# SURCA

## SHOWCASE FOR UNDERGRADUATE RESEARCH AND CREATIVE ACTIVITIES

**2020**

SURCA.WSU.EDU

Hosted by the Division of Academic Engagement and Student Achievement (DAESA), SURCA is an Office of Undergraduate Research Event. SURCA is a part of WSU Showcase Week.

*Division of*
Academic Engagement and Student Achievement
WASHINGTON STATE UNIVERSITY

# SURCA 2020

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## A Letter from the SURCA Committee

The ninth Showcase for Undergraduate Research and Creative Activities (SURCA) was on track to be the premier annual venue to highlight the exceptional efforts of hard-working undergraduate students across Washington State University. A record 250 accepted applicants from nearly all majors, campuses, and all years in college were preparing to make presentations at the March 30 event, describing their mentored investigations and results. Faculty and post-doctoral student experts as well as community members were completing online registrations to serve as judges. Volunteers and committee members were set to serve at the all-afternoon event that is part of WSU Showcase Week. The increasing excitement became palpable as SURCA 2020 neared.

But, as every researcher knows, even the best-planned and carefully coordinated efforts can take surprising turns. For SURCA 2020, that unexpected twist was the COVID-19 outbreak, caused by the novel coronavirus SARS-CoV-2. Just as it affected people around the world and brought nations to a halt, it became the reason to cancel SURCA 2020. As the alarming danger posed by COVID-19 to global society came into clearer focus, it also became evident that bringing large groups of people together in close proximity, such as would occur at SURCA, was an untenable course of action. Thus, we took the unprecedented step of canceling SURCA to diminish the possibility of spreading disease and endangering our students and citizens. This decision, albeit a difficult one, aligned with countless others made at the same time across the university, including the important one to transition all classes to delivery in an online-only format from mid-March through the remainder of spring semester. In the end, the health and safety of our beloved university community takes precedence above all else.

The SURCA Committee extends sincere thanks to all of the student researchers who were set to present nearly 200 posters and share information about their findings. Our undergraduate students and the impressive contributions they make to the research, scholarship, and creative activities of this university are the essence of and reason for this great event, which has become a campus tradition. Moreover, we note that the work that our students submitted this year, and which is published in this abstract book, was officially accepted for presentation to the public. It is for this reason that we encourage all SURCA 2020 participants to proudly document their acceptance to present at SURCA on their resumes, for it still represents a unique and notable accomplishment of your college experience.

We also thank the dozens of faculty, staff, graduate student, and supportive community volunteers who were poised to make their own valuable contributions to the event. Without their efforts, this event would not be possible.

As with past pandemics humanity has faced, we are hopeful that the world will soon learn to adapt to and overcome the threat brought on by COVID-19. Thus, we already look forward, of course, to another great SURCA next year. We encourage students and their research mentors to keep up the good work. And, we plan to provide another outstanding event for you to showcase your work. After all, and as any experienced undergraduate researcher would know, research, scholarship, and creative activity are all exercises in adaptation, persistence, and hope.

# SURCA 2020

## Committee Members

| | |
|---|---|
| Talea Anderson | WSU Libraries |
| Andrea Donnenwerth | Global Connections |
| Lydia Gerber | WSU Honors College |
| Samantha Gizerian | Neuroscience Program/College of Veterinary Medicine |
| Jeremy Lessmann | Dept. of Chemistry/College of Arts and Sciences |
| Beverly Makhani | WSU Division of Academic Engagement and Student Achievement (DAESA) |
| Jeffrey Moss | WSU DAESA |
| Anne Peasley | Office of Assessment of Teaching and Learning |
| Dee Posey | Dept. of Psychology/College of Arts and Sciences |
| Shelley Pressley | Office of Undergraduate Research/ WSU DAESA |
| Daniel Rieck | WSU DAESA |
| Mary Sánchez Lanier | WSU DAESA |
| Michael Solomon | Office of Undergraduate Research/ WSU DAESA |
| Andrei Smertenko | Institute of Biological Chemistry/College of Agricultural, Human, and Natural Resource Sciences |
| LeeAnn Tibbals | Health Professions Student Center/College of Arts and Sciences |

# Showcase for Undergraduate Research and Creative Activities 2020

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| **170** | **Kayla Beechinor**<br>Mentor: Michael Pumphrey | **Usage of Unmanned Aerial Vehicles to Score Damage from Beyond Chemical in Wheat (*Triticum aestivum* L.)** |
| **62** | **Sarah Dreger**<br>Mentor: Donald Llewellyn | **Comparison of Determination of Dietary Starch in Animal Feeds by Alpha Amylase Digestion (AADM) and Standard Enzymatic-Colorimetric Methods** |
| **2** | **Auni Edwards**<br>Mentors: Kathy Beerman, Steven McGeehan, and ,Ana Maria Rodriguez-Vivaldi | **Effect of Water Boiling Temperature on Iron Release from Lucky Iron Fish** |
| **144** | **Brenda Madrid**<br>Mentor: Lisa DeVetter | **Characterizing Fruit Development Across Blueberry Cultivars to Optimize Harvest for the Fresh Market** |
| **3** | **Llesenia Massey**<br>Mentor: Kathy Beerman | **Can Providing Daily Iron-fortified Lunches to School-going Children Living in a Remote, Impoverished Region of Guatemala Improve Iron Status** |
| **190** | **Sullivan Nevada**<br>Mentor: Patricia Okubara | **Biocontrol of *Botrytis cineria*: Interactions with Native Vineyard Yeasts** |
| **119** | **Sterling Smith**<br>Mentor: Philip Marston | **Maxwell Stress Excitation of Difference-frequency Vibrations** |
| **37** | **Thomas Synoground**<br>Mentor: Lindsey du Toit | **First Report Of Cercospora Leaf Spot Caused by Cercospora Chenopodii On Spinacia Oleracea In The U.S.** |
| **89** | **Keaton Zimbelman**<br>Mentor: Anita Vasavada | **Effect of Induced Stress on Neck Muscle Activation and Postural Sway** |

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| **97** | **Nicole Dryer**<br>Mentors: Michael Sanchez and Robert Krikac | **Environments for Learning; Learning about Environments: Ecological Design at Meyers Point Environmental Field Station** |
| **147** | **John Gonzalez**<br>Mentor: Minyoung Cerruti | **Rosalia Fire Station** |
| **96** | **Caedwyn Jones**<br>Mentors: Robert Krikac and Michael Sanchez | **Participatory Design and Service Learning: Designing for Dispute Resolution - Royal City Library Park** |
| **97** | **Caedwyn Jones**<br>Mentors: Michael Sanchez and Robert Krikac | **Environments for Learning; Learning about Environments: Ecological Design at Meyers Point Environmental Field Station** |
| **96** | **Jaime Kemple**<br>Mentors: Robert Krikac and Michael Sanchez | **Participatory Design and Service Learning: Designing for Dispute Resolution - Royal City Library Park** |
| **97** | **Jaime Kemple**<br>Mentors: Michael Sanchez and Robert Krikac | **Environments for Learning; Learning about Environments: Ecological Design at Meyers Point Environmental Field Station** |
| **67** | **Kris Kha**<br>Mentors: Robert Krikac and Lisa Johnson | **Splatt Table** |
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| **97** | **Josiah Pearson**<br>Mentors: Michael Sanchez and Robert Krikac | **Environments for Learning; Learning about Environments: Ecological Design at Meyers Point Environmental Field Station** |
| **67** | **Sarah Rosenthal**<br>Mentors: Robert Krikac and Lisa Johnson | **Splatt Table** |
| **147** | **Sarah Rosenthal**<br>Mentor: Minyoung Cerruti | **Rosalia Fire Station** |
| **108** | **Holly Slocum**<br>Mentor: Dene Grigar | **Boundless WebVR** |
| **13** | **Dylan Sterling**<br>Mentors: Julia Day and Shelby Ruiz | **Discovery and Development of a Multi-tenant Engagement Program for a Net-Zero Building in Spokane, WA** |

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| 57 | **Krista Brutman**<br>Mentor: Bertrand Tanner | **A computational Cross-bridge Model to Help Explain the Frequency-dependent Stiffness Response of Ca[2+]-activated Human Myocardial Strips** |
| 36 | **Maia Whitley**<br>Mentor: Sergey Lapin | **Toward Validating a Cahn-Hilliard Based Animal Migration Model Based on Flow Through Porous Media** |

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| 40 | **Sami Al-Hakim**<br>Mentor: Scott Beckman | **The Poly-Calicene Family of Molecules** |
| 35 | **Abdulljwad Almutawah**<br>Mentor: Howard Davis | **Infant Heel Stick Assistive Pressure Cuff** |
| 172 | **Abdulljwad Almutawah**<br>Mentors: Yiran Guo and Juejing Liu | **Material Science Engineering** |
| 35 | **Mohammed Alzawad**<br>Mentor: Howard Davis | **Infant Heel Stick Assistive Pressure Cuff** |
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| **47** | **Amy Chow**<br>Mentor: Howard Davis | **EcoLeg: Low Cost Environmentally Friendly 3D Printed Prosthetics For Impoverished Communities** |
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| **95** | **Theresa Czech**<br>Mentor: Catherine Cooper | **Can Supercontinents Form Without Plate Tectonics?** |
| **77** | **India Dykes**<br>Mentor: Arda Gozen | **3D Printing of Structural Scaffolds with Controllable Mechanical Properties for Articular Cartilage Tissue Engineering** |
| **64** | **Jordan Edwards**<br>Mentor: Howard Davis | **KEJ Medical Devices** |
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| **118** | **Hannah Goodspeed**<br>Mentor: Eric Russell | **Estimating Methane Emissions from Beef Cattle** |
| **104** | **Caitlin Grover**<br>Mentor: Arda Gozen | **Additive Manufacturing with Polymeric Bio-Inks** |
| **27** | **Heather Heidenreich**<br>Mentors: Alexandre Dixon amd James Brozik | **Fluorescent Probes for Stochastic Chemical Physics and Chemical Kinetics at the Single Molecule Level: Design, Synthesis, and Characterization** |
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| **113** | **Carl Johnson**<br>Mentor: Lynne Cooper | **Mitigating Charge Accumulation on Mars** |
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| **64** | **Eshna Prakash**<br>Mentor: Howard Davis | **KEJ Medical Devices** |

