterification in the reverse cholesterol transportation (RCT), Apo-A1 expression and secretion may be modulated independently of this process as we did not observe any changes in apolipoprotein concentrations.

## Do Cross Sectional Area and Muscle Stiffness of the Gastrocnemius Muscle of Senior Athletes Correlate with Each Other

Aunika John, Brigham Young University

Faculty Mentor: Brent Feland, Brigham Young University

SESSION D (3:30-5:00PM)

POSTER D36

BACKGROUND: The development of shear-wave elastography (SWE) creates a way to quantify the stiffness

or elasticity of muscle tissue. SWE data relating to a limited number of specific muscle injuries, overuse, or pathologies currently exist in the literature, however, understanding of normal relationships of muscle due to individual physiological characteristics is lacking. Studies investigating changes in SWE related to age, height, weight and CSA in the gastrocnemius are very limited, but necessary to establish an understanding of “normal state” for the gastrocnemius muscle. PURPOSE: This study aimed to determine how cross sectional area (CSA) and SWE correlate with each other, in both the medial and lateral gastrocnemius muscles of active older athletes participating in the Huntsman World Senior Games. METHODS: Data was collected from 109 volunteers (participants in the Huntsman World Senior Games) in St. George, Utah, 2022. All subjects (62 females: mean age =  $64.1 \pm 6.5$  yrs, Ht =  $165.6 \pm 7.9$  cm, Wt =  $67.2 \pm 12.8$  kg; 47 males: mean age =  $68.9 \pm 8.5$  yrs, Ht =  $177.7 \pm 8.9$  cm, Wt =  $79.9 \pm 14$  kg) signed an approved consent form and then lay prone on a treatment table for ultrasonic measurement of both CSA and SWE of both heads of the gastrocnemius. ANALYSIS: All data were analyzed using JMP ver16.2 with a Pearson product pairwise correlation and a multiple regression analysis to determine the effect of age, height, wt and CSA on SWE of the LG and MG independently. Data were normally distributed, not requiring transformation. RESULTS & CONCLUSION: Stiffness as measured by SWE does not significantly correlate with CSA for either the MG ( $p=0.3954$ ,  $r=-0.0822$ ) or LG ( $p=0.2351$ ,  $r=-0.1147$ ). However, age ( $p=0.0064$ ), height ( $p=0.0027$ ) and CSA ( $p=0.0319$ ) are variables with a significant effect on MG SWE, while only height ( $p=0.0178$ ) is a significant variable impacting LG SWE. So although CSA and SWE do not directly correlate, CSA, age and height have some significant effect over MG SWE, while height

only demonstrated a significant effect on LG SWE. The results of this study are limited to the gastrocnemius and further research should observe if similar results exist in a more sedentary population as well as a younger population to help determine normal expected values for SWE.

## Horizontal Gene Transfer by Transformation

### Brooklyn Jones, Brigham Young University

Faculty Mentor: Bradford Berges, Brigham Young University  
SESSION D (3:30-5:00PM)

#### POSTER D37

*Staphylococcus aureus* (SA) is a pathogenic bacterium which affecting humans, primarily affecting the blood, lungs, and soft tissues. There is no vaccine available for SA and it has already developed antibiotic resistance (AR) to many antibiotics, making it extremely deadly. SA can gain AR by obtaining a resistance gene from another organism, however, the process of such is not well understood. The purpose of this project is to elucidate the process of gaining AR genes in SA strains. We hypothesize that AR is conferred through horizontal gene transfer (HGT) because of the exchange of eDNA in the biofilm, an exterior film protecting the cell. We propose that by adding antibiotics (AB) to biofilms, it will provide insight into the mechanisms of transformation HGT in SA. While AB can increase eDNA concentration in a biofilm, they can also cause more pores in the cell wall; either or both scenarios can increase the probability of transformation. We expect only cell wall synthesis inhibitors (oxacillin and vancomycin) to increase

HGT via increasing the permeability of the cell while any AB causing cell lysis (erythromycin and tetracycline) could increase HGT via increasing the eDNA concentration. In our project, we will control for the addition of eDNA due to either AB and/or the creation of porous cells which naturally take up eDNA more easily by adding DNase to AB-treated biofilms. Using this method, eDNA concentration does not increase but cells retain the ability to create pores. This project will use pre-existing protocol to co-culture P12 (meat isolate) and USA400 (human isolate) which have complementary AB profiles in AR profiles between the two strains. After co-culturing the isolates in a single biofilm, adding the treatment antibiotics and DNase, and select for double-AB resistant colonies by plating them on AB plates, we expect to see HGT.

## Measured Thoracic Gas Volume Versus Two Equations

Jacob McBride, Utah State University

Faculty Mentor: Dale Wagner, Utah State University

SESSION D (3:30-5:00PM)

POSTER D38

Body composition, or one's fat mass relative to total mass, is important to a person's health and physical performance. One method to measure body composition is the Bod Pod air displacement plethysmograph. To determine body volume from the Bod Pod, thoracic gas volume (TGV), or the volume of air in the lungs during a normal breath, must be measured or predicted. PURPOSE: The intent of this study was to compare measured TGV to two predictions: one from the Bod Pod

(TGVBP) that makes assumptions about functional residual capacity and tidal volume, and one from a recent publication (TGVDucharme) that relies on measures of height and body mass rather than lung volumes. METHODS: Bod Pod data from university club sport athletes participating in a larger study were used. TGV was measured following the Bod Pod manufacturer's instructions. Comparisons of mean data were made between the measured test and the two predictions with a one-way repeated-measures ANOVA. Individual error scores were evaluated with Bland-Altman plots. RESULTS: Data from 26 club sport athletes (18 male, 8 female) revealed a statistically significant difference ( $p = .001$ ) between the three TGV measures. The measured TGV ( $4.108 \pm 0.850$  L) and TGVDucharme ( $4.092 \pm 0.655$  L) were not significantly different from one another ( $p = .851$ ), but TGVBP ( $3.724 \pm 0.409$  L) significantly underestimated the measured TGV ( $p = .002$ ) and Ducharme's prediction ( $p < .001$ ). A clear bias exists for TGVBP ( $r = -0.799$ ,  $p < .001$ ), such that the Bod Pod prediction overestimates athletes with a small TGV ( $< 3.3$  L) and underestimates athletes with a large TGV ( $> 3.3$  L). The bias for TGVDucharme is statistically significant ( $r = -0.460$ ,  $p = .018$ ), but much smaller than the bias from the Bod Pod prediction. CONCLUSION: When possible, measure TGV. If TGV must be predicted, use the Ducharme prediction rather than the TGV prediction from the Bod Pod.

## Indoor/Outdoor Ozone in Evaporative Cooler vs Central Air Homes in Utah County

Braedon Tarone, Brigham Young University  
Seth Van Roosendaal, Brigham Young  
University

Faculty Mentor: James Johnston, Brigham Young University

SESSION D (3:30-5:00PM)

POSTER D39

Ozone is known to be higher in the summer months when sunlight, Volatile Organic Compounds (VOCs), and Nitrogen Oxides (NO<sub>x</sub>) readily react: Sunlight + NO<sub>x</sub> + VOCs = Ozone. Exposure to ozone in concentrations higher than the Environmental Protection Agency's (EPA) National Ambient Air Quality Standard (NAAQS) of 70 ppb can lead to adverse health effects such as reduced lung capacity, exacerbated chronic obstructive pulmonary disease, asthma, bronchitis or heart disease. Little is known regarding the effects of various residential cooling methods on indoor ozone concentrations. We recruited homes in Utah County that use either central air conditioning (AC) or evaporative coolers (EC) during summer months. Gilian 113 Low Flow samplers were used to sample air over a 24-hour period through coated nitrite filters. Nitrite (NO<sub>2</sub>) on the filter reacts with any ozone (O<sub>3</sub>) present to form nitrate (NO<sub>3</sub>) which can then be measured to obtain an accurate ozone air concentration:  $\text{NO}_2 + \text{O}_3 = \text{NO}_3 + \text{O}_2$ . Two ozone samples were collected at each home with one indoors and one outdoors. Monitors were placed in a main living area of the home away from vents, air intakes, and main entrances. 30 samples were taken inside (n=15) and outside (n=15) AC homes. Additionally, 14 samples were taken inside (n=7) and outside (n=7) EC homes. Samples were analyzed at SGS Galson Labs according to OSHA Method ID-214 to determine total

concentration of ozone on each filter. Mean concentrations outside AC homes were 0.036 ppm. Mean concentrations inside and outside EC homes were 0.020 and 0.034 ppm, respectively. The indoor to outdoor (I/O) ratio of mean concentrations for EC homes was 0.596. Samples taken indoors at AC homes were below the limit of detection (LOD), therefore the I/O ratio for AC homes could not be calculated. Only 1 sample taken inside an AC home contained a concentration above the LOD, which was labeled an outlier and removed. Additionally, data from samples taken outdoors were compared to outdoor ozone concentrations measured at collection sites operated by the Utah Division of Air Quality. Homes provide a protective envelope from exposure to outdoor air pollution. All outdoor ozone concentrations were higher than indoor concentrations, suggesting both AC and EC homes provide this protection. However, our data suggests AC homes provide more protection than EC homes, as samples containing ozone concentrations below the LOD taken from inside AC homes are significantly lower than the calculated mean concentration inside EC homes.

## Indoor/Outdoor Ozone in Evaporative Cooler vs Central Air Homes in Utah County

Seth Van Roosendaal, Brigham Young  
University

Braedon Tarone

Faculty Mentor: Jim Johnston, Brigham Young University



## SESSION D (3:30-5:00PM)

## POSTER D39

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ratio for AC homes could not be calculated. Only 1 sample taken inside an AC home contained a concentration above the LOD, which was labeled an outlier and removed. Additionally, data from samples taken outdoors were compared to outdoor ozone concentrations measured at collection sites operated by the Utah Division of Air Quality. Homes provide a protective envelope from exposure to outdoor air pollution. All outdoor ozone concentrations were higher than indoor concentrations, suggesting both AC and EC homes provide this protection. However, our data suggests AC homes provide more protection than EC homes, as samples containing ozone concentrations below the LOD taken from inside AC homes are significantly lower than the calculated mean concentration inside EC homes.

## The Effect of Gender on Cross Sectional Area and Shear Wave Elastography of the Gastrocnemius in Senior Athletes.

Matt Nelson, Brigham Young University

Faculty Mentor: Brent Feland, Brigham Young University

SESSION D (3:30-5:00PM)

POSTER D40

**BACKGROUND:** Shear wave elastography (SWE) is a novel use of ultrasound that can help measure the intrinsic stiffness of a muscle. Intrinsic stiffness refers to an ability, or inability, to change shape when placed under a load. For muscles, changes in stiffness can occur frequently under normal circumstances (contraction, stretch, warm-up). Recent studies have reported

changes in stiffness in response to heavy use or injury which may make SWE a useful measure for tracking or predicting muscle recovery rates. However, not enough data is available to establish what “normal” is for individual muscles or groups. Furthermore, distinctions of muscle stiffness relating to age, gender, and activity level remains an area of SWE research that is lacking. PURPOSE: This study aimed to determine how gender affects cross sectional area (CSA) and SWE of both the medial and lateral heads of the gastrocnemius muscle of the dominant leg in active older athletes participating in the Huntsman World Senior Games. METHODS: Data was collected from 109 volunteers (participants in the Huntsman World Senior Games) in St. George, Utah, 2022. All subjects (62 females: mean age =  $64.1 \pm 6.5$  yrs, Ht =  $165.6 \pm 7.9$  cm, Wt=  $67.2 \pm 12.8$  kg; and 47 males: mean age =  $68.9 \pm 8.5$  yrs, Ht =  $177.7 \pm 8.9$  cm, Wt=  $79.9 \pm 14$  kg) signed an approved consent form and then lay prone on a treatment table for ultrasonic measurement of both CSA and SWE of both heads of the gastrocnemius with the ankle placed in a neutral position. ANALYSIS: All data were analyzed using JMP ver.16.2 with an Analysis of Variance for comparing both CSA and SWE between males and females for MG and LG independently. student t-tests were also used to confirm and determine differences. Data were normally distributed not requiring transformation. RESULTS & CONCLUSION: CSA was significantly greater in males than females for both MG ( $p=0.0131$ ) and LG ( $p<.0001$ ). Stiffness as measured by SWE is significantly greater in the MG than LG ( $p<.0001$ ) for both males and females, however, the effect of gender is not significant for SWE values for either the MG ( $p=0.5182$ ) or LG ( $p=0.3822$ ). These results are significant because they show both the expected outcome of a difference in CSA for muscle

size between genders, but that intrinsic stiffness of muscle does not appear to be affected by gender. The current population studied was an active elderly population regularly involved in sports. Further studies on a more sedentary age-matched population would help determine if intrinsic stiffness is similar regardless of activity level. Lack of a gender effect would better help define what stiffness of “normal” muscle would be to better delineate stiffness values that are both abnormal and predictive from a rehabilitation standpoint.

## Genome-wide CRISPR-Cas9 Screen Used to Build a Guide-RNA Library for Genetic Screens of INS-1 Cells Used Under Conditions of Glucolipotoxicity, Proliferation, and Insulin Secretion.

Spencer Paulsen, Brigham Young University

Faculty Mentor: Jeffery Tessem, Brigham Young University

SESSION D (3:30-5:00PM)

POSTER D41

Today approximately 537 million adults are living with diabetes. Worse still is that this figure is expected to rise to about 640 million by the year 2030. Factors like metabolic stress drive the development of this condition. The loss of functional  $\beta$ -cell mass due to these stressors is linked to the pathogenesis of diabetes. There are multiple gene expression changes that occur as a result of these stressors. The studying

of these genetic variations in  $\beta$ -cells can lead to a greater understanding of diabetes as well as potential cures. CRISPR-Cas9 is a powerful tool for creating gene knockouts for the purpose of studying heterogeneity. As a result, we created a CRISPR guide-RNA library for the rat pancreatic islet  $\beta$ -cell insulinoma (INS-1) cell line. This library will be used to perform genome-wide forward genetic screens under conditions of glucolipotoxicity, proliferation, and insulin secretion of all expressed genes in the INS-1 cell line. Here we present the state of our guide-RNA library development and forward progressive screens.

## Genetic Modification of NMAD-1 Demethylase in *C. elegans* to Affect Longevity

Harlan Stevens, Brigham Young University

Faculty Mentor: Steven Johnson, Brigham Young University

SESSION D (3:30-5:00PM)

POSTER D42

Almost all medical research focuses on extending human life. Recent studies into different aging mechanisms have revealed a new potential field of research for increasing lifespan: changing epigenetic marks. Histone and DNA methylation marks can repress or increase gene expression. As organisms age, alterations occur in epigenetic marks that control the chromatin state of DNA which exposes formerly protected DNA to genetic instability. A recent study identified 30 previously untested candidate genes in *C. elegans* (a model organism) that could affect longevity. Among those, a gene

previously associated with DNA repair in meiosis, demethylase *nmad-1* stands out. While recent research has found that other demethylases in *C. elegans* impact aging, N6 methylation regulation genes, such as *nmad-1*, have not been experimentally linked to aging. Our previous research proved that knocking down *nmad-1* expression through RNA interference (RNAi) significantly decreased life span. We hypothesize that overexpression of *nmad-1* using a ubiquitous *sur-5* promoter will increase longevity. Research into *nmad-1*'s effect on lifespan could link N6 methylation to new biological pathways. *Nmad-1* has a close mammalian homolog *ALKBH4*, so research based on *C. elegans* demethylase could later be used in novel therapeutic approaches to ameliorate age-related health conditions in humans.

## Minute by Minute Concentrations of PM2.5 in Homes with Evaporative Coolers versus Central Air Conditioners

Pablo Harline, Brigham Young University

Selah Willis, Brigham Young University

Faculty Mentor: James Johnston, Brigham Young University

SESSION D (3:30-5:00PM)

POSTER D43

Evaporative Coolers (swamp coolers) function by passing outdoor air over a water-saturated pad. The pad water then evaporates, cooling the air before it is directed into the home. Central air conditioning cools the home using recirculated

indoor air. In this study, we explore and compare the quantity of fine particulate matter (PM<sub>2.5</sub>) that enters a home being cooled by a swamp cooler versus central air conditioning. PM<sub>2.5</sub> is dangerous to the human respiratory system and is linked to lung cancer, chronic obstructive pulmonary disease, and asthma. Using an Optical Particle Counter (OPC), we collected the PM<sub>2.5</sub> concentrations every minute over a 24-hour period in 15 central air and 7 swamp cooler homes as well as outdoor PM<sub>2.5</sub> concentrations at the same locations. All measurements were done from June-September 2022 in Utah County. All participants were asked to behave as they normally would with the exception of any activities that produce indoor particulate matter (cooking, vacuuming, vaping, etc.). Using the uncorrected photometer data, the ratio of indoor to outdoor (I/O) revealed significant differences between the PM<sub>2.5</sub> concentration of homes with different types of air conditioners. Central air homes had an average I/O at 0.64, and standard deviation of 0.45. Swamp cooler homes, on the other hand, had an average I/O 0.90 and standard deviation of 0.18. These results meet our expectations due to the mechanical properties of each type of air conditioner: Swamp coolers bring in outdoor air, and central air systems filter and recirculate indoor air with less outdoor air infiltration. We are in the process of further analyzing the minute-by-minute data to discover any meaningful temporal patterns. The study confirms previous research that residents of swamp cooler homes will be exposed to higher levels of PM<sub>2.5</sub>. Our findings were corroborated by 24-hour PM<sub>2.5</sub> filter samples collected alongside the OPC readings. By examining hours with high levels of exposure, we hope to recommend interventions to decrease exposure to PM<sub>2.5</sub> in swamp cooler homes.

## Bulimia Nervosa and Treatment-Related Disparities: A Review

Kim Wilson, Utah Tech University

Faculty Mentor: Robert Kagabo, Utah Tech University

SESSION D (3:30-5:00PM)

POSTER D44

Bulimia Nervosa (BN) is a type of eating disorder disease which usually manifests between adolescence and early adulthood. The median age of onset is 12 with an estimated lifetime prevalence of 0.9%. BN is characterized by individuals' excessive eating of large amounts of food such as binge eating. The individuals then follow the eating episodes by engaging in unusual compensatory behavior such as self-induced vomiting, misuse of laxatives, or excessive exercise in efforts to control weight gain. There are two types of BN, the purging, and the non-purging type. Research shows that approximately 94% of those with BN never seek or delay treatment. While there are available treatments, it is thought that some populations may not have access to such treatments. This study is a review of clinical trials to explore available treatments and related treatment disparities.. Methods. This study followed qualitative review guidelines to review clinical trial studies of BN published between 2010 and 2021. The authors used PubMed and PsychInfo databases to search for articles meeting the inclusion criteria. Search terms included phrases such as, BN treatment, BN and clinical trials, BN and randomized clinical trials, or BN diagnosis and treatment. Any studies that did not involve clinical trials and treatment of BN were excluded from



the review. Results. Following the inclusion criteria, 15 studies were included in this review study. Most of the reviewed studies had their sample sizes between 80 and 100% female with age range between 18 and 60 years old. Sample sizes were mostly between 80 and 100% white. Treatment practices included both pharmacological and psychosocial interventions. Majority of the psychosocial interventions were, cognitive behavior therapy and limited motivational interviewing. Conclusion. While all in the general population face risks of developing BN, the reviewed research show that certain groups of populations face disparities in BN treatment. The 12-17, and older than 60 age groups are mostly excluded from research. Males and racial minorities are also excluded. Researchers and practitioners need to include these vulnerable groups to improve treatment-related disparities among individuals with BN.