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| **101** | **Yoni Rodriguez**<br>Mentor: Von Walden | **Experimental Considerations in Testing Low-Cost Air Filtration Systems for Vulnerable Communities to Fine Particulate Matter Pollution** |
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| **161** | **Marcelo Ruiz**<br>Mentor: Jacob Leachman | **Thermally Stabilized Small-scale Portable Hydrogen Liquefier** |
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| **76** | **Jasdeep Singh**<br>Mentor: Santosh Swain | **Influence of Tellurium Inclusions on Detector Resolutions of Cadmium Zinc Telluride** |
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| **74** | **Leah Snyder**<br>Mentor: Matthew McCluskey | **Peak Shifts in Green Polymer Microspheres Under Pressure** |
| **35** | **Anna Stompro**<br>Mentor: Howard Davis | **Infant Heel Stick Assistive Pressure Cuff** |
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# Showcase for Undergraduate Research and Creative Activities 2020

## Abstracts

**Poster # 1**

## Climate Change Is Reducing Water Storage in the Pacific Northwest

**Presented by:** Patrick Robichaud

**Mentor:** Jennifer Adam **Campus:** Pullman

**Major:** Civil Engineering

**Category:** Engineering and Physical Sciences

**Co-authors:** Jennifer C. Adam and Mariana Dobre

Water in the Western U.S. is vulnerable to climate change because of loss of reservoir storage and melting snowpack including magnified sedimentation after wildfires which are increasing in number and size. These human and natural induced disturbances have the potential to increase runoff-induced erosion and sediment load to rivers; downstream sedimentation can decrease the life expectancy of reservoir and consequently the dam. This is particularly critical in snowmelt-dominant regions because, as rising temperatures reduce snowpack as a natural reservoir, humans will become more reliant on reservoir storage. In the Northwest U.S., the Columbia River Basin (CRB) has more than 60 dams which were built for irrigation, hydropower, and flood control, all of which are affected by sediment to varying degrees. Determining what dams are most likely to be affected by sedimentation caused by post-fire erosion is important for future management of reservoirs, especially as climate change is anticipated to exacerbate wildfire and its impacts. In this study WEPPCloud was utilized, it is a cloud-based computing environment, that allows for parallel processing of multiple watersheds. Multiple watersheds in the Salmon and Clearwater River Basins will be modeled in pre- and post-wildfire conditions and then the sediment outflow will be calculated to inform management decisions. This sediment flows downstream to reservoirs where the majority of it is trapped. Using representative watersheds will allow for less intensive computation. This project will calculate how much sediment is deposited in select reservoirs and demonstrate how representative catchments can be used in erosion modeling. When this project is completed, the methodology will be transferable to predict erosion and sedimentation with and without wildfires over other large geographical areas in the US and internationally. When reservoir managers have this information, they will be able to better predict the lifespan of reservoirs. This research can also inform watershed managers of areas vulnerable to erosion that should be prioritized for post-fire mitigation such as mulching which can be implemented to reduce fire risk.

**Poster # 2**

# Effect of Water Boiling Temperature on Iron Release from Lucky Iron Fish


## **Presented by:** Auni Edwards

**Mentors:** Kathy Beerman, Steven McGeehan, and Ana Maria Rodriguez-Vivaldi **Campus:** Pullman
**Major:** Biology
**Category:** Applied Sciences
**Co-authors:** Kathy Beerman, Steven McGeehan, and Ana Maria Rodriguez-Vivaldi


Iron deficiency anemia (IDA) is a common diet-related micronutrient deficiency disorder. Exacerbated by poverty, IDA is particularly problematic in locales with limited access to food, healthcare, and remedial measures. Although iron supplementation can improve iron status, all too often it is a short-term solution to this endemic, chronic health problem.

Lucky Iron Fish (LIF) provide a novel, inexpensive approach to IDA remediation. LIF utilize a methodology similar to the time-tested intervention of using cast iron cookware to increase the iron content of food. Easily implemented in regions of the world where IDA is most prevalent, LIF release iron when boiled in acidified water. As the food absorbs the iron-enriched water, the overall iron content of the meal is enhanced. This clinically-proven solution to iron deficiency holds great potential to reduce the worldwide burden of iron deficiency anemia.

An unresolved issue related to LIF pertains to its use in high altitude regions. Whereas water boils at 100 C at sea level, the boiling point in San Marcos, Guatemala (3,185 m), a region known for its crushing poverty and high rates of IDA, is 87 C. Although the release of iron from LIF in water boiled at 100 C is well-documented, it remains unclear if lower boiling points associated with high altitude impacts iron release from LIF. Hence, a better understanding of the effect of water boiling temperatures on iron release is critical to assess the efficacy of LIF at high elevation.

To evaluate the effect of water boiling temperature on iron release, LIF were boiled at 80 C, 90 C and 100 C (in triplicate). The impact of higher boiling points on iron release was also assessed by using a pressure cooker. The Clausius–Clapeyron equation was used to calculate the water boiling point at each pressure. This equation predicts water boiling points of 109 C, 116 C, and 122 C at 5, 10, and 15 psi, respectively.

Study results indicate temperature significantly impacts iron release from LIF. Additional experiments are needed to optimize iron release from LIF when used in regions at high elevation.

**Poster # 3**

# Can Providing Daily Iron-fortified Lunches to School-going Children Living in a Remote, Impoverished Region of Guatemala Improve Iron Status


## **Presented by:** Llesenia Massey

**Mentor:** Kathy Beerman **Campus:** Pullman

**Major:** Biology

**Category:** Applied Sciences

**Co-authors:** Steven McGeehan, Ana Maria Rodriguez-Vivaldi, Manichanh Ratts, Thomas Mitchell, Alejandra Perez, and Alondra Solorio


Iron deficiency anemia (IDA) remains one of the most common diet-related micronutrient deficiency disorders in the world. It is particularly problematic in locales with limited access to food, education, healthcare, and remedial measures. Subsequently, the World Health Organization has identified IDA as a global health concern of high priority that requires multifaceted approaches to overcome barriers related to treatment.

Although food fortification is one approach to correct IDA, it has been shown to be ineffective in underdeveloped countries. Lucky Iron Fish (LIF), based on the concept of food fortification, provides a new approach to IDA remediation. Boiling LIF in acidified water releases iron, which subsequently is absorbed by the food.

To date, the efficacy of LIF has only been tested when used in preparation of single meals. The purpose of this study was to determine the feasibility of LIF to prepare daily school lunches, and if this methodology improves iron status in school-going children and adolescents living in impoverished regions of Guatemala.

Typical Guatemalan school lunches such as beans, rice, and soup were prepared with LIF. Baseline hemoglobin and hematocrit measures of 300 school-age students were taken and repeated after a 9-mo intervention of daily iron-fortified school lunches.

Significant increases in hemoglobin and hematocrit values were observed in students (n=25) with low baseline measures at the start of the study. The study concluded that LIF can be used to prepare large quantities of food and that iron-fortification of school lunches can improve iron status of children with IDA.

**Poster # 4**

# CFD and Experimental Analysis of Downdraft Cooling


## **Presented by:** Anguel Atanassov

**Mentor:** Omar Al-Hassawi **Campus:** Pullman
**Major:** Architectural Studies
**Category:** Applied Sciences
**Co-author:** Omar Al-Hassawi



This research utilizes computational and experimental methods to evaluate the performance of multiple passive downdraft evaporative cooling tower enclosure configurations. The model features an attached semi enclosed outdoor space located on a site in the hot arid climate of Riyadh, Saudi Arabia. We attempt to identify the cooling tower shaft design and inlet variation that provides the highest drop in temperature and most effective distribution of cooled air throughout the base of the tower. Autodesk Computational Fluid Dynamic (CFD) simulation is the software used to identify the effectiveness of each design variation on the environment it is cooling. Average summer conditions were used for the simulation, specifically a dry bulb temperature of 35.9° C, relative humidity percentage of 10% , a wind velocity of 3.8 m/s, and the prevailing wind direction from the north. Each shaft type is tested with four different inlet variations, yielding velocity, humidity, and temperature results. The sets of results are each influenced by the outside environment and how it interacted with the humidity and temperature changes once it has passed through the towers misting system. Results indicated that the tower, with the unidirectional curved shaft configuration with fins, is the most effective in cooling and distributing the air.

We plan on experimentally testing the most effective shaft design and inlet variation in order to determine whether or not the computational simulation matches the results of the experimental evaluation. The experiment will be conducted on a reduced scale model placed in a wind tunnel with a working misting system and data collection sensors. This wind tunnel will replicate the ambient conditions of our intended environment and match inputs used in Autodesk CFD. The finalized tower design is intended to be utilized in multiple locations throughout the site in Riyadh, in order to create more habitable communal spaces during high temperature days.

**Poster # 5**

## Privacy, Profiling, and Accessibility: The Ethics of DNA Databases

**Presented by:** Sierra Forler

**Mentor:** Samantha Noll **Campus:** Pullman

**Major:** Genetics and Cell Biology

**Category:** Humanities

With increasing accessibility to at-home DNA testing kits, the ability to find out your ancestral heritage is easier than ever. But at what cost to you and your family's privacy? Unsolved criminal investigation (Cold cases) are now able to be solved by using 3rd and 4th cousin DNA samples from individuals who have legally consented to upload their information to a database, which police also have access to. This study will be examining a case from Melbourne Florida, where the local police have partnered with a privately owned laboratory to begin building a crime DNA database for the police department of Melbourne. An officer came across a car with five juvenile boys between the ages of 15-16 in 2016. He confronted the boys about multiple car break-ins in the area at the time. After further questioning, he then demanded that one of them provide a DNA sample, which one of the 15-year-olds did. The major issues raised with this case study is the lack of communication and transparency from the interaction between the officer and the boys. Along with the boys are minors who consented to give a DNA sample without parents present. That is why this literature review aims to apply Beauchamp and Childress's principles of biomedical ethics to examine the issues of privacy, profiling, and accessibility to local law enforcement. This literature review is to provide knowledge about current ethical considerations and practices in working with DNA databases to inform policymakers and the general public. on how these practices impact individuals, families, and communities.

**Poster # 6**

# Snuggies at work: Case study examples of thermal [dis]comfort, behaviors, and environmental satisfaction in the workplace


## **Presented by:** Zakora Moore

**Mentors:** Julia Day and Shelby Ruiz **Campus:** Pullman
**Major:** Civil Engineering
**Category:** Arts and Design
**Co-authors:** Julia Day and Shelby Ruiz



This paper discusses findings from a large mixed methods study in the U.S. Differences between the climate type and thermal/visual satisfaction were explored through qualitative and quantitative methods. Multiple statistical tests were run to determine if there was a difference between a buildings' climate type and occupants' thermal or visual satisfaction. Climate types were grouped into three categories: hot and humid, mixed-marine, and cold or very cold. One-way ANOVA tests were run between climate categories and satisfaction scales. There was no significant difference found between the visual satisfaction scales and climate type. However, there was a statistically significant difference found among the three climate types and the thermal satisfaction scale responses. People in the mixed-marine climate type category were less satisfied with their thermal conditions than occupants in the other two climate type categories. Occupants' reported satisfaction levels remained positive, despite the significant differences found between climate types and reported temperature differences. Follow up interview responses alluded to the importance of adapting one's own behavior and playing a more active role to achieve thermal comfort as beneficial to building energy use outcomes. Interviews also uncovered interesting findings surrounding thermal comfort, including dress code, cultural expectations, communication styles and adaptive behaviors.

**Poster # 7**

# Effects of a Healthcare Pathway Program on American Indian/Alaska Native Youth in Washington State


## Presented by: Alexa Fay

**Mentor:** Janet Katz **Campus:** Spokane
**Major:** Nursing (BSN)
**Category:** Social Sciences
**Co-authors:** Janet Katz and Naomi Bender



**Background/Problem:** American Indian/Alaska Native (AI/AN) people continue to be severely underrepresented in healthcare fields in the United States. Under-representation can affect current health disparities, as well as the desire for AI/AN patients to seek treatment for health conditions. Pathway programs are one method to recruit underrepresented groups interested in healthcare careers. Participants gain information on healthcare careers and college via guest speakers, workshops, and hands-on experiences.

**Methods**: A 40-question survey was given to Institute participants who had given assent and had parental consent to participate in the study. The survey contained questions regarding participant's interests in different healthcare careers and attending college. The same survey was given on the first and last day of the Institute.

**Results:** Results were analyzed as significant with a P-value of 0.10 or less. Due to the sample size, many questions were not significant but did have an increase in agreement after the Institute. It was found that after attending Na-ha-shnee, students expressed more certainty in being prepared for and interested in attending college. They also expressed increased emotional concerns about attending college.

**Conclusions:** This research indicates the effectiveness of programs such as Na-Ha-Shnee in recruiting underrepresented groups, specifically AI/AN youth, into healthcare careers. This highlights the need for increased funding and support for pathway programs to increase the number of AI/AN healthcare professionals.

**Poster # 8**

# 21 Day Story


## **Presented by:** Emily Steinhilber

**Mentors:** Mike Bonifer and Donna Pahel **Campus:** Global

**Major:** Strategic Communication

**Category:** Social Sciences

**Co-authors:** Mike Bonifer, Donna Pahel, Joe Stafura, and Jerry Steinhilber


"21 Day Story is a one-of-a-kind mobile-enabled framework to empower dispersed and diverse groups to resolve a business challenge in a 21-day sprint. Contributors are immersed in 90-second, focused activities that are cumulative and progress over the course of the 21-day sprint to deliver extraordinary, actionable results. By helping teams produce resolution and an actionable roadmap in 21 days, organizations reduce complexity and dramatically improve business performance in areas such as cross-functional communication, employee and customer engagement, organizational health, and operational effectiveness." — www.21daystory.com

21 Day Story draws data from ecological momentary assessment testing or EMA. EMA data provides insight into existing sensitivities and problems that are disrupting communications cycles. Upon completion of the 21 Day Story sprint, a roadmap is presented to participants. It is up to each individual to decide what the next chapter in their story will be. If they choose to continue with the 21 Day Story program, they become players.

Each player can expect to gain a deeper understanding of the ecological, sociological, and psychological variables influencing the direction of their narrative by attending customized seminars and workshops designed by 21 Day Story professionals, scholars, and theorists. Ultimately, more aligned with themselves, players can walk away with the tools they need to analyze, empathize, and organize their team most honestly and efficiently possible. Our program teaches them how to be proactive in change by creating sustainable healthy communities that work together to solve problems.

Our remarkable 21 Day Story program was developed by a global network of scholars, theorists, and serious game-changers. We construct our aftermath programs with data-based evidence and develop a creative approach. For example, a 21 Day Story aftermath workshop could focus on communications forms similar to, indigenous storytelling, quantum mechanics, improv and theatre, game theory, and musical communications.

Our process brings new stories to light and breathes fresh air into old stories. We work with big ideas because they are the nodes in a network that connect one story with millions more. 21 Day Story helps turn *your* story and *my* story into *our* story.

**Poster # 9**

# Examining the Current Use and Effectiveness of Worksite Wellness Programs – A Review


## **Presented by:** Emily Toth

**Mentor:** Lee Daffin **Campus:** Global
**Major:** Psychology
**Category:** Social Sciences



With the continuing rise in costs of employer healthcare and employee insurance claims, businesses are looking towards the implementation of wellness programs to reduce the rate of disease and disability, both of which contribute to low productivity due to high absenteeism and presenteeism. While comprehensive wellness programs are considered a best practice in the success of a workplace health initiative, a lack of consensus exists within the scientific community on what constitutes an effective, long-term program. Comprehensive programs are also not considered viable solutions for businesses with limited financial and material resources, and small businesses have been found to be underrepresented in studies on the use of workplace wellness programs. In addition to costs and resources, employee participation remains a barrier to program success, along with possible risks pertaining to employee privacy and inclusivity. The purpose of this review is to examine common worksite wellness programs (WWPs), investigate programs that have implemented effective strategies to increase employee participation in both small and large businesses, discuss known barriers and risks to implementation, evaluate return on investment (ROI) and value on investment (VOI), and recommend best practices for implementation of a WWP for all business sizes based on findings.

**Poster # 10**

# The Antidiabetic Drug Pioglitazone Rescues Sleep Abnormalities in the GBA Deficiency Fly Model of Gaucher's Disease/Parkinson's Disease


## **Presented by:** Oluwanifemi Shola-Dare

**Mentor:** Jason Gerstner **Campus:** Pullman

**Major:** Neuroscience

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Jake Leinas, Shelby Bailess, and Jason R. Gerstner



Sleep disturbances are common in neurodegenerative diseases and may represent clinical-risk factors in disease etiology. Gaucher's disease (GD) is a rare lysosomal storage disease caused by mutations in the gene encoding for the enzyme acid β-glucosidase 1 (GBA1) and is the most common genetic risk factor for Parkinson's disease (PD). While current therapeutic approaches treat systemic GD symptoms, they fail to address neurological GD symptoms. Therefore, identifying therapeutic strategies to treat sleep disturbances in GD/PD models may provide an opportunity for developing novel drug targets in treating neurological manifestations of GD/PD. Whether sleep behavior is disrupted in this GD fly model remains unknown. Here, we observed sleep abnormalities in this GD mutant fly model and tested whether Troglitazone (TGZ) or Pioglitazone (PGZ) treatment was able to rescue the GD-associated sleep phenotype. Mutant flies with a homozygous deletion or control flies were exposed to media containing dimethyl sulfoxide (DMSO), or an equal volume of pioglitazone or troglitazone in DMSO and allowed to lay eggs for 3 days. Larvae were reared on PGZ, TGZ or DMSO food until adulthood, then 1-3-day post-eclosion males were individually collected under $CO_2$ anesthesia and transferred into polycarbonate tubes containing normal media for recording sleep using the Drosophila-Activity-Monitoring-System Sleep was measured on a 12:12 Light:Dark cycle. Activity was monitored to get a read-out of fly sleep/wake behavior. Total sleep, total daytime sleep, and total nighttime sleep were analyzed over a three-day period. We observed significantly decreased total sleep time in mutant flies compared to control flies, including daytime and nighttime sleep. PGZ was able to dose-dependently rescue daytime sleep deficits in mutant flies compared to control flies, but not nighttime sleep deficits. TGZ was unable to rescue daytime or nighttime sleep in mutant flies compared to control flies. This suggests PGZ may represent a potential compound for treating neurological effects of GD/PD. Whether PGZ can rescue other phenotypes associated with this GD/PD model, or nighttime sleep rescue at higher doses, remains to be determined. Future studies testing this and other related drugs on sleep deficits using this model may prove beneficial for screening therapeutic targets of GD/PD.

**Poster # 11**

## Measuring Police Militarization: Do Politics Really Play a Role?

**Presented by:** Hailey Bouffiou

**Mentor:** Dale Willits **Campus:** Pullman

**Major:** Criminal Justice and Criminology

**Category:** Social Sciences

Police use of force incidents throughout the United States have become increasingly discussed and are at center of prominent public debates in recent years. The 1033 program, which provides excess military equipment to both local and state law enforcement agencies has been argued to create police militarization. To measure police militarization, data from the 1033 program, use of force incidents, and political standings by state were gathered. To gain a better understanding of the 1033 program, data was collected from police agencies in every state throughout the United States. The 1033 data focused on and used for this research was a total dollar amount and total item amount. These data indicate how much 1033 military equipment each individual agency took in and its monetary value. Furthermore, in order to look at militarization based on use of force, data from the same agencies throughout the United States was collected. This data provided an exact number of reported use of force incidents that resulted in a fatal encounter. For the purpose of this research, police militarization is examined in comparison to fatal encounters, but to take it a step further, this research also examines the political leaning of each individual state. With 1033 and use of force data being collected from the years 2010 through 2014, the 2012 presidential election results were merged to control for political trends. My hypothesis is that there will be a positive correlation between republican states and 1033 items; however, there will be little to no supporting evidence that agencies who collect more from the 1033 program will have a higher number of fatal incidents. Analyses make use of correlational and multivariate models.