## **Evaluating the Association between Air Quality and Neurological Sequelae of Covid-19**

**Kennedy Zinn, Utah Valley University**

Faculty Mentor: Chris Anderson, Utah Valley University

SESSION D (3:30-5:00PM)

POSTER D45

Long haul COVID is a pervasive and pernicious COVID-19 sequelae and affects every organ system, including the central nervous system. Neurological symptoms can last over a year, and include brain fog, chronic fatigue, dyspnea, mood

dysregulation and headaches. Anosmia, for example, is the loss of partial or total smell and is a common symptom cited in acute and post COVID-19 infection. Current research surrounding the etiology of anosmia in COVID-19 cites olfactory epithelium damage, leading to neuronal death of olfactory receptors. Such damage is theorized to allow the virus to cross the blood-brain barrier (BBB) and lead to reduced cerebral spinal fluid (CSF) drainage via the cribriform plate. Reduced efficiency of cerebrospinal fluid is speculated to result in a decrease in CSF production and turnover in order to maintain appropriate intracranial pressure (ICP). This compensatory response can have a cascading effect on the entire central nervous system, particularly the meninges. Such etiology would allow for persistent neurological impairments, even in the absence of virus detection. Current research of anosmia also cites a relation between air pollution with olfactory impairment and neurodegenerative disease pathology. Although the mechanisms are unclear, the theorized etiology of Covid-19-induced anosmia is remarkably similar to the etiology of anosmia in relation with air pollution. Following IRB approval, we will analyze existing data from approximately 40 patients who completed neurological symptom questionnaires at a health clinic. Historical Air Quality Index (hAQI) of patient hometowns, collected by AirNow.gov and IQAir, will be tested for associations with self-report symptoms. Data analysis is planned for early January. We hypothesize that patients from areas of lower air quality will report more severe symptoms of long-haul Covid. Findings may provide insight into long Covid and other neurological pathology.

# The more you know: Knowledge about gender and sexual minority experiences as a tool to improve inclusive health care practices

Natalia Garrido, University of Utah

Faculty Mentor: Claudia Geist, University of Utah

SESSION D (3:30-5:00PM)

POSTER D96

In current literature, healthcare providers' attitudes, the healthcare system, and biased health curriculums are some of the main bridges between creating inclusive, gender-affirming healthcare for sexual and gender-diverse (SGD) people. For SGD people, many unnecessary barriers exist that prevent them from accessing health care and receiving quality affirming care. The burden of overcoming these barriers must not be mostly placed on SGD people, but rather on current and future healthcare providers. Education on SGD issues for undergraduate pre-health students is a first step toward shifting biased education and improving inclusive affirming patient care. In our previous research, we found that pre-health students express uncertainty and ambivalence on some issues related to sexual and gender diversity. Similarly, in other studies, medical and nursing students have expressed not having enough education and skills on LGBT and sexual health. Most health profession curriculums provide few hours of low-quality SGD health. Failure to understand and empathize with sex and gender differences and the interconnections of SGD identities and health have left the SGD community at risk for life-threatening and chronic health conditions. In response to the concerns and uncertainties about quality SGD education,

I plan to cultivate a digital infographic booklet that can be readily accessible for pre-health students at the University of Utah that focus on gender, sex, and sexual orientation. Initially, the resource will help define gender and sexual identities. Pre-health students will also learn about health disparities, social determinants of health, minority stress, and social safety in order to understand SGD people's sensitivity to healthcare and accessibility. Additionally, many pre-health pathways recommend patient exposure, so the source will also guide students on how to make social safety a tool for making SGD people more comfortable and safer to express their identities.

**Health and  
Medicine. Session  
D - Oral  
Presentations,  
Saltair, Union**

**SESSION D (3:30-5PM)**

**Location: Saltair, A. Ray Olpin University  
Union**

Effects of Tea Tree Essential Oil on Escherichia  
Coli & Staphylococcus Aureus

Jed Whetten, Utah Valley University

Taylor Eakins, Utah Valley University

Faculty Mentor Olga Kopp, Utah Valley University

SESSION D 3:30-3:45PM

Saltair, Union

Health and Medicine

*Melaleuca alternifolia* (tea tree) leaves have been used throughout many cultures around the world to help heal wounds and injuries because of its anti-inflammatory and anti-microbial properties. Some essential oil companies claim that tea tree essential oil contains purifying capabilities for air and contaminated surfaces. Essential oils are synthesized by many methods, the most popular being steam distillation. The essential oils, once purified, are sold to customers so they can use the oil to benefit from the plant's physiology and metabolic processes. In attempts to inform the scientific community about the antibacterial properties of the essential oil, we tested whether tea tree oil possesses the ability to fight common infections to any significant degree. We grew *Escherichia coli* & *Staphylococcus aureus* and measured the zones of inhibition in response to different concentrations of the essential oil. We also tested two different brands of tea tree oil, dōTERRA and Lagunamoon. We found that dōTERRA tea tree oil exhibited antibacterial properties while the Lagunamoon oil did not.

Preventing Eating Disorders by Promoting

# Healthy Weight Management and Health

Youssef Harraq, Utah Tech University

Faculty Mentor Dannelle Larsen-Rife, Utah Tech University

SESSION D 3:50-4:05PM

Saltair, Union

Health and Medicine

Among rising rates of obesity, healthy weight loss is a common and elusive goal. A prevailing misconception is that the most effective method to lose weight is to eat as little as possible. However, research does not support this idea. Extreme dieting may result in disordered eating with severe consequences. Eating disorders disproportionately affect adolescent girls and young women, as they are twice as likely to be diagnosed with anorexia nervosa than men with an average age of onset around fifteen (Morris, 2007). Anorexia nervosa is when individuals severely reduce calorie intake to lose weight and maintain low body fat due to a distorted body image (Morris, 2007), which often results in starvation. Starvation occurs when calories are severely restricted to fewer than required to maintain health over a period of time (Stratton et al., 2010). Diets involving severe calorie restriction often result in poor health (Stratton et al., 2010) and slowed weight loss long-term (Dullo, 2021). Severe lack of nutrients in starvation conditions negatively affects skin, hair and nail growth, hunger regulation, and immune functions (Eva, 2021), which may lead to death. Anorexia nervosa has the highest mortality rate among all mental health disorders (Morris, 2007). To preserve the remaining nutrients available and survive, the body prevents further weight loss by slowing the metabolism resulting in decreased overall energy. Intermittent fasting may

be confused with starvation. Intermittent fasting is a healthier method of weight loss that alternates between specific periods of eating and fasting while meeting nutritional and caloric needs (Eshghinia, 2013). Intermittent fasting reduces body mass index and glucose metabolism (Cho, 2019.) Thus, intermittent fasting is beneficial for health (Su, 2021). The goal of this paper is to summarize the literature on the use of starvation diets by people who are anorexic, and promote a comprehensive intervention approach for healthy and effective sustained weight management. The comprehensive approach will include intermittent fasting, body positivity, exercise, and the mind-body connection as effective for promoting health and well-being.

## Vascular function of the components of a murine arteriovenous fistula model

Nathan Hill, University of Utah

Faculty Mentor J. David Symons, University of Utah

SESSION D 4:10-4:25PM

Saltair, Union

Health and Medicine

When the kidneys can no longer remove waste, salt, and water appropriately, hemodialysis is required to complete this life-sustaining task. A reliable vascular access is necessary for successful hemodialysis treatment. The most reliable form of access is an arteriovenous fistula (AFV), but 60% of AVFs fail to mature for use. Mechanisms responsible for AVF failure include intimal hyperplasia and poor lumen expansion. Compromised



vasoreactivity might play a role but this has never been evaluated. In our murine AVF model, the external jugular vein (EJV) is connected to the carotid artery (CA), establishing 3 component parts to the AVF, i.e., proximal CA, EJV, and distal CA. Upon AVF creation, the EJV is acutely exposed to higher arterial pressures and disturbed flow patterns, known causes of endothelial cell dysfunction. First we tested the hypothesis that endothelial function is impaired in the EJV from the AVF (i.e., EJV-AVF) vs. the naïve (EJV-Con) mouse. Three days after creating the AVF, using isometric tension procedures, dose-dependent vasoconstriction to the TxA2 receptor agonist U46619 was robust in the EJV-Con ( $p<0.05$ ) but was absent in the EJV-AVF segment. Because vasoconstriction is requisite to subsequently test endothelium-dependent vasorelaxation, our hypothesis could not be evaluated. Our second hypothesis was that endothelial function is impaired in the distal vs. proximal CA, secondary to disturbed flow patterns. U46619 -evoked vasoconstriction was greater ( $p<0.05$ ) in the proximal vs. distal CA segment of the AVF. Acetylcholine-evoked vasorelaxation was greater ( $p<0.05$ ) in distal vs. proximal CA, whereas responses to sodium nitroprusside were similar between groups. These findings do not support our hypothesis and suggest that endothelial function is better in the distal vs. proximal CA. Studies are ongoing to : (i) substantiate these findings 21 days after AVF creation; and (ii) define compensatory mechanisms of vasorelaxation in the distal CA. Supported by R01HL153244 NIH/NIDDK (TL, YTS, JDS).

## Safe Zone Training for Professional Health

## Students

### Brekke Pattison, University of Utah

Faculty Mentor Claudia Geist, University of Utah

SESSION D 4:30-4:45PM

Saltair, Union

Health and Medicine

The inclusion of LGBTQIA+ lessons and educational material in professional health schools is a relatively new addition to the material taught to these students, this leads to fewer publications on how effective the material is taught to these students. The purpose of this study is to determine how to best provide education on patient care of LGBTQIA+ and gender diverse patients to help minimize the biases and barriers that these groups face while obtaining medical care. Working alongside medical students and the Office of Health Equity, Diversity, and Inclusion, a series of workshops designed to help work through different aspects of identity, diversity and intersectionality. These workshops contain an opening meditation and two activities designed to help provide an understanding of differences in identity, privilege, and diversity. One example of an activity ran had participants “purchase” privileges in pairs, with each pair receiving a different amount of money to use. Discussions are lead after the activities to help participants work through their thoughts and see the stand points of the other participants. Participants at the workshops will be asked to participate in a survey that will be used to determine how useful the participants view different activities are in expanding their understanding of the diverse patients they will encounter while working in their respective fields.

**Humanities.**  
**Session D - Poster**  
**Presentations,**  
**Ballroom, Union**

**SESSION D (3:20-5:00PM)**  
**Location: Ballroom, A. Ray Olpin University**  
**Union**

The Reality of Fictional Power: Students' Use of  
Fiction as a Coping Mechanism  
Miranda Judson, Utah State University

Faculty Mentor: Joyce Kinkead, Utah State University

SESSION D (3:30-5:00PM)

POSTER D46

This research explores the benefits of leisure and assigned reading as a coping mechanism. In this research I demonstrate that fiction is a powerful coping mechanism. While research has been done on Bibliotherapy, the guided use of literature for patients, clients, or students, and similar fields, no research has been done specifically on fiction or the self-guided use of fiction as a coping mechanism. I surveyed and interviewed university English students who responded that they find fiction to be soothing and that they find insight to problems they're facing when they read. I demonstrate that students find more insight and find reading to be more beneficial as a coping mechanism when they are reading for pleasure as opposed to assigned reading in school. The books these students choose as a coping mechanism are varied, including *Gods and Monsters* by Shelby Mahurin, *Merlin's Keep* by Madeleine Brent, *Aristotle and Dante Discover the Secrets of the Universe* by Benjamin Alire Sáenz, *Huckleberry Finn* by Mark Twain, *Little Men* and *Little Women* by Louisa May Alcott, to name a few. Perhaps this is because students also choose the books they read for pleasure with their emotional and psychological benefit in mind.

## Worship of Women in Ancient Greek Myth and Culture

Bridget Kelly, University of Utah

Faculty Mentor: Alexis Christensen, University of Utah

## SESSION D (3:30-5:00PM)

## POSTER D47

Mortal or semi-mortal heroes play a major role in the mythology of the Ancient Greeks, and many heroes are worshiped as gods. Some, like Heracles, become divine in the myths and in religious practice during the Bronze Age, while others, like Theseus, become deified much later. This does not only happen to the male heroes, however, as female heroes experience similar deification and worship. The worship of these heroes-and particularly the females-was distinct from other deities, but they still served an important role in the society. The Greek historian, Pausanias, writes about periods of Greece prior to his own and what remains of those periods, and much of the remains include how various mortal women were worshipped, both those who became divine in their myths and those who were deified by the Ancient Greeks themselves. Using archaeology and examining the claims Pausanias makes compared to earlier sources can reveal the significance of mortal women to the Ancient Greeks and how those women fit into the religion not only as extensions of the more known hero cults, but also as their own independent cults. Understanding that role can reveal much about the interactions between society, myth, and religion, and it can also show how women were viewed in a religious way.

## Effect of COVID-19 Pandemic on Oral Health Among Uninsured Populations

Emily Singer, University of Utah

Faculty Mentor: Akiko Kamimura, University of Utah

SESSION D (3:30-5:00PM)

POSTER D48

A major disturbance to many individual's semi-annual dental checkups occurred with the arrival of the COVID-19 pandemic in 2020. Because the pandemic disproportionately affected minority populations, a preliminary hypothesis was that this population's oral health was also disproportionately affected. Previous studies on oral health among uninsured free clinic patients indicate poor oral health practice among the population. Free clinic patients tend to experience poor oral health related quality of life (Kamimura, Gull, Weaver, et al., 2016). Patients of free clinics are often not familiar with proper oral care including the correct manner of tooth brushing and daily floss usage (Kamimura, Booth, Johansen, 2017). Dental services are extremely important to be provided at safety-net health care facilities such as free clinics (Kamimura, Gull, Weaver, et al., 2017) because this population tends to otherwise not have access to oral care or education about the importance of maintaining healthy oral care. 2020 brought another complication: the COVID-19 pandemic. Along with examining the statistics of how the COVID-19 pandemic has affected underserved, low-income populations, the results of this study will highlight the ripple effects of the detrimental event of the pandemic that this population has faced, with a focus on their oral care. Data collection was conducted by distributing surveys to patients of the Maliheh Free Clinic. The surveys

completed by patients are in their final stages of analysis. By comparing the pre-pandemic oral health habits of underserved populations to their current habits as the pandemic continues, my research will bridge the unknown gap of the pandemic's true impact on the underserved.

Kamimura, A., Booth, C., Lindsey, W., Weaver, S., Edwards, A., Nourian K., & Erickson, L. (2017). Home Dental Care Education for Uninsured Free Clinic Patients in the United States. *Diversity and Equality in Health and Care*, 14(6), 296-301.

Kamimura, A., Gull, B., Lindsey, W., Weaver, S., Edwards, A., Nourian, K., Ashby, J., & Erickson, L. (2016). Factors Associated with Oral Health-Related Quality of Life Among Safety-Net Clinic Patients. *Journal of Public Health Dentistry*. Doi: 10.1111/jphd.12193.

Kamimura, A., Gull, B., Weaver, S., Wright, L., W., Ashby, J., & Erickson, L. Association Between Health-Related Beliefs and Oral Health Behaviors Among Uninsured Primary Care Patients. *Journal of Primary Care & Community Health*. Doi: 10.117/2150131916680887.

Kamimura, A., Booth, C., Lindsey, W., Weaver, S., Edwards, A., Nourian K., & Erickson, L. (2017). Home Dental Care Education for Uninsured Free Clinic Patients in the United States. *Diversity and Equality in Health and Care*, 14(6), 296-301.

Kamimura, A., Gull, B., Lindsey, W., Weaver, S., Edwards, A., Nourian, K., Ashby, J., & Erickson, L. (2016). Factors Associated with Oral Health-Related Quality of Life Among Safety-Net Clinic Patients. *Journal of Public Health Dentistry*. Doi: 10.1111/jphd.12193.

Kamimura, A., Gull, B., Weaver, S., Wright, L., W., Ashby, J., & Erickson, L. Association Between Health-Related Beliefs and Oral Health Behaviors Among Uninsured Primary Care

Patients. *Journal of Primary Care & Community Health*. Doi: 10.117/2150131916680887.

## Decolonial postcard

Suzanne Kekoa, University of Utah

Faculty Mentor: Dr. Maile Arvin, University of Utah

SESSION D (3:30-5:00PM)

POSTER D95

Pele, to me, is a very intriguing Goddess; she is imperfect and powerful. For my presentation, I will create my version of Pele to express how tourism impacts Hawaiians, specifically Hawaiian women; pictures are truly worth a thousand words. Art can be a powerful tool to inspire change. In Huanani Kay-Trasks's book *From a Native Daughter*, she compares tourism to prostitution. The land is the sex worker, and Big Corporations such as Castle and Cook are the pimps. While the land is being commodified, Hawaiian women are being murdered and missing at disproportionately high rates. In Dr. Arvin's *Possessing Polynesians*, she justifies the continued commodification of Hawaii and its people. They are justified in abusing land and people by positioning Hawaiians closer to whiteness. Oceania Women are heavily sexualized in the mainstream media. They are depicted as willing and wanting sexual hula girls. They are rapeable bodies for the male gaze. When male tourists come to Hawaii, they expect Hawaiian women to perform. Hawaiian society was a matriarchal society pre-colonialization, women were held in high esteem, but the



abuse of women in today's society is appalling. Through Pele's image, Hawaiian women can gain the strength to change.