**Poster # 12**

## Parental Enabling of Adult Children of Substance Use Disorder

**Presented by:** Holly Anthieny

**Mentor:** Cory Bolkan **Campus:** Vancouver

**Major:** Human Development

**Category:** Social Sciences

**Co-author:** Cory Bolkan

Not just individuals feel the effects of substance use, but the entire family system. This study will focus on the relationship between parents and their adult children with substance use disorders (SUD), with particular emphasis on parental enabling and codependency behaviors. We will explore the associations between parental enabling behaviors (e.g. minimizing the problem to other family members, taking on responsibilities for the adult child, and using denial to maintain a sense of control) and the perceived willingness of the substance user and parents to engage in treatment, as well as in the overall health and well-being of the parents. Approximately 60 participants who meet the eligibility criteria will be recruited to complete an online survey. The findings of this study will help expand knowledge about the importance of including the entire family system in treatment and intervention programs, and place further emphasis on the need for support programs for family members.

**Poster # 13**

# Discovery and Development of a Multi-tenant Engagement Program for a Net-Zero Building in Spokane, WA


## **Presented by:** Dylan Sterling and Lewis Watson

**Mentors:** Julia Day and Shelby Ruiz **Campus:** Pullman

**Major:** Construction Management

**Category:** Arts and Design

**Co-authors:** Abdulljwad Almutawah, Anders Omsland, Anna Stom, Banafsheh Molki, David Gang, Kathm Alismail, Mohammed Alzwad, Phuc Ha, Ruifeng He, and Haluk Beyenal



The Catalyst Building is part of the first phase of a Spokane re-development project and city-wide sustainability initiative. This pioneering project, expected to be completed in May 2020, will be the first net-zero energy and zero-carbon building in Eastern Washington state. While many state-of-the-art and innovative energy-saving and carbon-reducing technologies have been implemented into the design (e.g. cross-laminated timber, shared central plant / eco-district, etc.), the owners realize that building occupants play a critical role in achieving aggressive energy goals. The goals of this project include the development of a tenant engagement and education program for the multi-tenanted Catalyst building to promote energy efficiency, health, and community within the project. These efforts will encourage a culture of energy efficiency and sustainability for Catalyst building occupants in ways that will positively impact the South Landing Development. As part of this program, tenants will learn strategies to save energy within the building and their community (e.g. human-building interface and interaction with energy usage including heating/cooling, plug loads, lighting, bicycle commuting, etc.)

This poster presents findings from an extensive literature review that was conducted to guide the development of the Catalyst Building tenant engagement program. Key topics include social science and behavioral change theories, occupant/tenant engagement strategies (such as technology and gamification), effective occupant and adult education, and best-practices case studies. These findings have guided the development of a robust tenant engagement program for the South Landing District to maximize net-zero energy and zero-carbon goals.

**Poster # 14**

# Zephyr Mattress: Improving Sleeping Conditions for People with Muscular Mobility Disorders

**Presented by:** Jackson Rieb, Katie Lober, and Sarah Schroeder

**Mentor:** Howard Davis **Campus:** Pullman
**Major:** Bioengineering
**Category:** Engineering and Physical Sciences
**Co-authors:** Katie Lober and Jackson Rieb

Approximately 5.06% of the United States population suffer from some form of mobility related disorder (e.g. ALS, Parkinson's, Arthritis, Cerebral Palsy, etc.) [1]. Our team set out to discover problems plaguing this customer segment's day to day life. After meeting with an ALS patient and family member support group (ALSSO out of Spokane, WA), we found that engaging in restful sleep was the number one issue. Interviews with members of the ALSSO group highlighted that because of the side effects of muscular dystrophy, patients were unable to shift during sleep. This often left them feeling stranded and uncomfortable. To address this, our team designed and constructed an innovative mattress and bed frame that utilizes pressure sensitive oscillating air vesicles, foam cushioning, adjustable frame height, and support bars. The vesicles allow the mattress to have a variable surface that supports users in shifting during sleep. Zephyr ensures that people suffering from mobility disorders receive the benefits of a full night of restful sleep in the comfort of their own bed. It was crucial to our team that Zephyr integrates seamlessly into a home. Zephyr features an aesthetically pleasing design that shows no reminiscence of a hospital setting. Future work includes developing a full scale programmable prototype and bringing our work to investors.

**References:**

[1] GH. Duchenne and Becker muscular dystrophy [Internet]. Genetics Home Reference. [cited 2020 Jan 30].

**Poster # 15**

# Swiping Right to Relief Stress? Understanding Tinder use Among Undergraduates


## **Presented by:** Zamzam Hufane

**Mentor:** Alexander Spradlin **Campus:** Pullman
**Major:** Psychology
**Category:** Social Sciences
**Co-author:** Alexander Spradlin



Mobile online dating applications have become popular among young adults seeking romantic partners, physical intimacy, and friendship. Tinder more specifically has quickly become one of the most popular mobile dating application used to meet people within the same proximity. To date, however, only a handful of studies have examined the types of people using Tinder, their reasons for doing so, and the role of negative affect in this relationship. Using a large sample of undergraduates at a major US university, the purpose of the present study is to investigate the role that stress and stress management play in driving Tinder use. Participants will complete multiple online self-report questionnaires regarding their frequency and quantity of Tinder use, their Tinder use motives, their Big 5 personality traits, and their levels of stress, depression, and anxiety. We hypothesize that people with higher levels of stress over the past week will also be more motivated to use Tinder to cope with that stress, leading to overall greater Tinder usage. We also hypothesize that this relationship will be moderated by the personality trait of neuroticism, such that those with higher levels of neuroticism will show a stronger indirect effect of stress on Tinder use via coping motives. These hypothesis will help us further investigate how validation on dating applications associate with stress and if the relationship between stress and dating application usage is moderated by specific motives. These findings will help us gain a better perspective on the popularity/use of Tinder amongst emerging young adults.

**Poster # 16**

## Officer Directed Incivility


### **Presented by:** Beau Holladay

**Mentor:** David Makin **Campus:** Pullman
**Major:** Psychology
**Category:** Social Sciences
**Co-author:** David Makin



The proliferation of body-worn cameras (BWCs) offers a unique opportunity to study police-citizen interactions. While traditional research places emphasis on actions taken by police officers, there remains a large gap concerning the behaviors of citizens towards police officers. This is problematic given the substantial body of research documenting police work as high in emotional labor. In an effort to help fill this gap, the present study documents incivility, as experienced by police officers from citizens, using a sample of 250 police-citizen interactions. Key measures of incivility include interruptions, profanity, slurs, deception and verbal resistance. Given the interactional nature of the observations, measures of incivility are captured for the officer and citizen. In addition to documenting incivility, additional research questions include to what extent incivility varies by gender or race. Results of this research could help inform the development of training and wellness programs.

**Poster # 17**

# Virulence Gene Expression in Providencia Alcalifaciens


## **Presented by:** Mattie Clark

**Mentor:** Leigh Knodler **Campus:** Pullman

**Major:** Zoology

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Leigh Knodler, Amanda Haeberle, and Jessica Klein



*Providencia alcalifacians* are Gram-negative rod-shaped bacteria belonging to the Enterobacteriaceae family. *P. alcalifaciens* have been found in a wide variety of hosts including insects and humans. This bacterium causes symptoms of diarrhea in humans and animals and is associated with foodborne outbreaks. There is little knowledge about the pathogenesis of this bacterium. From genome sequence data, our lab has identified genes encoding for two-type three secretion systems (T3SS) in *P. alcalifaciens* 205/92 that originated from a child in Bangladesh experiencing symptoms of diarrhea. T3SS are structures used for injecting bacterial proteins into host cells to manipulate cellular processes and they act as important virulence factors for many pathogenic bacteria. For example, the diarrheal pathogen, *Salmonella enterica* serovar Typhimurium, has two T3SS called T3SS1 and T3SS2. Sequence comparisons suggest that the *P. alcalifaciens* secretion systems are in the same family as T3SS1 from *S.* Typhimurium (Inv/Mxi-Spa family), hence we named them T3SS1a and T3SS1b. Prior work from other labs has shown that some *P. alcalifaciens* strains can enter human intestinal epithelial cells. Our lab has shown that *P. alcalifaciens* 205/92 is an invasive isolate and T3SS1a is necessary for host cell entry, whereas T3SS1b contributes to bacterial virulence in insects, specifically *Drosophila melanogaster*. Our aim was to detect stimuli that would induce the expression of T3SS1a and T3SS1b genes to better understand their normal environmental regulatory cues. We used bioluminescence as a real-time reporter of gene expression under various *in vitro* growth conditions and upon infection of mammalian and insect cells. The predicted promoters of representative genes from T3SS1a and T3SS1b were inserted upstream of the *luxCDABE* operon to create transcriptional reporter fusions in *P. alcalifaciens* 205/92. We found that genes encoded in T3SS1a are induced during the log-phase of bacterial growth in various media at 37°C but T3SS1b was not induced under these conditions or at a lesser temperature. Additionally, T3SS1a genes were rapidly downregulated upon the bacterial invasion of mammalian and insect cells, but the intracellular induction of T3SS1b genes promoters was not detected. We concluded from our data that T3SS1a and T3SS1b are differentially regulated in *P. alcalifaciens*.

**Poster # 18**

# Media Coverage of Opioid Medication Diversion By Healthcare Providers, 1981-2018


## **Presented by:** Kirsten Hauke

**Mentors:** Janessa Graves and Tracy Klein **Campus:** Spokane
**Major:** Nursing (BSN)
**Category:** Social Sciences



Introduction: Medication diversion describes healthcare providers taking patients' medications for their own use. There is a lack of information on the incidence, characteristics, and impacts of medication diversion on patients. The existent research is limited by scope and geographic location (in the U.S.). The news media is a source of near real-time data about current events, including incidents of medication diversion, which can be used to better understand the scope of and details surrounding the issue. The purpose of this study was to describe the frequency, characteristics, impacts, and consequences of pain medication diversion by healthcare providers through an examination of U.S. newspaper media coverage.

Methods: This study was a quantitative content analysis of newspaper articles that discuss diversion of pain medications by healthcare providers. Using LexisNexis and ProQuest databases, English language articles were identified based on key search terms (e.g., "opioid*") in headline text (limited to the U.S). Articles were coded using Qualtrics for the following content: type of provider, state, year, criminal implications, and mention of patient harm. Descriptive analyses summarized the proportion and frequency of media coverage by time, provider type, and patient impact.

Results: Initially, 1,607 newspaper articles were identified. After deduplication, 1,212 articles were retained for coding, of which 900 were excluded. The final sample included 308 articles published between 1991 and 2018 across 44 states. More articles described medication diversion occurring by registered nurses (n=187) than doctors (n=17), nurse practitioners (n=1). Other providers included paramedics (n=29), pharmacists (n=16), and pharmacy technicians (n=19). Criminal implications were noted in 69.5% of articles. One-third of articles mentioned any sort of patient harm.

Conclusions: Medication diversion negatively impacts patients, families, providers, and the healthcare system. Examining the news media's portrayal of healthcare providers' diversion of medications enhances our understanding of the scope and public perception of the issue and informs future research on medication diversion and its impacts on patients, providers, and society. Further exploration of themes specific to provider role or type may enhance understanding of provider impact such as stigma and patient impact based on type of provider contact.

**Poster # 19**

# Multicultural Literature: Teaching Through the Lens of Culturally Relevant Pedagogy


## **Presented by:** Lindsey Shannon

**Mentor:** Ashley Boyd **Campus:** Pullman
**Major:** English
**Category:** Humanities


**What I Researched:** Student populations have grown more diverse in race, ethnicity, and socioeconomic status. Preservice and current teachers must take a critical look at their current curriculum and ask if it reflects the same diversity of our student populations. A common question that has arisen in research, as well as in my own education classes is,**"Do canonical texts and traditional pedagogical methods support and create an environment rooted in student empowerment and cultural competency?"** In this research, I explored culturally relevant pedagogy and current academic research on using multicultural literature in classrooms to develop curriculum rooted in these practices. To secure student engagement and to reflect diverse students' perspectives, culturally relevant pedagogy requires a blended approach (Escudero, 2019) of teaching and is student-oriented and focused on skills and experiences outside of the classroom. It must be rooted in and connected to the students, and "*teachers* must bridge the gap between home and school—and between institutional expectations and our students' needs," (Grater and Johnson, 2013, p 38).

**Building Curriculum:** For the curriculum I developed as part of my research, I crafted three-unit overviews which each include: a linked text set, a detailed unit calendar, a specific unit theme (socioeconomic disparities, prejudice/bullying, or identity), and focus questions. These units are rooted in multicultural young adult literature, with each core novel being published within the last decade. The linked text sets include nonfiction texts, other novels utilized for small groups or read aloud, and multimedia sources; and they frame the unit and each day's lesson plan. Each unit aims to achieve one or two Common Core standards in either writing or reading, and each lesson plan has explicit student goals.

**Poster # 20**

# Geriatric Nursing as a Career Choice as Measured by the COCOA Instrument


## **Presented by:** Samantha Denison

**Mentors:** Catherine Van Son and Janessa Graves **Campus:** Spokane
**Major:** Nursing (BSN)
**Category:** Social Sciences
**Co-authors:** Catherine Van Son and Janessa Graves



**Purpose:** This research explores the influence of a gerontological course on nursing students' intentions to pursue a career in geriatrics.

**Background:** By 2030, one in five Americans will be over age 65 years, increasing the demand for nurses in geriatrics. The Carolina Opinions on the Care of Older Adults (COCOA) instrument assesses the psychological constructs related to attitudes toward older adults. One of the five subscales focuses on geriatrics as a career choice. To date, the COCOA has been used with medical students, but no research was found using it with nursing students.

**Methods:** A pre/post-test study was conducted using the 24-item COCOA instrument, which was administered to junior prelicensure nursing students. Students completed the instrument at the beginning and end of a geriatric nursing course and clinical. Descriptive statistics and paired *t*-tests were used to determine significant pre/post-test mean differences. Linear regression was used to evaluate the relationship between demographics and background/experiences with older adults and interest in geriatrics as a career.

**Results:** Ninety students' results were paired with complete pre/post-test data. Most students were female (86.5%) and between the ages of 18-24 (71.1%); 46.7% had completed some nurse aide training, and 53.3% had paid experience working with older adults. Out of 120, the overall mean pre-test score was 89.97, and the overall mean post-test score was 93.97. The geriatric career choice subscale (possible range 5-40 points) indicated a pre-test mean of 26.77, which increased to a mean of 27.86 after the course. This change is not statistically significant ($p=0.05$). Students who had not completed nurse aide training or had no paid experience working with older adults reported a significantly lower career interest in geriatrics ($p < 0.01$).

**Implications:** There is insufficient evidence-based research exploring geriatric nursing education and career intent. One course in gerontological nursing is ineffective in encouraging students to consider a career in geriatrics. While shifting attitudes through educational interventions is challenging, it is essential in order to ensure the nursing workforce is prepared to meet the growing demands of caring for older adults.

**Poster # 21**

## Genetic Variation Across Insulin Processing Genes in Grizzly Bears

**Presented by:** Maddi Bibby

**Mentor:** Joanna Kelley **Campus:** Pullman

**Major:** Neuroscience

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Shawn Trojahn, Michael Saxton, Charles Robbins, Heiko Jansen, and Joanna Kelley

Type II Diabetes is a major public health crisis, accounting for nearly 95% of all diabetes diagnoses. Type II Diabetes is characterized by insulin resistance, a defect where the organs and tissues of the body are not responsive to the physiological effects of insulin. Insulin is a hormone secreted by the pancreas in response to blood glucose levels. Under normal circumstances, when blood sugar rises, insulin induces glucose uptake by cells to store for energy later. When cells are not able to take up sugar and remove it from the bloodstream, the levels remain elevated and pose a threat to the health of the individual. Grizzly bears exhibit insulin resistance during hibernation but show no evidence of the disease when they emerge in the spring. This indicates a reversible process. The goal of the study is to determine the genetic variation present in insulin processing genes across the resident bears at Washington State University. Our project utilizes DNA extraction, Illumina sequencing, and computer analyses to identify genetic variants. We hypothesize that there will be variation at the nucleotide level in the insulin response pathway. Understanding the genetic variants in the insulin processing genes is crucial for understanding how bears are able to survive this process year after year.

**Poster # 22**

# Understanding the Role of the Anthocyanin Synthesis Pathway in Tolerance Exhibited towards Fusarium Root Rot in Purple-seeded Pea Lines


## **Presented by:** Leonardo Orozco

**Mentor:** Amit Dhingra **Campus:** Pullman

**Major:** Biochemistry

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Bruce A. Williamson-Benavides, Richard M. Sharpe, and Amit Dhingra



Pisum sativum, commonly referred to as pea is an excellent nutritional and economically important crop due to its short life cycle, low water usage, rich protein profile, and its ability to fix nitrogen. The fungus, *Fusarium solani* f. sp. *pisi* (Fsp), causes root rot and poses a threat to the production of peas. However, the purple-seeded pea genotypes appear to be completely tolerant to Fsp root rot. These pigmented genotypes are undesirable for human consumption due to a bitter aftertaste produced by the purple pigmentation. The purple pigmentation is produced by anthocyanins present in the seed coat within these tolerant genotypes. Previous research in our lab gave rise to an alternative hypothesis which states that the tolerance within purple-flowered pea genotypes is not determined by the pigmentation. The aim of this investigation is to assess whether or not the anthocyanin synthesis pathway is involved in tolerance to Fsp. We will evaluate the role of this pathway through RNA silencing and overexpression of the Flavanone-3-hydroxylase (F3H) gene involved in the anthocyanin pathway.

**Poster # 23**

# Production and Purification of 15N-labeled Tropomodulin Fragments for Structural Studies


## **Presented by:** Kaitlin Smith

**Mentors:** Alla Kostyukova and Dmitri Tolkatchev **Campus:** Pullman
**Major:** Chemical Engineering
**Category:** Molecular, Cellular, and Chemical Biology
**Co-authors:** Alla Kostyukova and Dmitri Tolkatchev



Actin polymerizes into long filaments which provide support for many cellular processes, such as intracellular transport, cell motility and muscle contraction. Two ends of the filaments are called the pointed end (slow growing) and the barbed end (fast growing). Tropomodulin (Tmod) modulates the actin filament length through capping the pointed end of the actin filament by binding onto actin and tropomyosin (Tpm). Together Tmod and Tpm serve many regulatory functions within cellular processes although their combined function must be explored further. In order to understand the length regulation mechanism of Tmod, the structure of Tmod-Tpm binding interface must be known. Our goal was to express and purify two fragments of Tmod2 representing tropomyosin-binding sites in $^{15}$N-enriched minimal media for future structural studies. Purification was done using affinity and reversed-phase chromatography, and the quality and identity of $^{15}$N-labeled Tmod2 fragments was confirmed by mass spectrometry and nuclear magnetic resonance.