**Humanities and  
Social Work,  
Session D - Oral  
Presentations, Pano  
East, Union**

**SESSION D**

**Location: Pano East, A. Ray Olpin University  
Union**

Key Partner Program

Megan Allred, Utah State University

Faculty Mentor Jayme Walters, Utah State  
University

## SESSION D 3:30-3:45PM

Pano East, Union

Humanities

Utah's Bear River Region (BRR; Box Elder, Cache, and Rich Counties) has seen a disproportionate increase of unsheltered individuals, up 400% from 2017-2019 (1). When a person is unable to afford their rent and is evicted, finding safe and affordable housing is harried by the high demand for housing, the lack of available housing (1), the absence of a comprehensive emergency shelter, and insufficient homeless response systems (2). Thus, homeless prevention and intervention efforts are vital to addressing homelessness. Landlords are important actors in housing issues, and they can contribute by learning about homelessness locally, ways to support high-risk renters, how to avoid evictions when possible, and supporting homeless mitigation programs in their community (3). Past research indicates that landlords in the BRR want to help address homelessness, but they do not know how to help (3). Using a qualitative design, the present study sought to understand program content and delivery methods preferred by landlords or property managers (n=15) in an engagement program about homelessness and housing solutions. Semi-structured interviews were used to gather data. A deductive, two-cycle coding approach (descriptive coding and pattern coding) was adopted to analyze the data. Final patterns

informed the development of an online course as part of the larger landlord engagement program, called the Key Partner Program (KPP), which includes: Information about homelessness in the BRR; Homeless resources in the BRR and how and why to access them; Interpersonal skills and landlord-tenant mediation training; and Problem-solving techniques to prevent evictions. Participants desired a combination delivery method – online and in-person. Landlords communicated that they would be interested in a program like this, and a gift card would also help incentivise participation. The online course of KPP is currently being piloted with local landlords, with hopes to roll out a full engagement program in Summer 2023.

Systemic racism in America; at the foundation of the social contract and the significance of choice

Roxana Carranza, Southern Utah University

Faculty Mentor Gretchen Ellefson, Southern Utah University

SESSION D 3:50-4:05PM

Pano East, Union

Humanities

In this paper I analyze the systemic treatment of people of color in America. I propose that America's social contract

and individualism is rooted in racism by creating differences between races and seeing people of color as inferior. This in turn, creates an issue of separation on a systemic level. I claim that this issue creates a “trickle effect” where the individual adheres to the social contract and in turn allows the contract to continue to purport systemic racism. This I contend allows for ignorance in individuals as they are not educated in how their choices affect everyone on the systemic level. Therefore I propose the choice of the individual to challenge the social contract (as is stated that we have full right to do so in America’s Declaration of Independence) and educate ourselves of the struggles that people of color face on a day to day basis.

## Goalkeeping or Gatekeeping? A Lexical Analysis of Sexism in Italy’s Female National Football League

Rachel McDonald, Brigham Young University

Faculty Mentor Dan Paul , Brigham Young University

SESSION D 4:10-4:25PM

Pano East, Union

Humanities

The Italian language as an echo of its country’s culture has contributed to the historical alienation of women in sports as well as reinforcing the gender-based discrimination that occurs in Italian soccer today. Rooted in a defiance of Italy’s developing Fascist state, the Women’s Soccer Group established in 1932 contradicted Mussolini’s emphasis on the

value of women lying solely in their reproductive capabilities. “Fascist Italy needs good mothers, not ‘virago footballers’” *Lo Schermo Sportivo*, a Milanese sports journal, claimed in a 1933 article. The propagation of negative sentiment towards Italian women in sports not only disbanded the Women’s Soccer Group, but also maintained its absence for a subsequent 35 years. It is with these origins in mind that I conducted research through social media tracking, interviews, and academic study in order to understand language’s impact more fully on Italian women’s soccer. In monitoring specific hashtags across various social media platforms over a period of 8 months, the statistics concluded that Italian women’s soccer was referred to negatively in 20.2% of mentions, as opposed to 14.6% positive references. The idea that female soccer continues to be spoken of unfavorably is reflected in the amendment scarcely made in 2022, allowing the Italian women’s soccer league to become professional and its salary cap removed. Though language continues to mirror a culture cemented in its hegemonic foundations, it may also positively influence the perception of Italian women in sports, which then transforms their reality.

## Institutional Enablers: The Catholic Church As An Enabler to Abuse, Rape, and Child Predators

Matylda Blaszcak , University of Utah

Faculty Mentor Amos Guiora, University of Utah

SESSION D 4:30-4:45PM

Pano East, Union

Social Work

According to the Massey Law Firm, more than 19,000 survivors have come forward claiming abuse by priests. Many of these survivors feel as though they were abandoned. They feel abandoned by the institutions and people within those institutions whom they trusted would protect them. Widespread abuse within institutions like this is made possible by enablers. The purpose of this study is to explore the role of the Catholic Church, specifically in enabling child predators and to propose legislation and other measures to hold enablers accountable and prevent enabling in the future. Using mixed-methods this proposed research project analyzes interviews with survivors and reports of sexual assaults within the Catholic Church. By gaining a better understanding of how these sexual assaults were allowed to occur, we can begin to develop measures to prevent enabling. This study proposes four potential solutions: legislation, expanding mandatory reporting laws for all adults, rigorous in-person enabling training distinct from the standard online bystander training within institutions, and therapy and counseling for those involved in the assault and those that enabled the perpetrator. Those 19,000 survivors, and countless others, deserve to see the enablers who abandoned them held accountable.

Firm, Massey Law. "How Much Has the Catholic Church Paid to Abuse Victims – Massey Law Firm: Scottsdale AZ." Massey Law Firm | Scottsdale AZ, 13 Dec. 2021, [dmasseylaw.com/how-much-catholic-church-paid-abuse-victims/](https://dmasseylaw.com/how-much-catholic-church-paid-abuse-victims/).

**Humanities and  
Arts. Session D -  
Oral Presentations,  
Room 312, Union**

**SESSION D (3:30PM – 5PM)**

**Location: Room 312 A. Ray Olpin University  
Union**



## The Effect of Gender and Age of the Leading Actor on Film Revenue

Kira Swann, Southern Utah University

Faculty Mentor Joshua Price, Southern Utah University

SESSION D 3:30-3:45PM

Room 312, Union

Arts

Film is one of more widely consumed forms of media, with many knowing and loving actors from the industry. This study is going to analyze and determine whether or not the gender and age of these leading actors have an effect on box office revenues. The results from this will be able to tell us who is more likely to help the films perform better in the box office: younger or older, men or women. Also, the information learned from this can help newer production studios and filmmakers know what they need to do to get their foot in the door in the entertainment industry.

## More than a fan: BTS Army going beyond the stereotypical stan behavior

Tatiana Meaole, Utah Valley University

Faculty Mentor John Dulin, Utah Valley University

SESSION D 3:50-4:05PM

Room 312, Union

Humanities

Screaming, obsessive teenage girls-that is the connotation society has associated with boyband fans. That stereotype hangs well over the heads of South Korean boy group BTS (Bangtan Sonyeondan)'s fans-Army (or BTS Army). Since Bangtan's debut in 2013, they have captured the attention of people across the globe, granting them the largest fan base in the world today. The influence BTS has on their fans will be observed through this project as I engage in the unorthodox dynamic of Army. There is a lifestyle adopted by the community that stems from observing and being impacted by the BTS members. Following that, the behavior and culture of Army has surpassed traditional fans and has developed more characteristic mannerisms that resembles a religious movement. This particular movement carries its own mythology which observes the band members as exemplary moral figures (to which fans model their lifestyles and philosophies), demonstrates organized routine practices that provoke ecstatic experiences resembling those of charismatic religious involvement, and establishes a global community sharing set values. Those within the Army community have developed a ritual cycle focused on birthdays, accomplishments, and milestones of the band members. Even the emotions the members share with the fans are received and reciprocated to a similar or greater extent-whether it be sadness, happiness, anger. Understanding what causes an individual to move beyond the line of "fan" to a devoted follower is simple, but when an entire group of people surpass that line it raises some questions. Through observing the Army community, my ethnographic research will highlight the relationship, conflict, and development of stan (an overzealous fan) behavior in connection to religious affiliation. This study

also seeks to encourage anthropology students and researchers to apply theory outside of their normal investigative routes.

## Urban Futures in Hao Jingfang’s “Folding Beijing”

Brady Turpin, Brigham Young University

Faculty Mentor Steven Riep, Brigham Young University

SESSION D 4:10-4:25PM

Room 312, Union

Humanities

In the Chinese dystopian science-fiction novella “Folding Beijing”, author Hao Jingfang depicts a future Beijing, separated into three distinct “Spaces” that fold into one another in order to accommodate the overwhelming population. In this paper, I analyze how author Hao Jingfang utilizes physical space and urban constructs to reflect and more deeply explore the stark inequality between each city level, and how these same disparities and challenges are manifested in contemporary China. I do this through a review of China’s current pattern of domestic migration and its relationship to the growing hyper-urbanization in many Chinese cities. Then, I explore how Hao Jingfang’s future projection of these phenomena lead to the severely classist society portrayed in “Folding Beijing”, and how this work of fiction reflects reality.

The Byronic Hero and Turgenev’s Fathers and

## Sons

Preston Waddoups, Utah State University

Faculty Mentor Alan Blackstock, Utah State University

SESSION D 4:30-4:45PM

Room 312, Union

Humanities

Throughout Russian literature's rapid development following the reign of Peter the Great, literature from western European nations was highly influential. Ivan Turgenev, as a reader, admirer, and translator of Lord Byron's works, serves as one example of this fact. Turgenev's 1862 novel *Fathers and Sons*, which takes a close look at generational differences, the waning influence of Romanticism, and social unrest in Russia leading up to the emancipation of the serfs, bears obvious signs of Lord Byron's influence. One of the novel's main characters, Yevgeny Bazarov, resembles a stereotypical Byronic hero in many respects. However, Bazarov is not simply a clone of Byron's heroes; he diverges from them in his weak sense of guilt and justice and his lack of determination. Through a comparative analysis of Bazarov's ideas and character with those of the eponymous heroes of Byron's dramas *Manfred* and *Cain*, I will illustrate how Bazarov's ambiguous status as a Byronic hero exemplifies a partial rejection and partial embodiment of Romanticism that reflects the atmosphere of social change and unrest in 19th-century Russia. In doing so, I intend to offer an analysis of Turgenev's novel that sheds light on the broader social and ideological conflicts of 19th-century Europe, conflicts that are still relevant today.

**Nursing. Session D**  
**- Poster**  
**Presentations,**  
**Ballroom, Union**

## **SESSION D (3:20-5:00PM)**

**Location: Ballroom, A. Ray Olpin University  
Union**

### **Improving Neonatal Resuscitation Curriculum Using Demographic Information and Preferred Learning Methods from Guatemalan Lay Midwives**

**Ella Baker, University of Utah**

Faculty Mentor: Kimberly Garcia, University of Utah

SESSION D (3:20-5:00PM)

POSTER D49

Midwives throughout the world practice in vastly different geographic areas, socioeconomic contexts, and with a variety of resources. Though midwives attend the majority of births across the globe, their role and educational opportunities are not standardized. Training in crucial skills, such as neonatal resuscitation, is often inadequate or inaccessible to midwives with limited literacy in developing countries, such as Guatemala. While the Guatemalan government has offered midwifery training since 1955, the training has failed to change midwife knowledge because they are taught with written material in Spanish, even though many midwives have limited literacy and speak Mayan dialects. More information is needed about how midwives best learn. This project aims to explore learning styles of midwives in the context of neonatal resuscitation training with a larger goal of ultimately

decreasing neonatal mortality. The project was conducted at Refuge International Health Clinic in San Raymundo, Guatemala, which is a suburban area located approximately 30 kilometers from Guatemala City and the project included 12 midwives with 1 to 46 years of midwifery practice experience. Participants reported a range of literacy from none to an ability to read and write, and education levels ranged from elementary school through university. By means of a select-all-that-apply question added to a general demographic survey, the preferred learning styles of the lay midwives were assessed. Response options to the question, “What methods best serve your learning?” included color drawings, black and white drawings, verbal instruction, demonstration, storytelling, written instruction, hands-on practice, verbally repeating what you learned to someone else, acting out what you learned, writing down what you learned, and/or watching a video. Participants could select all methods that applied. While no one learning style was preferred by all participants, color drawings and verbal instruction were among the top choices. Due to the lack of clear patterns in the data, assessing group learning styles independently and tailoring educational methods to the unique needs of participants may be preferable to a more generalized approach.

## Qualitative Usability Evaluation of the Revised Color Me Healthy App: Perceptions of Parents

Brianna Oliveros, University of Utah

Faculty Mentor: Lauri Linder, University of Utah

## SESSION D (3:20-5:00PM)

## POSTER D50

Background: Healthcare teams seek to alleviate symptoms of children that occur as a result of their disease and treatment. To support a person-centric approach to care, a mobile-based app, Color Me Healthy, was developed for children record their symptoms. The purpose of the study is to identify parents' perceptions of the revised Color Me Healthy app's perceived usefulness and perceived ease of use. Methods: Fourteen parents (11 mothers; median age 38.5 years) of children with cancer 6-12 years of age evaluated the app. Usability evaluations included audio recorded interviews which were analyzed qualitatively guided by following the Technology Acceptance Model (TAM). The TAM indicates that the perceived usefulness and the ease of use of technology determine its subsequent adoption. Interviews were transcribed and transcripts were uploaded into Dedoose software for analysis. Transcripts were reviewed to identify statements in which parents related aspects of the app's perceived usefulness or ease of use. Statements were further coded using specific constructs set forth in the TAM. Results: Preliminary analyses are complete for seven parents. Statements from all parents supported the relevance of the app either for themselves or their child and the ability of the app to demonstrate meaningful results, providing evidence of perceived usefulness. Statements from all parents also reflected self-efficacy in using the app, providing evidence of its ease of use. Parents' statements provided support for the perceived enjoyment of the app (n=4 parents) and the playful nature of the app (n=4 parents). Conclusion: Preliminary analyses indicate that parents perceived the Color Me Healthy app as useful and easy to use for the child to report their symptoms



and for the parent to interpret their responses. Next steps include evaluation of the revised app's clinical utility to support symptom reporting and subsequent initiation of interventions to alleviate symptoms.

## Qualitative Usability Evaluation of the Revised Color Me Healthy App: Perceptions of Children

Haley Utendorfer, University of Utah

Faculty Mentor: Lauri Linder, University of Utah

SESSION D (3:20-5:00PM)

POSTER D51

**Introduction:** Through qualitative analysis of patient and parent transcripts, I have, in conjunction with Dr. Lauri Linder, gauged user reactions to novel technology in the form of an app titled Color Me Healthy, which was designed by the University of Utah's Therapeutic Games and Apps Lab (The GApp Lab) to report pediatric cancer treatment symptoms. Stemming from the idea that children may often feel fatigue from conversing with doctors, nurses, and other healthcare workers almost constantly concerning their symptoms, an app would give them an avenue in which to relay their feelings electronically and create a consolidated area in which these reports can be viewed. **Methods:** The purpose of this project is to summarize constructs from the Technology Acceptance Model reflected in statements by children with cancer who evaluated the revised Color Me Healthy app. Participants were 14 children 6-12 years of age (median 8.5 years) who participated in guided usability interviews ranging from 10 to

29 minutes (median 18.5 minutes). Interviews were transcribed and uploaded to Dedoose software for qualitative coding. An a priori coding process was used based on constructs defined in the Technology Acceptance Model. Initial coding of interviews was completed independently by three individuals with each “blinded” to the others’ coding. The group then met together to review and discuss responses and reach consensus. For my presentation, I will be focusing on the child perspective of these interviews. Results: Interim analyses of 7 interviews are complete. Discussion: For this project, researchers have implemented qualitative coding protocol describing Technology Acceptance Model constructs to statements from 14 children with cancer and their parents from guided usability interviews with the goal of determining necessary revisions to the app. Then, we began analyzing uploaded data with Dedoose software via a priori coding process, which is based on constructs and definitions set forth in the Technology Acceptance Model (TAM) as proposed by Venkatesh & Balain 2008. Initial coding of three child and parent interviews were completed independently with each individual “blinded” to other coding. Then, we have calculated Cohen’s kappa to evaluate inter-rater reliability after each three child and three parent interviews with the goal of achieving kappa  $\geq 0.75$ . For constructs with kappa  $< 0.75$ , we gathered and talked through our logic to reach a consensus. At this point in time, we are currently halfway through analysis of all transcripts. Thus far, qualitative statements point towards the conclusion that both parents and children enjoy the app and find it relevant to the treatment they are receiving. As we finalize analysis this fall, we will prepare to effectively communicate the implications of our findings in order to improve upon the Color Me Healthy app and prepare it for clinical application.

# **Exploring the Relationship Between Traveling and Permanent Staff Nurses**

**Garrett Parker, Utah Valley University**  
**Lauren Pacheco, Utah Valley Uiniversity**

Faculty Mentor: Francine Jensen, Utah Valley University

SESSION D (3:20-5:00PM)

POSTER D52

**Background and Significance.** Travel nurses are registered nurses who work in a non-permanent or temporary nursing role. They are usually employed by an independent nursing staffing agency instead of one facility. They are usually assigned to one hospital for 13 weeks (Hansen & Tuttas, 2022b). Travel nursing was initiated in the 1980s to address inadequate staffing in healthcare facilities with nursing shortages (Yang & Mason, 2022). During the COVID-19 pandemic an unprecedented increase in demand for nurses occurred alongside a mass resignation of 534,000 healthcare workers in what has become known as “The Great Resignation”, resulting in an RN vacancy rate of 8% nationwide (Hansen & Tuttas, 2022b). Prior to the pandemic travel nurses comprised less than 2% of the nursing population, but in 2020 the number of travel nurses increased by 35% in an effort to address the mass nursing shortage from the pandemic (Yang & Mason, 2022). In 2018 staff nurses earned an estimated average salary of \$1,400 per week, whereas travel nurses were paid between \$5,000 to \$10,000 per week during the pandemic as their average salary rose by 25%. This discrepancy in pay has led to reported

animosity between permanent staff nurses and travel nurses (Hansen & Tuttas, 2022a; Gan, 2020). This animosity has also led to a decrease in overall morale among nurses and a decrease in well-being, particularly for travel nurses, with reports indicating that 70% of travel nurses are at risk for poor mental well-being (Raso & Fitzpatrick, 2022). This animosity may contribute to a higher turnover rate for nurses. Understanding the experiences of staff nurses who work and interact with travel nurses could help guide future research to identify interventions to improve team relations between travel nurses and permanent staff nurses. To explore these experiences, a survey with questions about perceptions of travel nurses from the perspective of permanent staff nurses was performed ( $n = 31$ ). An analysis of these responses demonstrated that almost all staff nurses believe that travel nurses have contributed to some staff nurses leaving their job on their units. Staff nurses had mixed reactions to the overall impact of travel nurses with more than half believing the travel nurses had a mixed (both positive and negative) impact on their units. The negative impacts were generally perceived to be a lack of training and unit knowledge amongst travel nurses, and an excessive pay discrepancy between travel and staff nurses. The positive impacts were perceived to be the introduction of new knowledge and techniques onto the unit. Based on these results, we recommend that travel nurses receive more extensive training on their new units and increase permanent staff pay to improve unit and staff morale.