**Poster # 24**

# *Campylobacter jejuni* Dramatically Alters Cell Motility by Modifying the Focal Adhesion


## **Presented by:** Courtney Klappenbach

**Mentor:** Michael Konkel **Campus:** Pullman

**Major:** Genetics and Cell Biology

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Nicholas M. Negretti and Michael E. Konkel



Many pathogens that colonize the intestine manipulate key host cell signaling and molecular processes to promote infection. *Campylobacter* species are the leading bacterial cause of foodborne illness in the United States and the third most common bacterial cause of hospitalization for gastroenteritis (inflammation of the intestine). *Campylobacter jejuni* is a bacterial pathogen that causes gastroenteritis in humans. Focal adhesions are dynamic cellular structures connecting intracellular actin bundles to the extracellular matrix (ECM), and due their major role in sending and receiving signals they are prime targets for bacterial manipulation. We hypothesize that *C. jejuni* manipulates focal adhesions in order to alter their core functions. To test this hypothesis, the footprint size of paxillin (a scaffolding and signaling protein at focal adhesions) was measured in fixed cells. Changes in host cell adhesion strength, single cell motility, and collective cell migration were investigated by low magnification time-lapse microscopy. We observed that the focal adhesion size increased significantly during *C. jejuni* infection and corresponded to an increase in adhesion strength. Both individual host cell motility and collective cell migration significantly decreased during *C. jejuni* infection. These results support the hypothesis that *C. jejuni* interacts with and manipulates focal adhesions. By identifying the pathways and cellular structures that pathogens use to cause sickness, treatments can be developed that target these interactions to lessen the severity and duration of disease. Future work will focus on dissecting the bacterial and host cell factors that contribute to the changes observed in focal adhesions.

**Poster # 25**

## Establishing Stable Policing in Desert Aire, Washington

**Presented by:** Savanna Obernberger

**Mentor:** David Makin **Campus:** Pullman

**Major:** Criminal Justice and Criminology

**Category:** Social Sciences

This research highlights the development process and milestones associated with a small municipalities need to increase safety and security for homeowners. The goal for this research project was to research traditional and non-traditional policing services that would meet the needs of residents as well as be able to transform with the growth of their community. As a yearlong project, the research discusses the development of a Request for Proposal (RFP) and diversity in applicants. Specific emphasis is placed on the creation of the Safety and Security Commission, the contract process, vetting process, and final selection. Twelve different companies responded to the RFP, with six finalists, who were then interviewed by the board members. The motives of changing policing services were due to the increase in crime, property and population. The research presented examines the scoring process, and other considerations used for selection directed towards the specific needs of the municipality, with broader policy discussions concerning achieving a 24/7 policing services without substantial raises in taxes for homeowners.

**Poster # 26**

# The Long Term Effects of Losing a Parent in Childhood


## **Presented by:** Mary Chalk

**Mentor:** Lee Daffin **Campus:** Global

**Major:** Psychology


**Category:** Social Sciences


Parental death during childhood is, conclusively, one of the most traumatic events that can take place for a developing individual. There has been conflicting research and subsequent conclusions regarding the long term repercussions of losing a parent during childhood with some of the potential effects including physical illness, immune dysfunction, brain cortex modifications, neurotransmitter abnormalities, educational attainment, and mood disorders. Early loss can affect the developing child in ways that we have yet to understand fully, despite multiple theoretical frameworks proposed by past researchers. This review presents a thorough review of both the short and long term effects of parental death during childhood, as well as what these effects mean for the child as they integrate the loss and mature. Drawing from a broad scope of literature on the topic, this review attempts to determine which of the long term effects of parental death during childhood have merit and which are seen only in impressionistic circumstances. Multiple perspectives are examined within this literature review, including proposed theories of grief integration, the neurobiology of loss, and how it can impact the immune system, as well as how genetic vulnerability can interact with childhood loss to produce undesirable outcomes. These variables can interact and produce a subjective grief experience for the child that can have a variety of long term consequences. Several additional factors can also determine the result of parental loss, including the age of the child at the event, which parent passed away, the coping strategies of the surviving parent, the presence of a support system, if the loss was sudden or expected, and even the gender of the child. Each of these components is examined in the article, and conclusions are drawn regarding how distinct loss experiences can impact a developing child.

**Poster # 27**

# Fluorescent Probes for Stochastic Chemical Physics and Chemical Kinetics at the Single Molecule Level: Design, Synthesis, and Characterization


## **Presented by:** Heather Heidenreich

**Mentors:** Alexandre Dixon amd James Brozik **Campus:** Pullman

**Major:** Bioengineering

**Category:** Engineering and Physical Sciences

**Co-authors:** Alexandre D.C. Dixon, Evan L. Taylor, and James A. Brozik



At the single molecule level all physical and chemical processes can be described through a discrete state mechanism that operates through stochastic jumps from one state to the next. Each stochastic jump is governed by a unique probability of a forward, backward, branched, or terminal transition. These concepts are some of the basic principles used to design a framework model to understand and quantify biochemical and synthetic molecular principles at the single molecule level. In order to identify discrete states and the stochastic transitions between them, single molecule measurements are often employed. Due to its ability to measure a fast time course, single molecule fluorescence was chosen as the preferred method of measurement. However, the main issue in using single molecule fluorescence to measure chemical and physical dynamics is the intrinsic photo-physical dynamics of the probe itself. This includes stochastic jumps from the ground state to the excited state, fluorescence, intersystem crossing, re-excitation from the triplet state, phosphorescence, and non-radiative deactivation. Fortunately, many of these processes happen at non-competitive times scales compared to the chemical rates of interest. However, the cumulative effect of the photo-physical properties of the probe leads to a systematic shortening of the actual rates measured in a chemical physics experiment. Described here is the design, synthesis, and single molecule characterization of a subset of fluorophores that will be used as stochastic quantum standards. These standardized probes will aide in the deconvolution of photo-physical rates from the stochastic rates that compose the mechanisms of complex molecular processes. A special emphasis will be placed on the synthesis of silicon-rhodamine dyes and their characterization using time-lapse single molecule imaging, fluorescence correlation spectroscopy, single molecule lifetime measurements, and single molecule quantum yield experiments.

**Poster # 28**

# Psychopharmacology of Benzodiazepines & Other Depressants: Potential Cognitive Impairment, Confusion, Memory Loss, Inattention, & Disorientation from GABA Receptors in Hippocampus


## **Presented by:** Katelyn Rinker

**Mentor:** Lee Daffin **Campus:** Global

**Major:** Psychology

**Category:** Social Sciences


**Introduction:** My independent hypothesis testing project involved the adverse effects of sedatives (e.g. benzodiazepines, opiates, and alcohol) on cognition and memory. The biological aspect of this study explored the theory that cognitive impairment might be caused by a drug-induced increase in GABA (gamma-aminobutyric acid) activity in the hippocampus. If the hippocampus and parahippocampal gyrus were responsible for memory and orientation to time/place, respectively, then I hypothesize that alterations in GABA production may negatively impact these areas through the occurrence of cognitive or behavioral side effects. Depressant medications may create the side effect of memory loss, disorganized thinking patterns, inattention, confusion, and lethargic behavior. This dysfunction may reduce the ability to complete tasks that require sound cognitive judgment, such as visual-spatial abilities. Memory impairment could negatively impact academic performance and social function, which can be measured with assessments on disorientation, abstraction, language, attention, and naming abilities.

**Method:** This study consisted of 470 participants, which included 70% females (n=275) and 30% males (n=113). Their ages ranged from 18-years-old to 44-years-old (M = 20.33). They were administered the Montreal Cognitive Assessment, Confusion Assessment Method, and Brief Cognitive Rating Scale. Cognitive impairment was measured using these assessments with subscales on attention, language, orientation, recall, and visuospatial awareness.

**Results:** The study focused on the potential adverse effects of depressant drugs, such as alcohol or benzodiazepines, and their relation to GABA receptors in the brain. These side effects include disorganized thinking patterns, inattention, confusion, and lethargic behavior. The purpose of the study was to conduct research on the biological basis of behavior (e.g., the neurochemical processes of psychopharmacology) and cognitive processes. The results indicate that depressant drugs, such as opiates and benzodiazepines, may cause cognitive impairment.

**Poster # 29**

# Compared to C57BL/6J Mice, C57BL/6N Mice Exhibit Reduced Ethanol Consumption that Is Not Due to a Discrepancy in Sweet Taste Perception


## **Presented by:** Kevin Douglas and Talia Thuet

**Mentor:** Chloe Erikson **Campus:** Pullman

**Majors:** Neuroscience, Psychology

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** David Rossi and Chloe Erikson



DBA/2J (D2) and C57BL/6J (B6J) mice are widely used as models for low and high ethanol (EtOH) consumption genotypes respectively. However, a key determinant of low EtOH consumption in D2 mice is taste-aversion to EtOH, which precludes voluntary consumption to neurologically active concentrations of EtOH. This phenomenon is explained in part by D2 mice having an allele of the *sac* locus which encodes a sweet taste receptor with reduced responsivity to sweet compounds like saccharin, sucrose, and EtOH. Furthermore, vast genetic differences between B6J and D2 mice make it difficult to identify key underlying neuro-molecular-genetic factors that contribute to their respective drinking profiles. To address these complications, we studied EtOH and sucrose reinforcement in C57BL/6N mice (B6N), a substrain of the original C57BL/6J line, distinguished by only five small nucleotide polymorphisms, that exhibits significantly reduced EtOH consumption. To determine whether taste-aversion to EtOH is a primary determinant of low EtOH consumption by B6N mice, we subjected animals to a modified sucrose fade procedure using a drinking in the dark, two-bottle-choice paradigm. We determined that; 1) B6Ns consume the same amount of a 10% sucrose solution as B6Js, 2) B6Js consume significantly more of a 10% EtOH/10% sucrose mix than B6Ns, but both achieve physiologically relevant blood alcohol concentrations (15-219 mg%), and 3) B6Js consume significantly more 10% EtOH than B6Ns upon removal of sucrose. Taken together, these results suggest that genetic differences in neurological response to EtOH contribute to differences in EtOH consumption between genetically similar B6J and B6N mice.