**Sciences. Session D**  
**- Poster**  
**Presentations,**  
**Ballroom, Union**

SESSION D (3:30-5:00PM)

**Location: Ballroom, A. Ray Olpin University**  
**Union**

Fundamental Spectroscopic Studies of  
Transition Metal Nitrides and Carbides  
Yexalen Barrera-Casas, University of Utah

Faculty Mentor: Michael Morse, University of Utah

SESSION D (3:30-5:00PM)

POSTER D53

The scientific exploration of the chemical bonds in transition metal nitrides (MN) is integral to a multitude of scientific fields. Some pertinent examples include the study of the Fe-Nitrogen bonds within the hemoglobin protein, electrochemical energy applications, and a deeper understanding of the complexities MN species demonstrate in organometallic chemistry. Although multiple studies have analyzed the general bonding mechanisms and schemes between transition metal and nitrogen atoms, there is a current lack of accurate and precise data on the fundamental bond dissociation energies (BDEs) for MN species. This shortage of thermochemical BDEs prevents the elucidation of quantitative and qualitative trends on the chemical bondings, electronic structures, and overall fundamental characteristics of MN species. Here, I present the predissociation thresholds of early and late 3d, 4d, and 5d MN species with the use of jet-cooled molecular beams through Resonant Two-Photon Ionization (R2PI) spectroscopy. The measured predissociation thresholds can be accurately assigned to the BDEs of the MN species studied within this work:  $D_0(\text{ScN}) = 3.905 \text{ eV}$ ,  $D_0(\text{TiN}) = 5.015 \text{ eV}$ ,  $D_0(\text{YN}) = 4.125 \text{ eV}$ ,  $D_0(\text{MoN}) = 5.220 \text{ eV}$ ,  $D_0(\text{RuN}) = 4.905 \text{ eV}$ ,  $D_0(\text{RhN}) = 3.659 \text{ eV}$ ,  $D_0(\text{HfN}) = 5.374 \text{ eV}$ ,  $D_0(\text{OsN}) = 5.732 \text{ eV}$ , and  $D_0(\text{IrN}) = 5.115 \text{ eV}$ . The R2PI spectra resolve a dense manifold of molecular vibronic states at energies below the ground separated atom limit. When the MN species of interest is energetically excited to exactly the ground separated atom limit, the transition metal-nitrogen bond is broken and at energies above the predissociation threshold, a baseline of zero molecular signal is resolved. The electronic structures of the MN species can be put into context of these spectroscopically resolved thermochemical BDEs, allowing for the fundamental

underpinnings of the chemical bond between transition metals and nitrogen to be illuminated.

## Reactive oxygen species and methamphetamine effects on nucleus accumbens circuitry

Matthew Burris, Brigham Young University

Faculty Mentor: Jordan Yorgason, Brigham Young University

SESSION D (3:30-5:00PM)

POSTER D54

The nucleus accumbens (NAc) underlies many aspects of motivational behavior, including encoding methamphetamine reward seeking behavior. NAc circuitry is regulated by numerous excitatory and inhibitory distal and local inputs, with increasing evidence supporting a regulatory role by local microglia. Microglia are the immune cells of the brain and microglia are sensitive to ligands known to affect dopamine release, including reactive oxygen species, Nitric oxide (NO), Glutamate and lipopolysaccharide (LPS) (among others). Microglia change their morphology in response to these signaling molecules which is indicative of microglia activation levels. Microglia are diverse across brain regions and how NAc microglia surveillance (i.e., ramification) relates to dopamine terminal activity and interactions with methamphetamine are unknown. The current project examines microglia morphology and dopamine terminal activity and the effects of reactive oxygen species and methamphetamine. Methamphetamine is known to increase reactive oxygen species, which play a role in neurotransmitter release in the NAc. In order to investigate

methamphetamine and reactive oxygen species effects on this circuit we took mice and followed a behavioral protocol known to cause methamphetamine locomotor sensitization. We also used a control group which were only given saline. These two groups were then used to measure inherent microglia morphology changes due to repeated methamphetamine injections. Additionally, these mice were used to look at responsivity of dopamine terminals to reactive oxygen species through dopamine and ATP release measured by fast scan cyclic voltammetry. We also looked at morphology changes of microglia from acute application of glucose oxidase, which is known to increase reactive oxygen species. Through investigations of this circuit, we can better understand how reactive oxygen species and methamphetamine affect dopamine terminals as well as microglia activity.

## Taxonomic Verification of Southern Utah

Bombus by of use COI sequence digestion and gel separation

Jake Olvera, Southern Utah University

Isaac Sorensen, Southern Utah University

Faculty Mentor: Jacqueline Grant, Southern Utah University

SESSION D (3:30-5:00PM)

POSTER D55

Bumblebees serve an important role as pollinators and many species are in decline. Effective conservation efforts rely on accurate species identifications which can be difficult because



of morphological similarities among species. Southern Utah is home to many species – including *Bombus morrisoni* and *Bombus nevadensis*, which are challenging to morphologically differentiate despite being in different subgenera. These species may be inadequately represented in Southern Utah and other databases due to their ease of misidentification. To solve this problem of misidentification, we examined COI DNA barcodes to determine if unique restriction enzyme sites could be used to differentiate the two species. We found at least 9 unique restriction enzyme sites that could be used to distinguish *Bombus morrisoni* from *Bombus nevadensis*. Our results can be used to provide a reliable method for differentiating these two species, especially in areas where morphologically similar variants coexist.

## The First SNAP Surface Brightness Fluctuation Distances

Mikaela Cowles, Utah Valley University

Faculty Mentor: Joseph Jensen, Utah Valley University

SESSION D (3:30-5:00PM)

POSTER D56

We have successfully acquired F110W (J-band) images of 68 massive elliptical galaxies in clusters and groups out to 80 Mpc by taking advantage of the efficient Hubble Space Telescope SNAP observing mode. We used the Surface Brightness Fluctuation (SBF) technique to measure distances to 44 of the galaxies so far with a typical uncertainty of ~5% in distance by implementing a new Python-based pipeline to simplify and

automate the SBF analysis procedure. This new SNAP sample doubles the total number of IR SBF distances to galaxies beyond 50 Mpc. The new distances will allow for more accurate determination of the mass distribution in the local universe when combined with the Cosmicflows-4 database (Tully et al. 2022, arXiv:2209.11238). It will also provide a more precise comparison between early-type population distance indicators and distances derived from late-type galaxies via Cepheids well into the Hubble flow. These data will be combined with existing HST SBF distance measurements (Jensen et al. 2021, ApJS, 255, 21; Blakeslee et al. 2021, ApJ, 911, 65) to reduce the uncertainties in the local measurement of the Hubble Constant, which is currently at odds with the determination of the expansion rate at cosmological distances derived from cosmic microwave background fluctuations.

Environmental factors have little influence on drosophilid genome size.

Samantha Curnow, Utah Valley University

Faculty Mentor: Carl Hjelman, Utah Valley University

SESSION D (3:30-5:00PM)

POSTER D57

The amount of nuclear DNA, or genome size, varies widely across the insect tree of life with no clear relationship with organismal complexity. Some insects have only 100 million base pairs, while others reach nearly 18 billion base pairs. Many hypotheses have been proposed to explain this genomic variation. Some suggest relationships to environmental

adaptations, while others suggest size is driven by effective population size. To date, no single hypothesis clearly explains the genome size variation observed. In order to investigate these hypotheses, we utilize data from nearly 150 drosophilid species. With over a century's worth of research on their genomes, life history characteristics, and behaviors, there is no shortage of available data for these organisms. We mined data from peer-reviewed papers and publicly available datasets pertaining to genome size, thermal limits, climatic variables, geographic location, haploid chromosome number, and a variety of other life-history characteristics. We then investigated the relationship of genome size to these variables using linear regression models and comparative phylogenetic analyses in R. Early work has found that while there is some relationship between genome size and climatic variables, much of these relationships are nullified when accounting for evolutionary relatedness. Since this early work, we have greatly expanded our dataset and explanatory variables. We present here the more complete and informative models of these relationships using this newly obtained data. With expanded data, we found no significant relationship between climatic variables and genome size. Future research may reveal relationships between environmental factors and genome size if running similar analyses with other groups of insects or if other variable data is published (i.e., humidity).

## Plackett-Burman Optimization of $KAl(SO_4)_2$

Emily Hiatt, Weber State University

Faculty Mentor: Brandon Burnett, Weber State University

SESSION D (3:30-5:00PM)

POSTER D58

KAl(SO<sub>4</sub>)<sub>2</sub> crystals were synthesized and analyzed using Plackett – Burman Optimization, comparing the success of crystallization between viscosity, temperature, and concentration. The Plackett-Burman optimization is used for analyzing a few variables with reproducibility without having a massive amount of trials. Adapting this to experimentation and the lab is difficult, given the lack of technology available to make it accessible. For our experimentation, KAl(SO<sub>4</sub>)<sub>2</sub> synthesis was manipulated in three ways – viscosity (water, propyl glycol, and glycerine), temperature (5C, 22C, and 45C), and concentration (0.2, 0.4, 0.6 g/mL). After a week of crystallization, the middle values of each variable performed the best and had the most measurable crystals. All crystals were measured with an optical microscope for size, and with x-ray diffraction for crystallinity. In order to make Plackett-Burman accessible, a program has been developed to automatically create the trials necessary to run any experiment necessary.

How big game animal's hair structure helps  
them thermoregulate

Taylor Millett, Utah Tech University

Faculty Mentor: Samuel Tobler, Utah Tech University

SESSION D (3:30-5:00PM)

POSTER D59

The Pronghorn antelope is an animal known to have hollow

hair strands among hunters and conservationists yet no one seems to know what it actually looks like on the inside. In this study, we examined what a hollow hair strand looks like under a microscope and how it helps with an animal's thermoregulation. Thermoregulation is the ability to regulate body temperature within a livable range even when external temperatures fluctuate. We studied animals like Mule deer, Rocky Mountain elk, and Pronghorn antelope, as well as other big game animals, as they exhibit this trait in a unique manner. These animals have an adaptation more commonly known as a summer coat and a winter coat. Using a scanning electron microscope, we measured and compared an animal's winter coat and summer coat to indicate why an animal can regulate body temperature through hot summers and cold winters. These coats of fur/hair change in thickness and length with the change of seasons. Under the microscope, we identified the different topography of the inner structure of a single hair strand. We found that the inner structure has hollow pockets in the winter coats of these animals. We then focused on the heat transfer of each individual hair and how this allows the animal to thermoregulate.

## The M.A.C.H. System

Ricks Ricks, Utah Valley University

Faculty Mentor: Michael Rotter, Utah Valley University

SESSION D (3:30-5:00PM)

POSTER D60

Food insecurity is an important global challenge. As of 2020,

around 282 million people in Africa suffered hunger due to this same food insecurity. We are faced with a problem that requires new techniques that can help to improve existing small scale farming. Enter the MACH system (Manageable Accelerated Community Horticulture), a mechanism that may provide a solution to communal horticulture and affordable small-scale farming. This system utilizes the elements of photosynthesis and magnifies those variables to generate produce at a much faster, and potentially larger rate. By filtering out harmful rays from the sun (namely infrared and ultraviolet), providing optimal climate conditions, and introducing supplemented concentrations of CO<sub>2</sub> within an enclosed environment, it may be entirely possible to create a reliable source of local produce for members of a community without breaking the bank practicing traditional farming methods. Our main objective with this technology is to provide several solutions at an affordable cost of production, low maintenance, and simple upkeep and attention from its caretaker. To achieve this requires interdisciplinary cooperation with our engineering students and faculty to both test the results of the plant's growth and develop the technology for the climate control system. With the success of this technology, we may be able to revolutionize the way that we do local farming, and may even shape the future of agricultural practices worldwide.

## Investigating the role of a charge-charge interface in chromosome pairing

Jesus Aguayo, University of Utah

Faculty Mentor: Ofer Rog, University of Utah

SESSION D (3:30-5:00PM)

POSTER D61

Meiosis is a specialized cell division process whereby gametes arise in preparation for fertilization. Exploring the meiotic process has shed light on mankind's understanding of the natural biological processes from reproduction to genetic engineering. The Synaptonemal Complex is a structure that forms during meiosis. This structure orients and aligns the two parental chromosomes which then allows for genetic exchange between them. Once germ cells have undergone meiosis, they are ready for the fertilization process which then results in offspring in ideal circumstances. Additionally, the SC allows for a precise number of gene exchanges between each set of chromosomes. Without the SC, there would be errors in the sets of chromosomes in a cell, reduced number of offspring, infertility, and more.

The SC is a highly conserved structure that is found in simple sexual reproducing organisms as well as complex multicellular organisms such as humans. If the SC were better understood, the quality of life of humans could be improved. Whether it's helping an infertile individual receive treatment to be able to reproduce or to better understand conditions that result from aneuploidy in humans and other creatures, it's undeniable that researching the SC is worthwhile. Using CRISPR/Cas9 technology, progeny and male count methods, immunofluorescent staining, and confocal imaging, I was able

to obtain insights as to how the SC functions within the nematode *Caenorhabditis elegans*. Specifically, I focused on conditions that suppress a temperature sensitive mutation, *syp-1 K42E*. The data from progeny counts indicates that mutating certain specific proteins within the SC (*syp-3 D62V*, *syp-3 D62N*, and *syp-4 E90K*) can suppress the temperature sensitive mutation when they are each found in the same SC structure as the *syp-1 K42E* strain but they are unable to significantly cause any change when the temperature sensitive mutation is not present in the same structure. Immunofluorescent imaging also indicated that there was no significant difference between the suppressor strains and the wildtype strain. The findings from testing the individual strains without the suppressor strain gave insight as to the importance of charged interactions between the proteins within the SC. Since Lysine (K) was replaced by Glutamic acid (E) in the SYP-1 K42E protein, there was a significant difference between the wildtype *C. elegans* strain and the *syp-1 K42E* strain. However, the suppressor proteins were able to restore the phenotype of the *C. elegans* that had both the suppressor protein and the SYP-1 K42E protein.

## Creation and Characterization of Electropolymerized Organic Mixed Ionic-Electronic Conductors

Arnel Besic, University of Utah

Faculty Mentor: Connor Bischak, University of Utah



## SESSION D (3:30-5:00PM)

## POSTER D62

Organic mixed ionic electronic conductors (OMIECs) are conjugated polymer systems that conduct both ions and electrons. They are promising materials for biosensors, neuromorphic computing platforms, and energy storage devices. An obstacle for these new materials is the lack of understanding of the fundamental processes that underlie operation, namely the coupled dynamics of ion motion, electron transport, and structural changes. This work presents the electropolymerization and characterization of thiophene-based polymers and copolymers. One advantage of electropolymerized materials is that they do not require bulky side chains to dissolve in organic solvents, allowing them to hold more charge per volume. Using electropolymerization, we synthesize several polythiophenes with different side chain chemistries. We investigate ion injection kinetics in these materials using spectroelectrochemistry and find that injection kinetics depend on the identity of the electrolyte. We also characterize their morphology with atomic force microscopy (AFM) and scanning electron microscopy (SEM). Electropolymerized OMIECs may play an important role in the advancement of OMIEC-based technologies due to their unique morphologies and ease of synthesis.

Carbon isotopic variability in paleosols and its effects on reconstructing pCO<sub>2</sub>: insights from the Upper Triassic Chinle Formation

## Aiden Beukema, University of Utah

Faculty Mentor: Randall Irmis, University of Utah

SESSION D (3:30-5:00PM)

### POSTER D63

Carbon isotope values from paleosols are an important proxy for atmospheric  $p\text{CO}_2$ , providing clues to deep time paleoclimate. In modern soils,  $\delta^{13}\text{C}_{\text{carb}}$  values typically reach equilibrium between 30-50 cm depth from the top of the soil profile (usually in the B horizon), so workers have assumed this to be true for paleosols as well. As a result, most paleosol carbonate  $p\text{CO}_2$  proxy data derive from point samples taken from the B horizon. However, few paleosol studies have examined the variability of  $\delta^{13}\text{C}$  down profile and within a single sampling horizon. Therefore, it is unclear whether taking a point sample at or below 50 cm is sufficient to recover the isotopic value at equilibrium for every paleosol, and how this sampling strategy affects subsequent reconstructed  $p\text{CO}_2$  values.

To investigate this problem further, we sampled calcic paleosols from the upper Chinle Formation of southeastern Utah, sampling every 10 cm along the soil profile. Multiple carbonate nodules were taken from each depth and were analyzed for  $\delta^{13}\text{C}_{\text{carb}}$  and  $\delta^{18}\text{O}_{\text{carb}}$ . Mudstone matrix from each depth was also analyzed for  $\delta^{13}\text{C}_{\text{org}}$ . Down-profile  $\delta^{13}\text{C}_{\text{carb}}$  values rarely fit well to a theoretical vertical slope representing equilibrium, with variation of up to  $-3.6\text{‰}$ , often below the 50 cm depth. At any single sampling horizon within a paleosol, we observe variation of up to  $-4\text{‰}$  between individual carbonate nodule  $\delta^{13}\text{C}_{\text{carb}}$  values. This range of variation can significantly affect the  $p\text{CO}_2$  estimations; a difference of  $-4\text{‰}$  in  $\delta^{13}\text{C}_{\text{carb}}$  values (assuming the same  $\delta^{13}\text{C}_{\text{org}}$  value) can result

in up to ~3605.4 ppm difference in reconstructed pCO<sub>2</sub>. Thus, we suggest that characterization of down-profile and within-horizon variability is critical for obtaining more accurate atmospheric pCO<sub>2</sub> values from paleosols.

## Exploring species boundaries in a widespread army ant genus using DNA barcodes

Megan DuVal, University of Utah

Faculty Mentor: John Longino, University of Utah

SESSION D (3:30-5:00PM)

POSTER D64

Army ants (Hymenoptera: Formicidae: Dorylinae) are keystone predators throughout most of the tropical and subtropical regions of the world. One of the most wide-ranging and ecologically important army ant genera is *Labidus*, which has a broad dietary niche and often high local abundance in the Neotropical region. *Labidus* taxonomy at the species level is in need of revision. Currently, seven valid species are recognized based on the morphology of workers and/or males, but little information on cryptic species within or phylogenetic relationships among them is available. Here, we attempt to define species boundaries within the genus by reconstructing its phylogeny using DNA “barcodes” (a segment of the mitochondrial COI gene) from 2,513 specimens, ultra-conserved element (UCE) data from six *Labidus* specimens plus two outgroup taxa, and COI barcodes extracted from UCE contigs. Phylogenies were reconstructed with Maximum Likelihood analyses, and based on a reconstructed UCE

topology, a constraint tree topology was obtained with 74 specimens. Our analyses revealed at least seven COI clusters, with three of the species mainly characterized by the worker caste corresponding to multiple putative cryptic species. Our phylogeny also allowed us to associate two species known only from males with their respective workers. With the addition of more UCE data, morphological data, and species delimitation analyses, a reliable updated taxonomy of *Labidus* will emerge.