**Poster # 30**

# Evaluating the Use of Iron-enriched Compost and Legumes to Enhance Soil Biological Activity and Reduce Grapevine Chlorosis in Central Washington


## **Presented by:** Rebeca Velasquez

**Mentor:** Tarah Sullivan **Campus:** Pullman

**Major:** Microbiology

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Tarah S. Sullivan, Ricky W. Lewis, Joan Davenport, and Tanya Cheeke


While Fe is relatively abundant in soils, Fe uptake is limited because most of the Fe in soils is not easily dissolved and is unavailable to the plant, particularly when soils are basic (alkaline). The application of synthetic iron chelates has been employed in many vineyards to reduce chlorosis; however, application of Fe-chelates is an expensive and temporary solution, requiring re-application each year, and therefore does not represent a sustainable cure to iron chlorosis. While links have been drawn between high soil pH, calcium carbonate levels, as well as high soil moisture and low soil temperature, all the work to date suggests that some factor beyond these is involved in grape chlorosis in areas of similar soils in Washington state.

Compost additions often improve soil health by increasing soil organic matter content, and iron deficiency-induced chlorosis in fruit trees grown in calcareous soils has recently been effectively addressed throught the application of iron-enriched compost or manure (Tagliavini et al., 2000). Currently, it is unclear if similar approaches will effectively improve soil health and decrease chlorosis in grapevines in Central Washington. However, the mechanisms thought to be involved in compost-driven reduction of chlorosis should transfer to vineyard systems, including increased activity of bacteria in the compost that can dissolve iron, increased soil microbial activity, and the potential to increase soil health and vineyard agroecosystem health in the long term.

Additionally, grapevines depend on fungal associations for uptake of vital nutrients, but recent work in ‘Concord’ vineyards has revealed a lack of mycorrhizal fungi (Lewis et al, 2018), which are a type of fungi that benefit plants. Work by Dr. Tanya Cheeke (WSU Tri-Cities), has shown nurse plants with the beneficial fungi may be used to help establish the fungi in agricultural soils undergoing ecological restoration. A similar approach could be used in vineyard systems to re-establish the beneficial fungi, which would not only improve soil health, but can assist the grapevines in phosphorus acquisition. Mycorrhizal fungi have been shown to alleviate chlorosis in susceptible rootstocks grown in calcareous soils.

**Poster # 31**

# Perceptions of Adulthood: Differences Amongst Youth From Alternative and Public High Schools


## **Presented by:** Leonard Covarrubias

**Mentor:** Monica Johnson **Campus:** Pullman

**Major:** Psychology

**Category:** Social Sciences



This study examines perceptions of what it means to be an adult between high school youth from alternative high schools and public high schools. While public high schools are culturally normative institutions where adolescents are not only educated but prepare for adulthood, alternative high schools are seen as institutions at-risk students attend and where they are given a last-chance in attempts of obtaining a high school education. It is unclear whether students from alternative high schools have similar understandings of what it means to be an adult compared with students in traditional high schools. A review of literature surrounding current perceptions of adulthood was conducted, along with an examination of student demographics across each school types. Research articles regarding adolescent transition into adulthood, racial and ethnic demographic differences of the perceptions of adulthood, and young-adults' perceptions of culturally meaningful markers was assessed to compare the perceptions of adulthood amongst the students. Demographics of the students within each types of schools are evaluated to understand possible differences across each school type. Survey data from the 1994-1995 National Longitudinal Study of Adolescent to Adult Health (Add Health) was also used in answering the proposed research question.

**Poster # 32**

# Investigating Chromatin Architecture and Fibroblast Heterogeneity During Skin Development


## **Presented by:** Sean Thompson

**Mentor:** Ryan Driskell **Campus:** Pullman

**Major:** Genetics and Cell Biology

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Ryan Driskell, Quan Phan, and Iwona Driskell



The formation of skin during embryonic development and wound healing relies on two types of fibroblasts which we have previously identified based on individual functions. Reticular fibroblasts (RFs) deposit fresh tissue while papillary fibroblasts (PFs) support hair follicle (HF) formation and regeneration during mammalian wound healing. A hallmark of aging skin is the loss of PFs and the formation of scars that lack HFs during wound healing. The molecular mechanism underlying the establishment of these distinct fibroblast lineages during skin development has yet to be discovered. We used Single-Cell ATAC-seq (an assay to measure the accessibility of DNA to regulatory elements) to assess the chromatin architecture within fibroblast lineages that are capable of supporting skin regeneration and to generate chromatin accessibility profiles. These chromatin accessibility profiles allow for the separation of fibroblasts by their chromatin architecture and for the investigation of elements of gene regulation between the two lineages. Further analysis via Single-Cell RNA-seq (an assay for gene expression) has validated the relationship between chromatin architecture and the regulation of gene expression. Utilizing these unique datasets has allowed us to identify the genes required to convert adult RFs (contributors to aging skin) to PFs. This has the potential to induce regeneration during wound healing in aged skin.

**Poster # 33**

# UV Exposure Contributes to the Development of the BRAF V600E Driver Mutation in Melanoma


## **Presented by:** Haley Morris

**Mentor:** John Wyrick **Campus:** Pullman

**Major:** Biochemistry

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** John Wyrick, Marian Laughery, Steven Roberts, and Debra Mitchell



In skin cancers, most somatic mutations are cytosine to thymine (C>T) substitutions in dipyrimidine sequences (TC, CT, and CC). The enrichment of these UV signature mutations in melanoma and other skin cancers indicate that they might arise from UV exposure, and are likely induced by canonical DNA lesions at DNA dipyrimidine sequences. However, two of the common driver mutations in melanoma do not fit this UV signature, and this has called into question the hypothesis that melanoma are UV induced. Here, we investigated the BRAF V600E driver mutation. Although this driver mutation is the most frequent oncogenic mutation in melanoma, it is caused by either a thymine to adenine (T>A) substitution or a TG>AA tandem substitution, neither of which fits the UV signature. Through a series of UV reversion assays in *Saccharomyces cerevisiae*, T>A and TG>AA mutations were found to consistently be induced by UV irradiation, indicating that the BRAF V600E driver mutation may indeed be caused by UV exposure in melanoma. These findings suggest that rare, non-canonical UV lesions in DNA may cause critical oncogenic mutations leading to the development of melanoma.

**Poster # 34**

## Targeted Sequencing Using CRISPR/CAS9

**Presented by:** John Stack

**Mentor:** Michael Phelps **Campus:** Pullman

**Major:** Biochemistry

**Category:** Molecular, Cellular, and Chemical Biology

Breakthroughs in DNA sequencing have expanded capabilities to identify and characterize genetic variation between individuals. Unfortunately, most sequencing methods designed for specific regions of the genome are either too expensive, have low efficiency, or are unable to profile large numbers of locations simultaneously. This project aims to develop new approaches for simultaneously sequencing thousands of genes across the genome at a very low cost. By combining CRISPR/Cas9 and Gibson assembly technology we will cut out and capture specific areas of the genome for targeted sequencing. The process begins with designing gRNAs that are complementary to the genes wanted to be sequence. This is how our cas9 knows where to cut. From there we can design thousands of different gRNAs complementary to the specific cut site and then use Gibson to capture these genes by using adaptors. This approach is fast and efficient and has the potential to significantly reduce overall targeted sequencing costs, solving many of the problems with current targeted sequencing methods. If successful, our approach would significantly increase our ability to profile genetic variation between individuals, which could be used in a wide range of applications from detecting known or unknown disease mutations to improving agricultural production through genomic selection. Our methods have already proven to be successful with both plasmid DNA and fish genomic DNA. So far, we have only captured one gene to be successfully sequenced with our method but we are ready to begin moving onto a larger scale so we can capture thousands of genes and sequence them at once. The results for this can be visualized on a gel to ensure our captured product. Moving forward if we can prove that our methods can capture thousand of genes at once then we will be able to move forward with sequencing human genomic DNA to screen for cancer mutations.

**Poster # 35**

## Infant Heel Stick Assistive Pressure Cuff

**Presented by:** Abdulljwad Almutawah, Anna Stompro, and Mohammed Alzawad

**Mentor:** Howard Davis **Campus:** Pullman

**Major:** Bioengineering

**Category:** Engineering and Physical Sciences

**Co-authors:** Abdelrhman Mohamed, Gretchen Tibbits, Kathm Alismail, Max McDaniel, and Haluk Beyenal

**Introduction to The Problem:** The blood screening test is considered to be a metabolic test that looks into disorders that are not usually detectable.

The infant blood screening test is performed using a heel blood draw method. The method is a minimally invasive capillary blood draw procedure performed on infants that gives similar results compared to arterial catheters results. The heal blood draw is considered to be more feasible for the infants, even though it is more painful than other methods. The other methods, such as venous blood draw and arterial blood draw, have other complications performing on the infants. Veins in the infants are very small and a highly professional specialist is needed to perform a venous blood draw. In addition, the veins in the infants are saved for IV access to supply the infants with medication and nutrients. The mean Femoral Vein average diameter is 4.5 mm. Artery and vein blood draw samples are considered as “gold standard” samples because of their precision and accuracy in providing body’s conditions. However, because of the complications associated with them, professionals consider venous and arterial blood draw not feasible as heel blood draw method for the infant screening test.

The problem associated with the heel blood draw is the highly concentrated pressure on the heel that the nurses apply to direct the blood out of the puncture site. Looking into the procedure, the nurse circulates the heel and applies pressure on the heel. Since the surface area of the circulation is low and the pressure applied is high, it leads to complications with the high pain felt by the infants. The concentrated pressure on the heel can also have potential damage to the heel tissues. In addition, the nurses develop pain in their hand after repetitive heel blood draw procedures over the years.

**Poster # 36**

# Toward Validating a Cahn-Hilliard Based Animal Migration Model Based on Flow Through Porous Media


## **Presented by:** Maia Whitley

**Mentor:** Sergey Lapin **Campus:** Pullman

**Major:** Computer Science

**Category:** Computer Science, Mathematics, Statistics, and Information Sciences

**Co-authors:** Sergey Lapin, Lynn Schreyer, and Zach Hilliard


Due to changing environmental factors, migration routes of animals are being altered. For effective conservation decisions to be made, it is necessary to understand where animals travel currently and where they may travel given alterations in environmental conditions. One way that we can make these predictions is by using mathematical modeling. I am working with a team to develop a model based on the Cahn-Hilliard equation that incorporates push and pull factors from an area, considerations for herd cohesion, and difficulty of traversal through a given terrain.