## Detecting Black Holes in Omega Centauri

Zack Freeman, University of Utah

Faculty Mentor: Anil Seth, University of Utah

SESSION D (3:30-5:00PM)

POSTER D65

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, I am 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 far has been modeling 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.

## Raman Spectroscopy Characterization of Antibody-Ligand Association at Supported Phospholipid Bilayers

Clista Galecki, University of Utah

Faculty Mentor: Joel Harris, University of Utah

SESSION D (3:30-5:00PM)

POSTER D66

There are fundamental questions about the chemistry of antibody-ligand interactions. Antibodies are proteins generated by the immune response to target pathogens through their specific binding to proteins or other ligands on cell membranes. One of the fundamental questions that is being addressed in this research is to determine how the accessibility of ligands at supported-lipid bilayers (models of cell

membranes) varies with ligand coverage, thereby impacting their association with antibodies in solution. We detect the binding of proteins by measuring inelastic light scattering from their characteristic molecular vibrations using Raman microscopy. The use of Raman spectroscopy allows label-free and quantitative analysis of antibody-to-ligand binding. We are able to determine the concentration of antibody that has accumulated on the surfaces of supported-lipid bilayers. Unlike current methodologies, Raman spectroscopy can detect changes in the binding state of the targeted ligand. Understanding the binding state is crucial in assessing how ligand accessibility may influence its interaction with solution-phase proteins. We prepare lipid bilayers on the interior surfaces of porous silica particles, whose high surface area provides a sufficiently high concentration of both ligand and its antibody to allow detection of quite modest mol-fractions (2-mol%) of ligand-modified (2,4-dinitrophenylated) lipid. Capture of antibodies requires the presence of ligand in the bilayer, where lipid bilayers prepared without dinitrophenylated-lipid produce no detectable signal from the antibody. By varying the dinitrophenylated-lipid density, the surface concentration of captured antibody increases proportionally to a level that is limited by antibody size and packing density of antibody at the lipid-bilayer surface. After establishing specific protein accumulation and detectable changes in ligand state following binding, we plan to determine how the coverage of antibody impacts the binding state of the recognition ligands at supported lipid-bilayer interfaces and determine the stoichiometry of ligand-to-antibody binding.

# Coinfection of Malaria and Gammaherpesvirus

## Erin Garzella, University of Utah

Faculty Mentor: Tracey Lamb, University of Utah

SESSION D (3:30-5:00PM)

### POSTER 67

Malaria kills more than 400,000 people a year. 67% of those deaths are children under five. Some children get malaria, but they do not die. The reasons for this are not completely understood. Malaria is caused by the Plasmodium parasite, in particular Plasmodium falciparum. Co-infection of malaria with gammaherpesviruses, such as Epstein Barr Virus (EBV), is common in young children under five in countries where malaria is present. Data from children living in Cameroon in Central Africa shows that children who have EBV and malaria are more likely to be hospitalized due to malaria complications than children who do not have EBV. Antibodies are one of the main weapons the immune system uses to fight malaria. EBV antagonizes antibody production, possibly by induction of IL-10, a molecule that prevents B cells from producing antibodies. EBV induces IL-10 production in infected cells and can synthesize a homolog of IL-10. We hypothesize that the IL-10 induced during EBV infection results in lower antibody titres in children who are infected with both the virus and Plasmodium parasites that cause malaria. The first goal of this research is to identify which cell types produce IL-10. VertX reporter mice will be used to determine this in a mouse model of EBV-malaria co-infection. Once specific cell types are identified genetically modified mice will be used to observe what happens during co-infection when those cell types have the IL-10 gene knocked out.

## The Cause of Excess Magmatism in the Northern Atlantic Margin

Autumn Hartley, University of Utah

Faculty Mentor: Emily Cunningham, University of Utah

SESSION D (3:30-5:00PM)

POSTER D68

Excess magmatism is a common occurrence near areas of tectonic rifting, but a region off the coast of Norway was found to have a much greater degree of magmatism than typical circumstance permits. To investigate the cause of this excess magmatism, the International Ocean Discovery Program (IODP) launched Expedition 396 to take drill core samples from ocean floor basalts that erupted about 56 million years ago. There are three leading hypotheses for the source of excess magmatism in the Northern Atlantic: a thermal anomaly caused by an interaction with the Icelandic mantle plume, small-scale convection at the base of the lithosphere, heterogeneities in the mantle source, or a combination of all three. Through the use of thermobarometry (Lee et al. 2009), we have determined that a thermal anomaly was present at the time of emplacement. However, it is not the sole contributor to the sheer amount of erupted material present. As such, we have begun our investigation into the other two hypotheses by modifying the excel software package Melt-PX (Lambart et al. 2016) to model an active upwelling region and analyzing samples to determine what role convection and composition play in this system.



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## Reconstruction of fire and vegetation history by analysis of charcoal morphometrics from known Utah plants

Amy Harvey, University of Utah

Faculty Mentor: Stella Mosher, University of Utah

SESSION D (3:30-5:00PM)

POSTER D69

Fire is one of the major forces that influences vegetation type and ecosystem dynamics of an area. Reconstructing past fire regimes can help us understand not only about the type of plants that were once in an area and how they responded to fire, but also how best resource and landscape management practices can be employed to preserve present ecosystems under a changing climate. This research contributes to the reconstruction of a mid-Holocene fire record from Verlorenvlei,

South Africa, a dry west coast site in South Africa's Fynbos biome. The paleofire reconstruction provides insight into fire frequency, fire intensity, and fuel type, and the study of charcoal morphology (the shape of the particles) and morphometry (length:width ratio of the particles) is a method used to determine the types of vegetation that were burned. In this project, the morphometric analysis of macroscopic charcoal particles from lake sediments in tandem with the analysis of charcoal particles collected from experimental burning of modern plant reference material was used to understand vegetation change around Verlorenvlei, and may shed light on other metrics of interest to the paleofire community, such as wildfire temperature and intensity. Work is underway to experimentally burn fynbos vegetation at the Natural History Museum of Utah. This research adds to a developing body of work exploring charcoal morphometry and fire history in South Africa, and will be compared to charcoal morphometrics from a more humid and wet portion of South Africa's Fynbos biome along the southern coast. Together, these findings will help us understand how the vast diversity of plants in South Africa's Fynbos biome is reflected in the charcoal record.

## Understanding the Multifaceted Nature of the pasTI Toxin-Antitoxin System

Sam Hendry, University of Utah

Faculty Mentor: Mathew Mulvey, University of Utah

## SESSION D (3:30-5:00PM)

## POSTER D70

Toxin-Antitoxin (TA) systems are common bipartite operons in prokaryotes. TA systems are composed of two genes adjacent to one another in which one encodes a protein toxic to the bacteria while the later provides the antitoxin. While TA systems are not well understood they have been implicated in phage resistance, biofilm production and persister cell formation which helps bacteria survive antibiotics and cause recurrent infection. One such system, PasTI, has been shown to be important for Extraintestinal pathogenic *Escherichia coli* (ExPEC) survival in the kidney and bladder and promotes the formation of persister cells when exposed to antibiotics. To better understand the pasTI system, strains lacking the TA operon were grown under oxidative and nitrosative stress conditions and shown to respond significantly worse than wild-type *E. coli*. Additionally pasT clones from other bacterial species with different pasT N-termini sequences: *Y. pestis* and *N. meningitidis*, were generated. When expression of PasT was induced in these clones and the wild-type, only the wild-type pasT proved to be toxic to the cell. Meanwhile, the clones continued to grow to an equal or better level than the wild-type. The clones also responded to stress conditions to equal or greater than wild-type abilities. Together the results suggest that the pasTI TA system plays a role in bacterial persistence and stress response and that the toxic effects observed in *E. coli* are the result of the N-terminal domain of the protein while differences in this protein region appear to relieve the toxicity of PasT while maintaining persistence and stress resistance abilities. The PasT protein's ability to aid in stress response and persistence could make it a target for antibiotic therapies

against ExPEC and other pathogenic prokarya that have the gene.

The identification and characterization of an autosomal gene that works in association with Overdrive to create hybrid incompatibility within *Drosophila pseudoobscura* subspecies.

Caroline Keller, University of Utah

Faculty Mentor: Nitin Phadnis, University of Utah

SESSION D (3:30-5:00PM)

POSTER D71

The evolution of reproductive barriers is essential for speciation – the process by which one species splits into two. One of the fastest barriers to evolve between species is the sterility of hybrid males. With a speciation event of 175,000 years ago, the USA and Bogota subspecies of the fruit fly *Drosophila pseudoobscura* are among the youngest pair of species to be studied genetically. Crosses between Bogota females and USA males results in sterile hybrid males. Rarely, these hybrid males are able to produce offspring, but when they are successful all offspring are female, a process known as sex-ratio distortion. The hybrid incompatibility system of *Drosophila pseudoobscura* is the premier system to study the role of selfish genetic elements such as segregation distortion in the evolution of new species. The genetic architecture underlying both sterility and segregation distortion in this system is complex. One of these components has been

identified so far – Overdrive (Ovd), located on the X chromosome of Bogota is required for both sterility and distortion. Ovd, however, has no effect on its own and requires an interaction with a dominant autosomal gene. Previous mapping suggests that this gene, whose interaction with Ovd is essential for both hybrid phenomena, is located on the second chromosome of USA. My goal is to identify this autosomal factor using an approach that combines an X-ray mutagenesis screen with whole genome sequencing. Identification of this final component of the *Drosophila pseudoobscura* hybrid incompatibility system will provide key information on the genes underlying segregation distorters and hybrid sterility between species, and open the door to understanding molecular mechanisms of selfish genes.

## Dalekin Signaling: Genetic Analysis of Suppressors

Haylee Mathews, University of Utah

Faculty Mentor: Leslie Sieburth, University of Utah

SESSION D (3:30-5:00PM)

POSTER D72

Dalekin is a novel plant hormone that is made in the plant roots; it moves through the plant to signal the perception of drought and salt stress. These stresses are known to repress growth, and dalekin does this by repressing WUS expression (which is necessary for shoot stem cells that allow for plant growth). Because dalekin is over-produced in *bps1* mutants, the loss-of-function *bps1* mutant is believed to normally function

to regulate the synthesis of daledin. The phenotype that results from the excess of daledin in bps1 mutants is that both shoots and roots are highly abnormal. However, a cold-sensitive suppressed line was isolated after bps1 was crossed to a different accession (Apost-1). These plants, which we call Red4A bps1, produce normal-looking shoots and roots that are somewhat short and highly branched when grown at warm temperatures. Because drought stress is an urgent problem, my project is to identify additional genes that function through daledin signaling. To identify genes that function in daledin synthesis or response, I am characterizing suppressor mutants. Mutagenesis was carried out using Red4A bps1 seeds, and the mutagenized seeds were grown at warm temperatures to collect self-pollinated seedlings. The resulting self-pollinated seeds were then grown at the restrictive temperature (16°C), and suppressors (called RT lines) were identified because they, but not the parental Red4A bps1, were able to flower and set seeds. My goal is to identify one of the genes that, when mutated, allowed bps1 suppression. Identifying suppressor genes will help us understand the daledin signaling and biosynthesis pathway. Because mutagenesis leads to many mutations across the genome, the RT lines were then backcrossed to Red4A bps1, F1 seeds were grown and allowed to self-pollinate, and F2 seeds recovered. The F2 seeds are homozygous for bps1 but segregate for the RT suppressor. I am currently characterizing the phenotypes and segregation ratios of the

## Effect of Deforestation on Aksumite

## Agriculture: a long-term perspective from the Tigray Plateau, Ethiopia

Corinna McMurtrey, University of Utah

Faculty Mentor: Mitchell Power, University of Utah

SESSION D (3:30-5:00PM)

POSTER D73

The Aksumite Empire was a prosperous African civilization that thrived on the Tigray Plateau in modern-day Ethiopia between c. 50 BCE and 700 CE. Their advanced agriculture techniques and fertile volcanic soils aided in productive yields able to support their population. Located on the East African Rift Zone, the Tigray Plateau was formed from ancient volcanic activity. Because of this geologic history, the deposition of volcanic ash provided a resource that ultimately improved soil quality for agricultural use. However, volcanic activity can also produce short-term climate changes that severely hinder agricultural activities. As the impact of volcanism on the Aksumite Empire has yet to be explored, my proposed Undergraduate Research Opportunity aims to understand the impact of volcanism on the Aksumite Empire's agricultural production and if volcanic activity played a role in their ultimate collapse. This research will be conducted by processing and analyzing sediment samples previously collected from a valley system near the modern town of Adigrat, on the Tigray Plateau, Ethiopia. These sediment samples will be analyzed using X-ray fluorescence (XRF), which can detect and measure most soil elements providing insight on mineralogical content, including elements that will aid in identifying periods of volcanic ash or tephra fallout. This research will also explore the evidence of fire activity from

charcoal analysis of sediment samples to examine potential links among climate, fire, volcanism, and agriculture. Although fire may be both natural and human-caused, this analysis will provide an opportunity to explore if fire was used as tool during Aksumite agricultural production.

## Calibration of the Sizing Mobility Particle Scanner

Angelina Miller, University of Utah

Faculty Mentor: Gannet Hallar, University of Utah

SESSION D (3:30-5:00PM)

POSTER D74

Small particles suspended in the air called aerosols play important roles in radiative forcing and human health, but there is still much that is unknown about the net effect of aerosols on other environmental interactions and how that will play into future climate models. In order to better understand where our earth is heading, and possibly plan for ways to mitigate this change, we need to learn more about these versatile nano-particles, how they form, and what else they can affect. One instrument used to do this is the sizing mobility particle scanner (SMPS). The SMPS measures particle size and concentrations for particles between roughly 8.51nm and 461.4nm in the Salt Lake Valley, but its measurements can drift over time. It is essential that this data is accurate, organized, and easy to work with so that it can be used to better understand the makeup of our atmosphere in the Salt Lake Valley and how it might change in the future. To ensure the



accuracy of the measurements from the SMPS a manual calibration and analysis of the instrument is needed to adjust for any uncertainties. Calibrations are run by running 350nm beads through an atomizer and adjusting the instrument if the peak of the particle sizes read by the instrument does not line up with the expected value of 350nm. A statistical analysis of the data received from the calibration will ensure that any drifts in the instrument are adjusted for correctly.

## Development meets Metabolism: Investigating how Diet and Nutrition Influence Developmental Decisions

Samantha Nestel, University of Utah

Faculty Mentor: Michael Werner, University of Utah

SESSION D (3:30-5:00PM)

POSTER D75

The effect of the environment on development is critical to human health, and animal and plant ecological strategies. However, the molecular mechanisms that regulate developmental (phenotypic) plasticity remain poorly understood. When exposed to different environments, the nematode *Pristionchus pacificus* expresses one of two possible mouth forms: either the ‘Stenostomatous’ morph with a narrow buccal cavity and one tooth-like denticle, or the ‘Eurystomatous’ morph that has a wide buccal cavity and two teeth-like denticles. In my project, I have been assessing whether morph choice, an experimentally tractable example of

developmental plasticity, is mediated by nutrition. Specifically, I performed two experiments to test the putative connection between nutritional status and phenotype: 1) grew and collected *P. pacificus* on different environments – poor and rich nutrition – for metabolomic analysis and 2) conducted dietary restriction experiments with different *Pristionchus* species to assess the generality and conservation of the diet:phenotype connection. For the primary project, I initiated the growth of ten worm-pellets collected from each NGM agar and liquid culture dietary conditions, that result in differing phenotypic expression, and submitted samples to the University of Utah Metabolomics Core Facility. In the second project, I phenotyped four different species grown on high- or low-bacterial food conditions. Results thus far from the first experiment LC/GC- Mass Spectrometry metabolomics reveal that there are significant metabolite differences between conditions, specifically those related to the lipid and protein metabolic pathways. Results from the second experiment show that all four species exhibited significant differences in mouth form under dietary restrictive conditions. Collectively, these results suggest that the effect of diet on morph choice is a deeply-rooted phenomenon feasibly connected to lipid and protein catabolism. My current experimentation aims to use free fatty acid and amino acid assays on samples from the two conditions to deeper analyze differences in these pathways that could have significance in the mechanism behind chromatin modifications.

## Molecular Dynamics Analysis of FMS

## Taylor Ottley, University of Utah

Faculty Mentor: Dmitry Bedrov, University of Utah

SESSION D (3:30-5:00PM)

POSTER D76

The solid-electrolyte interphase (SEI) is one of the most important components of a Li-ion battery. The SEI forms from the breakdown of the electrolyte and anode during early cycling and serves as a passivating layer, leading to a longer battery lifespan. While many different compounds can form on the SEI, selective electrolyte choice can be used to control their formation. The use of fluorinated solvents allows for the formation of LiF, which allows for fast ion transport and suppresses non-beneficial reactions. The Bedrov group has conducted research on a newly proposed fluorinated solvent, 3,3,3-trifluoropropylmethyldimethoxysilane (TFPMDS). This solvent was compared to an traditional electrolyte cosolvent system using ethylene carbonate (EC) and ethyl methyl carbonate (EMC). Both solvents were studied with LiFSI molarity varying between 1 and 3 M. Molecular dynamics simulations of the systems found differing lithium-ion transport mechanisms. In the EC-EMC systems solubility of the LiFSI salt was high, leading to Li<sup>+</sup> ions to be move highly independent of the FSI- molecules; this behavior was consistent over all concentrations. The TFPMDS systems, on the other hand, underwent a structural change as the concentration increased. At 1 M the LiFSI salt clustered together, stifling Li<sup>+</sup> transport. However, as the concentration increased to 3 M the FSI- molecules began to form percolating 'bridges', creating new pathways for Li<sup>+</sup> transport. Due to this, the conductivity of the two electrolyte systems had opposing trends. While the EC-EMC systems decreased in conductivity, from 7.59 mS/

cm at 1 M to 4.22 M at 3 M, the TFPMDS systems increased in conductivity, from 0.103 mS/cm at 1 M to 0.230 mS/cm at 3 M. These results matched well with experimental data from collaborators at South China Normal University. The understanding gained from this study will allow for further design of new fluorinated solvents utilizing this new transport method.

## Characterization of *Escherichia coli* CheA Linker Mutants and their Effects on Intracellular Signaling

Savannah Romney, University of Utah

Faculty Mentor: Sandy Parkinson, University of Utah

SESSION D (3:30-5:00PM)

POSTER D77

Every motile cell and organism is able to monitor and track its chemical environment, a behavior known as chemotaxis. The chemotaxis machinery of bacterial cells like *Escherichia coli* enables them to move toward beneficial chemicals (attractants) and away from harmful ones (repellents). The “central processing unit” of the *E. coli* chemotaxis machinery is the CheA signaling protein. In my project, I created mutant CheA proteins in a 6-residue domain linker that is important for CheA signaling activity. I assessed the CheA mutant chemotaxis phenotypes on soft agar plates. Some residues supported chemotaxis; others did not. I plan to evaluate the cellular amounts and stability of CheA protein in each mutant.

Stable CheA proteins were tested for their ability to regulate intracellular signaling activity in response to chemical stimuli. Further characterization of the functional defects of the mutated CheA domain will enable me to test a working model of CheA signaling.

## An Instrument (TEOM™) Validation Study Using Air Quality Data from a Wildfire Smoke Event

Nancy Sohlberg, University of Utah

Faculty Mentor: A. Gannet Hallar, University of Utah

SESSION D (3:30-5:00PM)

POSTER D79

This study uses air particulate mass concentration data taken during a 5-day smoke event (9/9/2022-9/14/2022) in Salt Lake City (SLC) to demonstrate the functionality of a re-engineered 1405-DF TEOM™ instrument. The TEOM is designed to be set-up outside with a PM10 inlet head that removes particles above 10  $\mu\text{m}$  in diameter out of a sample air stream, from which PM2.5 is then subsampled. This allows the instrument to take continuous mass concentration measurements of PM2.5 (particles with a diameter of 2.5  $\mu\text{m}$  or less) and PMCoarse (particles with a diameter of  $\sim 10$   $\mu\text{m}$  or less) in the ambient air. We have re-engineered our TEOM to allow for a larger range of measurements for coarse mode particles by using a different inlet head that has been shown to sample particles up to 13  $\mu\text{m}$  in diameter (Petersen et al., 2019). This inlet is

located on the roof of University of Utah's William Browning Building (WBB) and is connected to the TEOM via a large pipe that comes down into our lab where the instrument is located. Hawthorne Elementary school, located about 3 miles south west of the University of Utah, contains a 1405 series TEOM that follows the set-up laid out in the instrument's standard operating procedure (Ray et al., 2009). This instrument is maintained so that its data can be reported to the EPA, and its PM<sub>2.5</sub> mass concentration data is made publicly available. A comparison was done between the PM<sub>2.5</sub> mass concentration data from the WBB TEOM and the Hawthorne Elementary TEOM for the period of 9/9/2022-9/14/2022 (fig. 1), which was characterized by a significant presence of smoke in the Salt Lake Valley due to wildfires in the western US. This period was chosen because of its prominent impact on PM<sub>2.5</sub> levels, which makes for a more obvious data comparison. Strong correlation was found between the two data sets, suggesting a high degree of performance for the WBB TEOM. This result allows for more confident use of the WBB TEOM's data, and with the instrument's site located up near the Salt Lake Foothills, this data can contribute towards prevalent questions surrounding elevation impact on air quality differences in SLC. This result also opens up opportunity for more TEOM instruments sampling outdoor air to use an indoor instrument location coupled with a broader particle size range inlet. This unique set-up has the potential to extend instrument lifetime, increase instrument accessibility, and enhance instrument ability to sample larger particles like dust (a prominent coarse mode particle with significant environmental impacts).

#### REFERENCES

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Numerical, wind-tunnel, and atmospheric evaluation of a turbulent ground-based inlet sampling system. *Aerosol Science and Technology*, 53(6), 712-727.

Ray, A. E., & Vaughn, D. L. (2009). Standard operating procedure for the continuous measurement of particulate matter. Thermo Scientific TEOM.

## Avalanche Activity and Plant Biodiversity in the Wasatch Mountains, Utah

Macey Tilk, University of Utah

Faculty Mentor: Mitch Power, University of Utah

SESSION D (3:30-5:00PM)

POSTER D81

The Wasatch Mountains of Utah are widely known for their steep vertical relief and significant seasonal snowpack. These two factors create dangerous conditions during winter storms in which the probability of an avalanche occurring increases. Physical factors such as temperature, snowpack depth, amount of relief and slope orientation are important considerations for avalanche risk, however, what's happening below the snow on the ground may be just as important. Limited research has been conducted on the impact to plant diversity and how seasonal avalanche cycles may influence biodiversity over space and time. This study explores several well-known avalanche chutes to see if avalanche frequency plays a role in biodiversity. To study this, vegetation communities were studied through line transects perpendicular to avalanche paths. Species inventories were collected along each transect and were categorized into

six dominant vegetation types (herb, forb, grass, shrub, juvenile tree, adult tree) to provide an index of community diversity. Maps were then created to capture the frequency of avalanches in each research site. Surprisingly, data analysis of community plant diversity in three study sites suggest that the higher frequency avalanche chutes contain higher biodiversity while less active chutes had lower biodiversity.

## Accumulated Damage and Recovery in Drought-Stressed *P. tremuloides* Hailey Wells, University of Utah

Faculty Mentor: William Anderegg, University of Utah

SESSION D (3:30-5:00PM)

POSTER D83

Past research has demonstrated that multiple droughts can lead to accumulated hydraulic damages within plants, which has been a major contributor to large-scale quaking aspen die-off events in recent decades (Anderegg et al. 2013). This research project aims to better understand these compounded hydraulic changes resulting from repeated droughts and whether aspen are more susceptible to other stressors, particularly pathogen invasion, during or after a drought season. Over a two year-period, aspen propagules were raised in an experimental garden under four different treatment conditions: true-drought, recovering, once-treated, and control. In 2022, we measured drought stress responses throughout the growing season and took mortality surveys at the end of the season. We will now be quantifying and characterizing leaf



microbiomes in each of the plants in an attempt to identify recognizable pathogens. We will then be analyzing whether water stress is potentially linked to increased pathogen vulnerability. This research will begin to answer larger questions about how plants allocate their resources under stress, and how compounded stressors can affect overall forest health year to year.

Anderegg, W.R.L. et al. 2013. Drought's legacy: multiyear hydraulic deterioration underlies widespread aspen forest die-off and portends increased future risk. *Global Change Bio.* 19:1188-1196.

## Ethnobotany and Medicinal Chemistry

### Investigation Culturally Relevant Medicinal

### Plant Species in Southern Utah

Kaleigh Rasmussen, Southern Utah University

Maisey Peterson, Southern Utah University

Kennedi Childs, Southern Utah University

Brionna Taylor

Faculty Mentor: Guizella Roccbado, Southern Utah University

SESSION D (3:30-5:00PM)

POSTER D85

Southern Utah is a place of great geo- and biodiversity, ranging from ancient rock formations to the myriad of plant and animal species occupying the desert ecosystem. It is perhaps this biodiversity that has drawn the Paiute people

to settle here since ~1100 A.D. and allowed them to live and thrive in this land. Along with the majestic mountains and arid plains, there are many species of beautiful and useful plants that have served as medicine and been used for other purposes for generations by the Paiute people in this area. Medicinal plants have been used for millennia in all areas of the world, and are a current inspiration for the creation of synthetic drugs. However, these plants have been unsustainably harvested for these purposes to the point of endangerment or extinction. In Southern Utah many of these plant species have been used medicinally by the Paiute people for centuries. However, when it comes to scientific literature, little exploration has been done on Utah medicinal plants in relation to their ethnobotanical uses. The goal of this project is to bridge the gap between the chemistry of native Utah Flora and their cultural medicinal uses by the Paiute people in an effort to conserve the species along with the rich history that accompanies them. Our group has engaged in compiling data available on the plant species in Southern Utah that are endangered and have cultural significance to the Paitute people. In addition, we are gathering information on historical medicinal uses of these plants. Put together, these data sources reveal significant gaps of knowledge about these plants, and also uncover a great need of preserving culturally meaningful species in a more holistic manner.

Seasonal changes in worker fat content of  
*Formica obscuripes*, the western thach ant

## Christian Furness, University of Utah

Faculty Mentor: John Longino, University of Utah

SESSION D (3:30-5:00PM)

POSTER D87

*Formica obscuripes* is a species of thatching ant that thrives in semi-arid regions of the Western United States. They create dome shaped mounds out of twigs and are common in the state of Utah. Overwintering nests of *F. obscuripes* contain adult workers only, with no brood, yet brood is present in the Spring before foraging commences. This suggests workers are storing fat, which they mobilize to make new workers in Spring. We measured fat storage throughout 2022's growing season, predicting an immediate decline in worker fat shortly after snowmelt and an increase in fat through the summer. We sampled 10 ants from each of 20 nests weekly, measuring wet weight, dry weight, and "lean" weight following the extraction of fat in hexane. Fat content was measured as dry weight minus lean weight, and water content as wet weight minus dry weight. Sampling occurred from the last week of April to the last week of October. Temporal dynamics of worker fat and water content were examined, with worker size and nests as covariates.

## Bulk vs Serial Sampling in $\delta^{13}\text{C}$ , $\delta^{18}\text{O}$ , and $^{87}\text{Sr}/^{86}\text{Sr}$ Isotopic Analysis of Fossil Herbivore Teeth

Katya Podkovyoff, University of Utah

Faculty Mentor: Kaedan O'Brien, University of Utah

SESSION D (3:30-5:00PM)

POSTER D89

Since the 1970s, the fields of archaeology and geochemistry have used stable isotope analysis for reconstructions of paleodiets and other prehistoric behaviors which have since been used as evidence for topics such as human evolution, migration research, transitions to agriculture, among other topics. Focusing on tooth enamel has allowed researchers to avoid any diagenetic alteration damage since the tissue has high resistance to such a process. However, due to cost and effort, the vast majority of studies analyzing these elements utilize cross-sectional (bulk) sampling, rather than incremental (serial) sampling. Previous studies have shown that there are systematic offsets in values between the two methods, and quantifying these differences across different taxa within an ecosystem adds valuable information for future stable isotope research. In this study, we determine the extent to which information is lost about an organism's diet, water intake, and movement when bulk, rather than serially, sampling along the growth axis of mammalian molars. We do this through the evaluation of samples taken from bovid and equid fossils dating to the Late Pleistocene of southern and western Kenya as a part of a larger project tracking seasonality and migration in eastern Africa from 100-12 ka. Our results for carbon, oxygen,

and strontium isotopic analyses indicate that caution is needed when evaluating bulk sampled isotopic samples, as the majority of information stored in each tooth either remains unsampled or is averaged into a single neutral value, erasing information about seasonality and intra-year movements. This has strong implications for both how new research should best be conducted and how paleoecologists should interpret previous studies utilizing bulk sampling.

## Environmental factors needed for juvenile success

MacKenzie Woodrum, University of Utah

Faculty Mentor: Austin Green, University of Utah

SESSION D (3:30-5:00PM)

POSTER D94

Human Influence is becoming increasingly ubiquitous across most landscapes in North America, forcing wildlife to adapt to ever-changing situations in order to persist. In this light, it is critical that scientists understand how wildlife behavior and distribution is affected by human influence. Recent research suggests that wildlife adapt to human influence in different ways, largely based on evolutionary taxonomy and life history characteristics, highlighting how interspecific variation in human influence response leads to differences in wildlife community structure across a wild to urban gradient. However, there is little work done on how individual species' responses to human influence vary across major life stages (e.g., when raising young vs. when dispersing to new environments).

Therefore, in this study, we will investigate how species use their environment in different life stages. Specifically, we will elucidate what elements of the environment are utilized at different stages of life and whether or not species responses to human influence change as they raise young. We will do this by comparing the distribution and habitat preferences of lone-adult vs. young-raising individuals, discovering the difference between the environments. We hypothesize that species distributions and habitat preferences, including responses to human influence factors, will vary across life stages. We predict that the presence of juveniles will make species more likely to avoid areas of higher risk, like areas rich with human development and recreational activity. This research will highlight the importance of studying wildlife during different life stages, making it possible for wildlife managers to better understand what elements of an environment that are critical to juvenile development.

**Sciences. Session D**  
**- Oral**  
**Presentations.**  
**Collegiate Room,**  
**Union**

SESSION D (3:30-5:00PM)  
COLLEGIATE ROOM, **A. Ray Olpin University**  
**Union**

Changes in Evolutionary Acceptance Following  
Introductory Biology, 2011-2021

## Sawyer Baum, Utah Valley University

Faculty Mentor T. Heath Ogden, Utah Valley University

SESSION D 3:30-3:45PM

Collegiate, Union

Science and Technology

In 2019 Miller and colleagues found that 52% of the general public accepted evolution compared to only 45% in 1985. This change in acceptance is most likely influenced by multiple factors, education, decreased religiosity, age, role models, and survey format (Miller et al., 2006; Barnes et al., 2019; Holt et al., 2018 & Pew Research Center, 2019). Our objective in this study was to identify any trends that might have been present among Introductory Biology students at a large public university over 2011-2021. During that time period students were asked if they accepted biological evolution before and after the semester's instruction. We found an increase in both student's acceptance of evolution over that time period with 25% of students accepting evolution in 2011 and 44% in 2021. In this study, there were two types of course delivery, face-to-face and online courses, all of which were given the same question and survey delivery. There was no significant difference in acceptance between course structure as there was a 28% and 26% increase on average in acceptance for face-to-face courses and online courses following respectively. Overall, acceptance of evolution is increasing among Introductory Biology students both prior and after the semester.

## Medical Conditions and Stem Motivation at an



# Open Enrollment Institution

## Porter Bischoff, Utah Valley University

Faculty Mentor Britt Wyatt, Utah Valley University

SESSION D 3:50-4:05PM

Collegiate, Union

Science

Prior research has investigated the recruitment and retention of certain student identities (such as gender and ethnicity) in STEM courses and careers. Recruitment and retention in STEM can be influenced by a student's connection to the STEM community, science identity, and engagement. Yet none of this research has investigated the impact of having either a medical experience or chronic condition on our STEM students despite other research indicating medical students with medical conditions are less likely to complete their degree. Additionally, individuals with medical conditions tend to feel disconnected from others and experience higher levels of stress during their life. Thus, it is important to study the potential impacts of medical experiences and conditions on undergraduate students. This study explores the potential impacts of having a medical experience or chronic condition on students taking science classes at an open enrollment institution. Specifically, we hypothesized acute medical experiences may include a limited number of interruptions to one's daily lifestyle and education and thus have a smaller impact on science students in comparison to students with chronic medical conditions. We specially focused on how acute medical experiences and chronic conditions may be related to varying levels of student science career motivation, science interest, science self-determination, engagement of science outside of the classroom,

communal view of science, and value of peers in their classroom. Pre-course data was collected from 1280 students across 14 biology courses (including non-majors) taught by 16 different instructors at a focused-teaching institution. Surprisingly, 55% of students surveyed reported having an experience with an acute medical condition and 20% reported having a chronic condition. This indicates that medical experiences and chronic medical conditions are indeed an important and large identity to investigate further. Interestingly, there were no significant variations for students with acute medical experiences across science career motivation, science interest, science self-determination, engagement of science outside of the classroom, communal view of science, and value of peers in their classroom. However, we did see significant differences for students with chronic medical conditions depending on the major of the student (biology major, non-biology STEM major, pre-health professional major, or non-STEM major). Specifically, non-STEM majors had more appreciation and engagement with STEM if they also had a chronic medical condition. Further investigation of the potential differences for students with chronic medical conditions will continue to be explored with a post-survey.

## Examining Motivation through STEM courses by GPA and Major

Kody Garrett, Utah Valley University

Faculty Mentor Britt Wyatt, Utah Valley University

## SESSION D 4:10-4:25PM

Collegiate, Union

Science and Technology

With an increase of diverse students entering college (including non-traditional and first-generation students), it is important students are engaged in science. To be engaged in science, students might be motivated by both external (grade and career motivation) and internal factors (interest in science). Previous research has been conducted to determine internal and external motivational factors and the impact of those factors on student achievement in class (GPA). However, most of this research has been done at research-intensive institutions and not at open enrollment teaching focused institutions that tend to have a larger non-traditional and first-generation student populations. Therefore, research on the student populations at an open-enrollment institution is needed. Our study focused on various declared majors (Pre-Professional, Biology, Non-Biology STEM and Non-STEM) of students who were taking science classes and their self-reported GPA in addition to other factors in the beginning of the semester. As such our research questions were: 1) Which majors at a teaching focused, open enrollment institution, will have a higher science interest and career motivation? 2) How does science interest and career motivation at an open enrollment, teaching focused institution relate back

to student science identity and career choice? A survey was sent out amongst 18 Biology department courses ranging from non-major introductory Biology courses to advanced Biology major courses. Comparisons were drawn between all majors for interest, career motivation and GPA by using one-way ANOVA to determine how different all the groups were from each other. A bonforroni post test was used to show a more detailed difference between groups. Our results indicated that there was significant difference between majors on interest and career motivation but no significant difference on overall GPA (this might be due in part to the self-reported aspect of this question). Those who declared themselves as Biology majors had the highest science interest, while those who were Non-STEM majors had the lowest science interest. Biology and Pre-Professional majors had approximately the same level of career motivation which is significantly higher than Non-Biology STEM and Non-STEM majors. Further research will be conducted on how much science interest plays a role in motivating students' career choice and science identity in a post-survey.

Is general chemistry too costly? How different groups of students perceive the effort and

## emotional costs of taking a chemistry course and the relationship to achievement

Cassidy Wilkes, Southern Utah University

Faculty Mentor Guizella Rocabado, Southern Utah University

SESSION D 4:30-4:45PM

Collegiate, Union

Science

It is well known that chemistry is one of the most feared courses in college. Although many students enjoy learning about science, most of them perceive that chemistry is “too difficult”. These perceptions of chemistry result in many students not considering STEM majors because they require chemistry courses. Ultimately, these perceptions are also thought to be related to high attrition rates of students who begin STEM majors but do not persist. The perceived cost of studying chemistry is a notion that many researchers have spoken about, but have not formally investigated. Students’ perceived costs of a chemistry class can be many, such as task effort, loss of valued alternatives, emotional, and others. These costs might be overcome by students’ interests and goals, yet the level of perceived costs might have a lasting impact on the students’ overall perception of chemistry and their desire to pursue chemistry and other STEM careers in the future. In this mixed methods study we investigated task effort and emotional cost, as well as a mastery or performance goal orientation and the impact these constructs may have on achievement in general chemistry classrooms. Utilizing cluster analysis as well as student interviews, we investigated students’ profile of perceived cost and goal orientation as it relates to their final grades. Our results show that students who are well prepared

for general chemistry, such as those who have taken AP chemistry in high-school, display less negative perceived costs and thus believe they can master the material more fully. Other interesting results have also emerged from this research, which have the potential to have an impact on future instruction of these courses.

**Sciences. Session D**  
**- Oral**  
**Presentations, East**  
**Ballroom, Union**

**SESSION D (3:30-5:00PM)**  
**Location: East Ballroom, A. Ray Olpin**  
**University Union**

GABA cell characterization in the Ventral  
Tegmental Area  
Kaj Anderson, Brigham Young University

## Derek Fairbanks, Brigham Young University

Faculty Mentor Jeff Edwards, Brigham Young University

SESSION D 3:30-3:45PM

East Ballroom, Union

Science and Technology

91,799 Americans died from a drug overdose in 2020 – an increase of 21,000 deaths compared to the previous year. With overdose numbers climbing, it is imperative to invest resources into the study of addiction. Addictions are mediated by the ventral tegmental area (VTA) of the brain. It is composed of primarily dopamine neurons and Gamma-aminobutyric acid (GABA) neurons. When a drug is taken, the connections between neurons in the VTA are either strengthened through long-term potentiation (LTP) or weakened through long-term depression (LTD). While dopamine neurons have been extensively studied, GABA neurons in the VTA have been neglected. It has recently been discovered that some disinhibitory GABA neurons cause LTD when fired, while others cause LTP. In order to see if there is a genetic difference between these two populations, GABA cells that synapse with other GABA cells will be isolated from the VTA of a mouse brain, and then characterized using polymerase chain reaction (PCR) techniques. It will show if GABA neurons that induce LTD are genetically different from those that induce LTP. This is the next step in understanding the reward circuit and discovering solutions for addiction.

## The Effect Of The Ketogenic Diet On



# Long-term Potentiation In The Hippocampus

## Bryson Reed Brigham Young University

## Jared Weight, Brigham Young University

Faculty Mentor Jeff Edwards, Brigham Young University

SESSION D 3:50-4:05PM

East Ballroom, Union

Science and Technology

Four in ten Americans claim to follow a specific diet regime, with 12.9 million Americans electing to follow the ketogenic diet annually [1]. The ketogenic diet has rapidly established itself as one of the most popular fad diets in the United States over the past decade due to short-term weight loss success. It utilizes ketones, such as beta-hydroxybutyrate (BHB), as the body's primary energy source instead of the typical source, glucose. Little research has been performed regarding the cognitive effects of the ketogenic diet. We aim to understand the effects of a ketogenic diet on formation and consolidation of memory, which is measured with long-term potentiation (LTP) in the hippocampus. Recalling and acting upon prior experiences uses LTP by strengthening neuron synapses (elevates their activation), which leads to a long-lasting increase in signal transmission between neurons [2]. Every time we recall an event, we strengthen the synapses involved in forming that memory. By measuring LTP in the hippocampus, we can determine if the ketogenic diet impacts cognitive ability to form memories. To accomplish this, we bathe coronal slices from a rodent's brain that include the hippocampus in a solution containing BHB. Electrodes are placed in the ventral region of the hippocampus of the slice to induce a current to stimulate and measure LTP. Our objective is to illustrate

that the ketogenic diet has measurable cognitive effects on our ability to form and consolidate memories. Understanding the cognitive effects on memory the ketogenic diet inflicts could potentially sway the dietary choices of about 5% of Americans. Additionally, if we discover that the ketogenic diet enhances LTP, further testing can determine if it could potentially become a treatment modality for neurological disorders that arise from diminished LTP or weakening of synapses, such as Alzheimer's Disease.

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[2] Purves D, Augustine GJ, Fitzpatrick D, et al., editors. Neuroscience. 2nd edition. Sunderland (MA): Sinauer Associates; 2001. Long-Term Synaptic Potentiation. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK10878/>

[3] Yazdi, Puya. "Long-Term Potentiation: Importance & 17 Ways to Increase It." SelfHacked, SelfHacked, 15 May 2020, <https://selfhacked.com/blog/long-term-potentiation-ltp/>.

## Teaching a Computer to Untie a Knot

Adam Call, Brigham Young University

Faculty Mentor Mark Hughes, Brigham Young University

SESSION D 4:10-4:25PM

East Ballroom, Union

Science and Technology

Genetic algorithms are a class of algorithms in reinforcement learning that use models inspired from evolutionary processes

to help computers learn to solve complex problems. Different solution strategies are modeled as individuals in a population, which are allowed to evolve through an iterative process aimed at maximizing a given fitness function. These algorithms have been shown to be adept at solving problems in a variety of different fields. In this talk we will explore uses of genetic algorithms for solving computationally complex problems in low-dimensional topology and knot theory.

## Synthetic Handles for Peptide Synthesis

Abbie Darling, University of Utah

Faculty Mentor Andrew Roberts, University of Utah

SESSION D 4:30-4:45PM

East Ballroom, Union

Science and Technology

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 synthetically using solid-phase peptide synthesis (SPPS) up to approximately 50 amino acids. These fragments are then used to access longer peptides and proteins through selective coupling known as native chemical ligation (NCL). NCL achieves this site and termini selectivity using the reaction of a C-terminal thioester and N-terminal thiol. However, the commonly used method leaves a Cysteine (Cys) residue at each juncture, which is the least abundant amino acid naturally. Our research aims to explore the synthesis of synthetic amino acids that enable NCL to produce a new peptide bond at a range amino acid junction

through the elimination of a thiol auxiliary. Creating these amino acids would allow access to a wider range of natural peptides and proteins.

**Sciences. Session D**  
**- Oral**  
**Presentations,**  
**Parlor A, Union**

**SESSION D (3:30PM – 5PM)**  
**Location: Parlor A, A. Ray Olpin University**  
**Union**

## New Biological Concepts for Artificial Life and Intelligence

Landon Drewes, Utah Valley University

Faculty Mentor Fernando Otalora-Luna, Utah Valley University

SESSION D 3:30-3:45PM

Parlor A, Union

Science and Technology

Currently, there is a need to build new concepts for the development of original forms of life. Our traditional biological concept of life is restricted, as life is considered a spontaneous phenomenon, i.e. not created according to plans and projects. Thus, the natural concept of life restricts the development of artificial life, which is based on plans and projects. If we want to “create” life, certain terms such as cells, growing, DNA and evolution represent an insurmountable constraint—they could be problematic- or just useless. In this regard, scientists must concentrate efforts in order to critically review long-standing concepts and propose transcendental ideas for a novel type of life, a type that is actually defined and created by humans rather than by nature. The challenge is enormous. But we can start by addressing the old biological problems and the new technological challenges. The old biological problems include, naturalism, vitalism, anthropocentrism, adaptationist program, teleology, orthogenesis, intelligent design, Anthropocene etc. and the new technological challenges focus on ecological crisis, artificial life, artificial intelligence, Novacene, cyborgs, etc. These categories cannot be addressed with only the classical biological theoretical framework. If life is really a universal phenomena, it should be possible to make general and novel theoretical contributions to the construction of a new type of

life, while surpassing the frontiers of the traditional concepts, e.g. genes, mitosis, meiosis, natural selection, etc. Here, we review a) how Darwin treated the concepts of natural and artificial and b) his notion that *Homo sapiens* makes himself different from nature. Additionally, we discuss the possibility of broadening the range of concepts so as to develop a universal basis that might serve to carry life to a broader scope, proposing several definitions for life, one of which is inclusive to both natural and artificial life alike.

## The role of CEBP/A in the unfolded protein response in Ins-1 beta cells and primary rat islets

Peter Ellsworth, Brigham Young University

Faculty Mentor Jeffery Tessem, Brigham Young University

SESSION D 3:50-4:05PM

Parlor A, Union

Science and Technology

The transcription factor Nkx6.1, when overexpressed in primary rodent and human islets, is sufficient to enhance beta cell proliferation, increase insulin secretion and enhance cell survival. We have sought to define the transcriptional targets of Nkx6.1 that allow for its ability to increase functional beta cell mass. We have shown that Nkx6.1 induces expression of the transcription factor CEBP $\diamond$ . CEBP $\diamond$  overexpression is sufficient to induce proliferation of Ins-1 832/13 beta cells and primary rat islets. CEBP $\diamond$  overexpression enhances glucose stimulated insulin secretion from primary rat islets, while

decreasing total insulin content. Finally, CEBP $\diamond$  overexpression protects Ins-1 832/13 beta cells from thapsigargin and glucolipotoxicity induced cell death but fails to protect against etoposide and camptothecin induced cell death. These data suggest that CEBP $\diamond$  plays a critical role in Nkx6.1 mediated expansion of functional beta cell mass through protecting against endoplasmic reticulum induced stress. We demonstrate the effect of CEBP $\diamond$  on gene transcription of genes essential for modulating endoplasmic reticulum induced stress.

## The Effects of Phthalates DEHP and DBP on Daphnia Magna Survival and Reproduction

### Reese Gorey, Westminster College

Faculty Mentor David Kimberly, Westminster College

SESSION D 4:10-4:25PM

Parlor A, Union

Science and Technology

Phthalate esters are one of the most frequently detected toxic organic pollutants in our environment, affecting human and animal development through endocrine disruption. These pollutants are widely used in human-made products, such as plastics, polyvinyl chlorides (PVC), cosmetics, surfactants, perfumes, paints, etc. However, these chemicals easily leach into our water, soil, sediment and even the air we breathe. In this project, we collected surface water, soil, and sediment samples from the Big Cottonwood Canyon (BCC) Creek, since it is a major source for Salt Lake City's drinking water, for phthalate quantification using chemical analysis techniques.



Additionally, we used the aquatic invertebrate *Daphnia Magna* as a model organism for chronic phthalate exposure in the lab, observing the effects that phthalates have on their development and reproduction at various concentrations. This research will help quantify phthalate concentrations present in the local BCC environment and show how this pollutant may affect organisms, including humans, which use this water to survive.

## The Effects of Exercise on THC Reduction of Learning and Memory

Dylan Kendall, Brigham Young University

Faculty Mentor Jeffrey Edwards, Brigham Young University

SESSION D 4:30-4:45PM

Parlor A, Union

Science and Technology

In the last decade, most states have legalized marijuana for recreational and medicinal use. Millions of people in the United States alone use marijuana and it has been estimated that 3 in 10 people who use marijuana have marijuana use disorder. (Hasin 2001). Up to this point, some research has shown that Tetrahydrocannabinol (THC), one of the two primary psychoactive elements in marijuana, may cause memory and learning deficits in the hippocampus of mice (Barfi 2021). Because of this, learning more about THC has widespread impact on the world and the future of healthcare. In particular, its vital that physicians and healthcare providers understand the potential risks and benefits associated with prescribing medical marijuana to patients. The purpose of our project is to better understand the effect that exercise has on learning

and memory deficits caused by chronic exposure to THC. The primary measure of learning and memory in our experiments will be synaptic plasticity and long-term potentiation (LTP). Synaptic plasticity refers to the ability of the brain to adapt its connectivity while LTP refers to the strengthening of synapses in the brain. Overall, our results will lend greater insight into the mechanism of THC on the brain, and how exercise affects this mechanism.

### References

- Barfi, E., Tehrani, A. M., Mohammadpanah, M., Boroujeni, M. E., Meftahi, G. H., Sadeghi, Y., Eziy, S., Khatmi, A., Abdollahifar, M. A., Ghorbani, Z., & Aliaghaei, A. (2021). The role of tetrahydrocannabinol in inducing disrupted signaling cascades, hippocampal atrophy and memory defects. *Journal of Chemical Neuroanatomy*, 113, 101943. <https://doi.org/10.1016/j.jchemneu.2021.101943>
- Hasin, D. S., Saha, T. D., Kerridge, B. T., Goldstein, R. B., Chou, S. P., Zhang, H., Jung, J., Pickering, R. P., Ruan, W. J., Smith, S. M., Huang, B., & Grant, B. F. (2001). Prevalence of marijuana use disorders in the united states between 2001-2002 and 2012-2013. *American Medical Association (AMA)*. <https://doi.org/10.1001/jamapsychiatry.2015.1858>

**Sciences. Session**

**D- Oral**

**Presentations,**

**Theatre, Union**

**SESSION D (3:30PM – 5PM)**

**Location: Theatre, A. Ray Olpin University  
Union**

## Pollinators Role in an Ongoing Speciation Event

Samantha Ingram, Utah Valley University

Faculty Mentor Michael Rotter, Utah Valley University

SESSION D 3:30-3:45PM

Theatre, Union

Science and Technology

There are many factors that contribute to speciation events. Importantly in plants, pollinators can have a large impact on breeding between different individuals. This discrimination of pollinators is driven by a variety of morphological traits in the plant, therefore possibly leading specific pollinators to having a strong plant preference. In the Western United States, rabbitbrush is a common shrub with over 20 different sub-species that co-exist and may exchange genes. Despite their interbreeding these sub-species appear as seemingly stable evolutionary units. This knowledge leads to the question: Do pollinators discriminate between sub-species of rabbitbrush? Studying these differences can be important for predicting gene flow and how speciation events may start to occur. To answer this question, we intend to complete a series of experiments comparing variables of two sub-species of rabbitbrush; viability of seeds, morphological floral measurements, identification of insect communities, observational field trials with fluorescent pigment as a proxy for gene flow, and chemical analysis. We expect that due to the floral morphological differences, pollinators will favor one sub-species of rabbitbrush over the other. Thereby, providing evidence of pollinator impact on speciation events through gene flow. This study will provide understanding of ongoing diversification events of rabbitbrush.

Additionally, the knowledge found will contribute to the more general and deeper understanding of how ecological roles, between pollinator and plant, contribute to evolution.

## Provitamin D3's photochemical reaction and previtamin D3's isomer-selective formation via phenylalanine

Tony Ochsner, Southern Utah University

Faculty Mentor Jacob Dean, Southern Utah University

SESSION D 3:50-4:05PM

Theatre, Union

Science and Technology

Vitamin D3 is an essential steroid for humans to maintain calcium levels and preserve bone density. The creation of vitamin D3 in the body is activated by light and is a well-studied reaction. The ring opening of its steroid precursor 7-dehydrocholesterol, or provitamin D3(PVD), is photo-initiated from UVB and some lower energy UVC wavelengths. Studies have shown a strong wavelength dependence on the final

product formation due to subsequent isomerization reactions. Previtamin D3 is the ring opened metastable intermediate, formed after the absorption of lower energy UVB wavelengths. It will eventually thermally rearrange to form the bioavailable vitamin D3. However, if previtamin D3 interact with a higher energy UVB or lower energy UVC photon this will trigger an isomerization and increase minor product formation, such as tachsterol or lumisterol. In this study the experiments were

focused on maximizing previtamin D3 formation in the UCV region by minimizing secondary isomerization. This was accomplished by introducing phenylalanine(PHE), a known UVC absorber into a solution with PVD, for the purpose of converting UVC wavelengths into lower UVB energy. In the process, the energy is made available through energy transfer to initiate the ring opening reaction itself. Through several experiments and data analysis there is strong evidence that when illuminated with lower energy UVC wavelengths the PHE-PVD solution aided in the formation of previtamin D3. A secondary influence caused by phenylalanine was to diminish previtamin D3's secondary isomerization by acting as an inbound energy down-shifter that suppresses isomerization. When a similar mixed solution was illuminated with lower energy UVB wavelengths the formation of previtamin D3 proceeded unimpeded by the phenylalanine.

## Remediation of Benzo(a)pyrene in soils for urban agriculture using aerobic compost amendments

Victoire Soumano, Westminster College

Faculty Mentor Christy Clay, Westminster College

SESSION D 4:10-4:25PM

Theatre, Union

Science and Technology

Benzo(a)pyrene (BaP) pollution in urban soils is a concern for urban farmers and limits cities' ability to use vacant land to

grow food. BaP is a hydrophobic organic compound that forms as a result of incomplete combustion of organic materials from asphalt paving, diesel and gasoline emissions, wood burning, and burning of coal, oil, and soot from industry. Our research aims to develop a low cost ecological remediation method to reduce BaP concentration in urban soils to a level safe for food production. Previous studies suggest that soil microorganisms can break down organic pollutants such as BaP, however a successful method has yet to be determined. The ultimate goal of this project is to determine the effectiveness of BaP remediation using aerobically produced compost with a diverse and abundant microbial community. Currently we are developing a synchronous scanning fluorescence spectroscopy method to evaluate the soil at 90 locations on the farm to assess the extent of BaP contamination. The method and results of the soil assessment will be presented. In continued work, we will also measure BaP concentration after in situ amendment of aerobic compost in ratios of 1:1, 1:0.5, and 1:0.33, to determine the proportion required for BaP degradation. We hypothesize that the 1:1 soil ratio will decrease BaP concentration by half, simply by dilution, and more due to degradation by soil microorganisms. As for the other ratios, we expect them to decrease BaP concentration in the soils as a result of the microorganisms breaking down BaP molecules, perhaps at various levels.

## Role of FliQ in flagellar secretion-specificity switch

Angus Wu, University of Utah

Faculty Mentor Fabienne Chevance, University of Utah

SESSION D 4:30-4:45PM

Theatre, Union

Science and Technology

The assembly of the bacterial flagellum in *Salmonella* is achieved via a flagellar type III secretion system (fT3SS), translocating flagellar proteins from the cytoplasm through the center of the growing organelle where they self-assemble at the distal end of a growing structure. Upon completion of an intermediate assembly structure (the hook-basal body or HBB), the fT3SS undergoes a secretion substrate specificity switch from early assembly proteins (HBB subunits) secretion to late substrate proteins (filament subunit) secretion. We previously isolated a spontaneous mutation in FliQ (G32D) that enables late substrate (FlgM-bla) secretion prior to HBB assembly. FliQ is a core component of the fT3SS. To explore how FliQ partakes in the flagellar specificity switch, FliQ was subjected to targeted doped oligo mutagenesis in order to identify other residues in FliQ that would cause a similar effect as the FliQ G32D mutant. We were able to isolate such a critical residue in at amino acid 48 (T48M) in FliQ. Subsequent targeted randomized (NNN) mutagenesis of amino acid codons 32 and 48 of FliQ revealed amino acid substitutions with similar secretion properties as the FliQ G32D and T48M alleles that are able to switch flagellar specificity prior to HBB assembly plus other substitutions that were defective in secretion. We therefore can conclude that both the G32 and T48 amino acid



residues of FliQ are crucial to the function of FliQ and to the secretion-specificity switch. To test whether FliQ mutants lose or retain the ability to facilitate early protein secretion, we will construct a fusion product of  $\beta$ -lactamase protein lacking its Sec-dependent secretion signal (Bla) to the C-terminus of FlgE, a hook subunit protein (early secretion-substrate), as a reporter for detecting early flagellar protein secretion. In addition, all fliQ mutants will be complemented with wild type fliQ to characterize their dominant or recessive features. This in-depth research is a continuation of my UROP project, and this study should add its own unique contribution to the current understanding of the flagellar secretion-substrate specificity switch.

**Social Sciences.**  
**Session D - Oral**  
**Presentations.**  
**Boyer Conference**  
**(2nd floor), Alumni**  
**House**

**SESSION D (3:30-5:00PM)**  
**Location: Boyer Conference (2nd floor),**  
**Alumni House**

**Educating and Engaging Youth about the**

# **Equal Rights Amendment Through Legislative Advocacy**

**Tiffany Chan, University of Utah**

Faculty Mentor James Curry, University of Utah

SESSION D 3:30-3:45PM

Boyer Conference (2nd floor), Alumni House

Social Sciences

The Equal Rights Amendment (ERA) is designed to guarantee equal legal rights for all American citizens regardless of sex. Due to legal issues with the ratification deadline and meeting the necessary state ratification quota, the ERA has been at a standstill across the U.S. The longer the ERA is not ratified in Utah, the longer that many live without equal rights indefinitely. This is pertinent to the youth as they are changemakers and help change the future of the country. ERA ratification relies on education, advocacy, and activism that targets today's youth and decision-making legislators. The literature on the importance of youth engagement in legislative advocacy and the obstacles to it and what can motivate legislators to take action on what issues help understand why the effort to ratify the ERA is centered around these two pillars. The overall goal of this project is to educate and engage youth about the ERA through legislative advocacy. The objectives were to create a comprehensive education curriculum in a social justice lens for youth (high school and college) and develop toolkits about legislative advocacy for use in preparation for the next state legislative session. The expected impacts here are increased knowledge, connections, skills, and engagement youth will gain to further ERA legislative advocacy, and increased youth base and influence for the Utah

ERA Coalition. The overall long-term impact is that there is more of an organized, effective legislative advocacy for the ERA ratification in Utah from the efforts of youth activists.

## **Applying the Extended Parallel Process Model to Climate Change Communication Mikenna DeBruin, Utah State University**

Faculty Mentor Tim Curran, Utah State University

SESSION D 3:50-4:05PM

Boyer Conference (2nd floor), Alumni House

Social Sciences

The Extended Parallel Process Model (i.e. the EPPM) is a health-risk model that combines appeals to fear and efficacy in order to promote a productive danger-control response in individuals. The EPPM has traditionally been applied to the fields of epidemiology and chronic illness; however, it has minimally been applied to climate change communication. Some climate change research examining fear appeals and efficacy appeals separately suggests that the EPPM may be a salient model for encouraging mitigation efforts towards climate change. Thus, I plan to expand the scope of the EPPM through a quantitative survey examining the impact of different EPPM message exposures on efficacy perceptions and behavioral intentions of individuals. These message exposures will vary along a positive-negative efficacy dichotomy and a high-low threat dichotomy. In January of 2023, survey participants in the United States will be reached through Prolific, and individuals will take the survey through Qualtrics. The data will be analyzed with the Statistical Package for the

Social Sciences (SPSS) using a one-way multivariate analyses of variance (MANOVA).

## **On the Universality of Personhood: Implications for Social Science Research from a Hmong Model for Personhood Ellie Johnson, Brigham Young University**

Faculty Mentor Jacob Hickman, Brigham Young University

SESSION D 4:10-4:25PM

Boyer Conference (2nd floor), Alumni House

Social Sciences

In the ethnographic research I undertook among a Hmong community in northern Thailand, my aim was to understand my Hmong interlocutors' perceptions of self and models of personhood. A Hmong model of personhood differs from typical Western models of personhood, and these divergences are due to underlying cosmological differences. The cosmological underpinnings of cultural models of personhood have not received enough sustained attention in social science research. I demonstrate the merits of my interlocutors' personhood by arguing that their personhood, performed on their cosmological stage, enables innovative approaches to recreating Hmong tradition, and empowers individuals to actively and creatively negotiate a sense of self within their social context. In so doing, I depict some fundamental, ontological differences between my Hmong interlocutors' personhood and Western personhood, and how this should

change how cross-cultural research is conducted in the social sciences.

## **Class-Based Affirmative Action, Higher Education, and Racial Economic Disparity**

### **Francisco Meza, University of Utah**

Faculty Mentor Annie Fukushima, University of Utah

SESSION D 4:30-4:45PM

Boyer Conference (2nd floor), Alumni House

Social Sciences

The United States, while becoming incrementally more progressive, is plagued by issues of social inequality and a lack of social welfare most evident in the poor quality of life experienced by minority communities often living in lower socioeconomic statuses. As policy in the United States regarding social inequality has evolved in the past couple centuries from being explicitly racially motivated to gradually placing less emphasis on racial aspects, an adequate response to social inequality in an effort to develop methods of solvency has become increasingly difficult. For this reason it is especially important for the state of an increasingly diverse nation that social inequality is dealt with, leading us into a deeper discussion on how policy will reflect that need. Within the scope of social inequality the racial wealth gap is evaluated in order to provide an understanding of how policy may aid in the future decline of this wealth gap. The need for policy that ameliorates racial disparity in regards to access to higher education is identified as a potential method for solvency. In this study the needs of communities will be assessed to see

what kind of policy should be chosen as it is either developed or amended. The failures of social welfare will also be evaluated to avoid the pitfalls of past legislation along with assessing what kind of policy may be politically and socially appropriate to meet the needs of those experiencing a lack of social equity while maximizing the potential success of said policy. The goal by the end is to develop a recommendation for primarily class-based policy and how race-based policy may best fit alongside it to best provide guidance for the development of social welfare and equity.

**Social Sciences.**  
**Session D - Oral**  
**Presentations,**  
**Parlor B, Union**

**SESSION D (3:30-5:00PM)**  
**Location: Parlor B, A. Ray Olpin University**  
**Union**

Phonological Effects in Mandarin Chinese Names

Sean Cameron, Brigham Young University

Faculty Mentor Rachel Liu, Brigham Young  
University



## SESSION D 3:30-3:45PM

Parlor B, Union

Humanities

Mandarin Chinese does not have a succinct method of adapting foreign words and names (He, 1989). This presents a major issue to Mandarin L2 speakers who wish to adapt their name using a natural and native-sounding way (Liedel, 2014). In this paper, we ask: which phonological features contribute to a native-sounding name? This study identifies key phonological features used by native speakers in generating native-sounding Mandarin names. A collection of native Mandarin names was gathered from graduating students from Peking University with primarily Mandarin-speaking backgrounds. These names were fed through the `pinyin_jyutping_sentence` module in Python to create frequency lists for sequences for tones, onset place of articulation, manner of articulation, vowel quality change, and syllable coda presence. The data suggests that all of these play an important role in Mandarin onomastics. Mandarin L2 speakers can use principles put forth in this paper to create normal and native-sounding names for themselves.

Testing the Deterrent Effect of Sentence

Lengthening Legislation on Violent Crime

## Holly Day, Southern Utah University

Faculty Mentor Joshua Price, Southern Utah University

SESSION D 3:50-4:05PM

Parlor B, Union

Social Sciences

This paper explores the assumed deterrent effect of longer sentence length on the frequency at which violent crime is committed. To do this, an econometric analysis of state panel data using a difference-in-differences model examines the effects of sentence lengthening legislation by comparing a treatment group of states that have enacted stricter sentencing policies to a control group of states that have not done so. Many policymakers and voters believe that longer sentencing increases the costs of crime which discourages potential criminals, thus having a determinant effect on the rate at which crime is committed. This paper tests the hypothesis that the supply of violent crime is, for the most part, inelastic to costs such as sentencing lengths. Some possible explanations for this lack of elasticity might be the complexity of the legal system itself and/or a misunderstanding of the motivations that incentivize criminals.

## Black Scholes Delta Hedge in Imperfect Markets

Mitchell Pound, Utah State University

Faculty Mentor Pedram Jahangiry, Utah State University

SESSION D 4:10-4:25PM

Parlor B, Union

Social Sciences

The Black-Scholes model for pricing European call options relies on continuous delta hedging with prices distributed log-normally with a known, constant volatility. This only works in a perfect, “friction-less” market. We simulate cumulative returns for a market maker using a discrete delta hedge with different time intervals between rebalancing the portfolio. A Julia package is developed by the authors to achieve this goal, which will be open source for the benefit of the public. Using the Julia package, we estimated the distribution of cumulative returns for a delta hedged portfolio by Monte Carlo analysis. This is done using both a log-diffusion parametric model and stationary bootstrap of historical returns for simulated stock prices. With both the parametric and non-parametric models, as the time between rebalancing the portfolio decreases, the variance of the returns decreases, while the expected return is near 0. This provides empirical evidence that a Black-Scholes delta hedge is a viable hedging strategy for helping market makers to better manage and quantify their risk, even given market “imperfections”.

The Public Perception of Terrorist Activity

Measured Against Database Evidence

Chandler Robinson, Utah Tech University

Faculty Mentor Jessica Abbott, Utah Tech University

SESSION D 4:30-4:45PM

Parlor B, Union

Social Sciences

Data shows that Americans are fearful of a variety of different crimes; some more than others. Understandably, Americans are particularly fearful of the idea that a terrorist attack may effect their lives in some way. As destructive as these events have the potential to be, they are uncommon in comparison to fear index data. This study seeks to understand how demographics and media consumption determines an individual's perception of terrorist groups and organizations.

Keywords: Terrorism, Media, Crime

**Social Sciences.  
Session D - Oral  
Presentations,  
Conference Room,  
Sill Center**

**SESSION D (3:30PM – 5PM)  
Location: Conference Room, Sill Center**

Post Now, Eat Later: Social Policy for Eating  
Disorders

Alyssa English, Utah Tech University

## Aspen Marshall, Utah Tech University

Faculty Mentor Danelle Larsen-Rife, Utah Tech University

SESSION D 3:30-3:45PM

Sill Center

Social Sciences

Eating disorders are increasingly prevalent among adolescents. Adolescence is a time of relatively rapid physical, mental, and emotional change, and is a prominent time to develop a mental health disorder. Nearly all diagnoses of eating disorders occur between the ages of 12 and 25 (Johns Hopkins All Children's Hospital, 2022). Disordered eating brings harmful side effects and may result in death. Among mental health disorders, death from eating disorders is second only to opioid overdose (ANAD, 2022). The growth of technology has increased use of electronic devices and social media platforms, especially after the COVID-19 pandemic. Social media has increased awareness of eating disorders, however the lack of regulation of social media permits the promotion of eating disorders. There is an association between screen time and social media use and eating disorders in adolescents (Wilksch et al., 2020). Parents spend less time with their children during adolescence resulting in a potential lack of awareness of their social media use and disordered eating behaviors (Marceau et al., 2014). Due to limited understanding of eating disorders, treatments that are available are not entirely effective (McAleavey, 2008). Thus, it is important to prevent the onset of eating disorders and intervene early. Most treatments for eating disorders do not focus on prevention, rather they attempt to reduce symptoms of eating disorders in general. This paper will synthesize the literature on eating disorders and propose a prevention and intervention program implemented

through the education system, including parent education and public service announcements. Instituting mental health wellness checks for adolescents in schools is a proactive approach to prevent eating disorders before they become entrenched. Prevention and intervention may reduce the incidence and severity of eating disorders.

## “Finite Diversity in Infinite Combinations”: A Study of Women in the Original Star Trek Fandom

Hayley Anderson, Brigham Young University

Faculty Mentor Rebecca de Schweinitz, Brigham Young University

SESSION D 3:50-4:05PM

Sill Center

Social Sciences

When asked for the motivations behind the Star Trek convention of 1972, the first exclusive fandom convention, organizer Devra Langsam responded with, “...[so] we can talk about Star Trek, and nobody would look at us funny and say, ‘That’s not real science fiction...’” (Langsam, 2017) While scholars, including Michael Jindra and Erin Hanna, have noted the impact of the early Star Trek fandom on shaping the series and modern fan activities, few have studied the fandom’s activities, such as fanzines and exclusive conventions, as a women’s group excluded from the broader science fiction fandom. This research involves examination of the themes and

practices of Star Trek fanzines, mainly published and consumed by women. I will discuss how certain conventions developed by the fandom, such as creative writing within the series and the creation of fan art, have become commonplace within fan culture. For example, Star Trek fanzines featured the first creative fan-written stories set within this fictional universe. Previously, science fiction fanzines featured only original work or essays. These differences distinguished the fandom from its predecessors but also made it a target for exclusion. Interviews from fanzine publishers and authors will reveal the backgrounds and experiences of these Star Trek fans throughout their time with the series. In examining these sources, I will reestablish women's presence as a driving force within fandom and illuminate causes for their exclusion.

#### Reference List:

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## Geraldo the Fearless: The Unsung Hero of Portugal

Jacob Badal, Brigham Young University

Faculty Mentor Cacey Farnsworth, Brigham Young University

SESSION D 4:10-4:25PM

Sill Center

Social Sciences

It is well known that Western Europe has enjoyed a longstanding fascination among scholars and students. So much so that calls to move beyond the region towards a global



focus in academia are increasing daily. Yet, much of Western Europe's history beyond England, France, and Germany remains unexplored. Spain has enjoyed a resurgence of interest, but Portugal has largely been ignored. Indeed, many do not even consider the two Iberian nations and their entangled histories with Islam and North Africa as part of Europe proper despite their many contributions to the western tradition. Even more isolating is the fact that much of the recent effort at recovering the Portuguese past remains confined to studies within the Portuguese language. This piece, therefore, aims at tackling both lacunae by examining the deeds and achievements of an important but forgotten hero of an often-forgotten nation, Geraldo the Fearless. Geraldo the Fearless was a marauding knight who lived on the edge of conflict between the young Kingdom of Portugal, the Spanish kingdom of Leon, and the Muslim realms with his band of motley knights. Working with the King of Portugal, Geraldo launched an offensive campaign against the neighboring Christian and Muslim kingdoms, rapidly conquering many cities in the Muslim South, causing new alliances, and creating political turmoil in a bid to conquer Badajoz. Later, Geraldo continued his mission in Morocco, where he attempted to take possession of several cities with the assistance of the Berber tribes for the Kingdom of Portugal. This article utilizes numerous Portuguese, Spanish, Latin, and Arabic sources to methodically gather the many pieces required to recreate a comprehensive view of Geraldo and his life. Moreover, this research, by employing additional evidence, attempts to infer events and fill historical gaps. By creating a clear narrative of the life of Geraldo, it then becomes possible to fully see his influence on Portuguese history as a critical lens into the forming of the Portuguese Empire and its later imperial expansion. Had

Geraldo succeeded in his designs, the borders of Spain and Portugal would have been drastically different; furthermore, if he had succeeded in Morocco, Portuguese expansion out of Europe would have begun nearly 240 years earlier. An earlier Portuguese conquest of North Africa would likely have tipped the balance of power in the Iberian Peninsula, which could have elevated Portugal to a more prominent role among the other European monarchies. As intriguing as it is to consider hypotheticals, there is no way to know what would have occurred for sure. What is certain is that Geraldo the Fearless rose from obscurity and left an indelible mark on Luso-Hispanic history before disappearing once again.

## Using Facebook and Reddit to code support group member posts: What we can learn about the needs of patients with Postural Orthostatic Tachycardia Syndrome (POTS)

### April Law, Utah Valley University

Faculty Mentor Lisa Petot-Rincon, Utah Valley University

SESSION D 4:30-4:45PM

Sill Center

Social Sciences

Many patients with chronic illnesses feel that they lack resources when it comes to finding knowledgeable specialists, helpful consumer products, and support for loved ones. This research project aims to bridge the gaps of understanding between patients and their families and medical professionals by observing common patient complaints and requests for

advice on social media platforms. By coding these responses and looking for commonalities, manufacturers may also benefit by learning to create better products that serve the needs of chronically ill patients. Similar studies have been performed for other areas of research. Sutter et al. (2021) used Facebook and Reddit to code for food parenting posts. They categorized food parenting styles that were coercive, structured, or autonomy supportive. They found a correlation between food parenting styles and children's unhealthy eating habits and adiposity (Sutter et al., 2021). A social media study was conducted in Canada to determine social levels of hesitancy toward COVID-19 vaccines (Rotolo et al., 2022). Most Canadian citizens have been vaccinated, and researchers believe that the results of this study can help guide educational attempts for unvaccinated citizens (Rotolo et al., 2022). Perry and Park (2021) performed a qualitative analysis of Twitter feeds to search for major themes of suicidality and found that while intrapersonal and interpersonal factors were amply expressed, about half of the tweets expressed suicidality when discussing social issues such as health and politics. This study will compare posts from Facebook and Reddit to search for commonly used keywords among patients in support groups for Postural Orthostatic Tachycardia Syndrome (POTS). After posts are qualitatively coded, a statistical analysis will be performed. By discovering the most discussed support group topics, doctors, manufacturers, and loved ones can better understand the needs of patients with POTS.



# Resources

Check out folks who are tabling at UCUR in the A. Ray Olpin University Union

## **University of Utah**

- Bennion Center
- Campus Recreation Services
- Center for Student Wellness
- College of Humanities
- College of Social Work
- Dream Center
- Financial Wellness Center
- Graduate School Diversity Office
- Honors College
- Martha Bradley Evans Center for Teaching

Excellence

- Master of Computer Science
- Material Science & Metallurgical Engineering
- Women's Resource Center

**Brigham Young University**

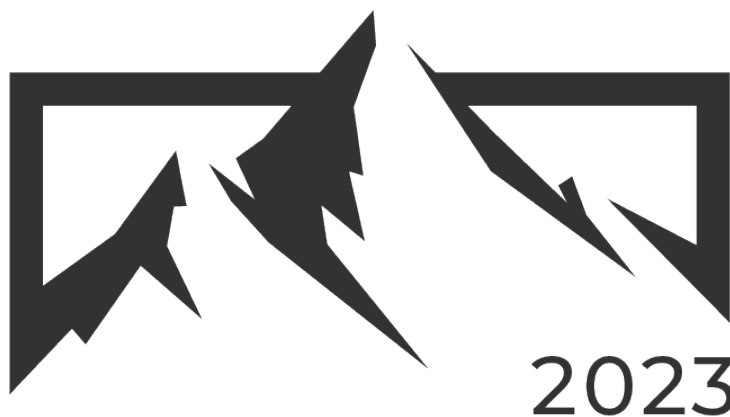
- BYU
- BYU Electrical & Computer Engineering
- BYU Graduate Studies
- BYU Neuroscience
- BYU McKay School of Education

**Utah Valley University**

- UVU MBA & MFPA Graduate Programs
- UVU Physician's Assistant Program
- UVU Master of Public Administration

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