When we are examining an area of terrain, the region is broken into elements, and each element is assigned a conductivity matrix to represent how difficult it is to traverse across the element. To determine these matrices, elevation data for the nodes of each element must be extracted or interpolated from data obtained from Digital Elevation Model (DEM) files using Geospatial Information Systems (GIS) software. This data is then input into a program to calculate the conductivity matrices based on the gradient of each element, and the matrices can then be transferred to the program that runs our model.

To further tune these conductivity matrices, we must consider factors beyond elevation change. Analysis of real data from animal tracking studies will provide us with an idea of how greatly factors such as terrain type affect difficulty of traversal.

**Poster # 37**

# First Report of Cercospora Leaf Spot Caused by Cercospora Chenopodii on *Spinacia oleracea* in the U.S.


## **Presented by:** Thomas Synoground

**Mentor:** Lindsey du Toit **Campus:** Pullman

**Major:** Agricultural Biotechnology

**Category:** Applied Sciences

**Co-authors:** Alex Batson, Michael Derie, and Lindsey du Toit



Spinach is a nutritious leafy-green vegetable with a USA domestic crop value >$300 million. Leaf spot diseases of spinach reduce the marketability of this crop. In November 2017, leaf spots were observed in a certified organic, fresh-market spinach crop of the cultivar SV2157VB in New Jersey at an incidence of ~20%. Fungi resembling *Cercospora* were isolated consistently from the leaf spots based on colony and conidial morphology. The objectives of this study were to: 1) identify the species of the fungus associated with these spinach leaf spots in New Jersey; and 2) use Koch's postulates to determine if the isolates were the causal agent of the leaf spots observed. To identify each of six of the *Cercospora* isolates to species, four DNA loci were amplified and sequenced for each isolate - *calmodulin, actin, translation elongation factor 1-α*, and the internal transcribed spacer region of ribosomal DNA. The four sequences per isolate were combined into a multi-locus sequence analysis (MLSA) and used for phylogenetic analysis and species determination by comparison with sequences of diverse *Cercospora* species and closely related fungi. Based on the MLSA phylogeny, the isolates were identified as *C. chenopodii*. For the pathogenicity test, the six isolates were inoculated onto each of four cultivars of spinach (SV2157VB, Unipack 151, Mandolin, and Viroflay), two red beet cultivars (Red Ace and Ruby Queen), Swiss chard (cv. Silverado), and sugar beet (cv. KDH4-9, highly susceptible to *C. beticola*, the species reported to cause Cercospora leaf spot of beet, chard, and spinach in the USA). Leaf spots only developed on the four spinach cultivars, and there were differences in severity of leaf spot among the four cultivars. The most severe symptoms were observed on SV2157VB (mean ± standard error of 18.3 ± 2.0% leaf area with spots), and the least severe symptoms were on Unipack 151 (2 ± 0.5%). *Cercospora chenopodii* has not been reported previously as a pathogen of spinach in the USA. Further research is needed to evaluate susceptibility of more diverse cultivars and management options for this species compared to *C. beticola*.

**Poster # 38**

# pH-triggered Phosphoramidate-based Small Molecule Drug Conjugates (PhosAm SMDCs) for Treatment of Metastatic Prostate Cancer


## **Presented by:** Jacob Herman

**Mentor:** Clifford Berkman **Campus:** Pullman

**Major:** Biochemistry

**Category:** Engineering and Physical Sciences

**Co-authors:** Clifford Berkman, Feyisola Olatunji, Cindy Choy, Michael Pun, Brittany Kesic, and Mitchell Maniatoploulos


Prostate cancer, like most cancers, usually is asymptomatic resulting in thousands of cases going undiagnosed until it's too late. When this happens, the cancer has become metastatic and very difficult to treat, until now. Prostate-specific membrane antigen (*PSMA*) is the preeminent enzyme-biomarker for prostate cancer because it is expressed on nearly all prostate cancers and increased expression correlates with progression to castration resistance and metastatic disease. Hence, this provides a unique and efficient target for drug conjugates (*DCs*), both small molecule (*SMDCs*) and antibody-based (*ADCs*).

Herein, we report the discovery of Phosphoramidate-based (*PhosAm*) SMDC that consists of a four major chemical moieties: a PSMA-targeting phosphoramidate-based ligand (*CTT1298, 0.9 nM for PSMA binding*), a "click" assessible DBCO-$PEG_4$ moiety, a pH tunable phosphoramidate linker and cytotoxic payload *(Monomethyl Auristatin E, 0.502 nM for LNCaP cells*). All intermediates and final compounds were synthesized from commercially available reagents and characterized by NMR, HPLC and HRMS. Results from P31 pH decay experiments show that the chosen pH-tunable linker will be stable in normal physiological pH of 7.4 and unstable at pH of 4.5. Once the SMDC binds with PSMA on the cell surface, it is internalized into the endosome (*pH 6.5 – 5.0*) until it gets to the lysosome (*pH 4.5*). It is expected that the linker will hydrolyze whilst undergoing receptor-mediated endocytosis to release its cytotoxic payload *(MMAE*) into the cancer cells. We will report results of PSMA-binding affinity (*IC50 data*) and cell studies on PC3 (*PSMA*-) and LNCaP (*PSMA*+) prostate cell lines which should corroborate the potency and specificity of the SMDCs toward cancer cells expressing PSMA.

The significance of the PhosAm linkers are rooted in their tunability and its ability to release its payload in the decreasing pH gradients, characteristic of receptor-mediated endocytosis. This creates a scaffold that can be easily adapted to other SMDC and ADC-type chemotherapeutic treatment for cancers. Furthermore, the stability of the chosen PhosAm linker in normal physiological pH will ensure that there are little to no off-target effects, typical of most conventional chemotherapeutic agents.

**Poster # 39**

# Equine Rabies Prevalence and Vaccination Protocols in the United States

**Presented by:** Mackenzie Janzen and Madison Janzen

**Mentor:** Marsha Quinlan **Campus:** Pullman

**Major:** Zoology

**Category:** Organismal, Population, Ecological, and Evolutionary Biology

Equine rabies is an incredibly rare disease, affecting only 13 US equids in 2017 according to Ma et al. [*Journal of the American Veterinary Medical Association*, *253*(12), 1557 (2017)]. Despite its low prevalence, equine rabies has been recommended for vaccination for over 35 years and considered a core vaccine since 2008; however, only recently has rabies been incorporated into the annual 5-way vaccine of a local equine hospital in Eastern Washington. The purpose of this study was to determine the effectiveness of equine rabies vaccination protocols based on equine rabies incidence and vaccination prevalence in the US. Additionally, we aimed to highlight and analyze trends in the prevalence of equine rabies across different states and periods of time in order to determine possible factors influencing these trends, such as innovative wildlife vaccination methods and changes in the incidence of rabies in vector populations. Analysis was conducted from 1998 to 2017 using equid rabies data from a long-term US rabies surveillance project, USDA vaccination estimates, and equine population estimates from various sources. The incidence of equid rabies in the US has significantly decreased over time from 1998 to 2017 despite an increase in the overall size of the equid population. From our analysis, we determined that the use of equine rabies vaccines was negatively correlated with the prevalence of equine rabies; however, because of deficiencies in data regarding equine rabies vaccine compliance and population estimates, this result is not reliable. The inaccessibility or absence of these estimates is concerning as they are necessary to determine the efficacy of rabies vaccine protocols as well as other equine diseases. Our findings also suggest that wildlife may have the most significant impact on the transmission of rabies in the US, providing further support for wildlife vaccination efforts by the USDA. This study warrants further examination of the most effective vaccination protocol for the control of equine rabies and whether equine rabies vaccines could be revised for 3-year rather than annual administration.

**Poster # 40**

## The Poly-Calicene Family of Molecules

**Presented by:** Sami Al-Hakim

**Mentor:** Scott Beckman **Campus:** Pullman

**Major:** Mechanical Engineering

**Category:** Engineering and Physical Sciences

**Co-authors:** Scott Beckman, Willard Collier, Hong Zhong, and Michael Faust

Triapentafulvalene (Calicene) is an aromatic hydrocarbon consisting of an unusually large dipole moment. The scope of this investigation was to determine the stability of poly-calicene based molecules and how the atomic and electronic structure depended on the size and morphology of the molecule. Calicene based ribbons and rings were investigated. The interaction of a variety of small molecules with the poly-calicene molecules was investigated. The vibrational modes were calculated as were the IR and Raman spectra of the stable molecules.

**Poster # 41**

# The Reputational Benefits of Small-Profit Companies Engaging in Corporate Social Responsibility


## **Presented by:** Blessing Adaramola

**Mentor:** Olusola Adesope **Campus:** Pullman

**Major:** Management


**Category:** Humanities


Corporate Social Responsibility (CSR) is when corporations make an effort to improve society through its business practices. CSR is a growing topic and has been researched extensively and implemented mostly among large corporations; garnering the attention of stakeholders, sponsors, investors, and media. Researchers have conducted meta-analysis on the effects of CSR on reputational benefits of companies, but little is known on the impact of the reputational benefits of a small profited company. The present research investigates the reasons small-profit companies engage in CSR. The study became of interest when the researcher visited the Pullman Action Community Center (PACC). The PACC is a donation organization that provides support services to low-income earners and students. Over time, I have observed how stores like Walmart, Safeway, Ross and local businesses donate their products to the center. Companies like Walmart include this in their financial statement, explaining to stakeholders how they provide goods and services while also caring for their interest by engaging in CSR. However, small businesses who donate blankets, clothes, and groceries often remain unnamed. Therefore, the research investigates the underlying reasons small-profit companies engage in CSR. I researched and interviewed three local stores which include Digilent Inc., Pullman building supply and the Gladish community center. In sum the research uncovers the reasons small-profit firms engage in CSR activities and the benefits associated with engaging in CSR activities.

**Poster # 42**

# Aggressive Parenting and Childhood Behavioral Outcomes


## **Presented by:** Hannah Thornton

**Mentor:** Lee Daffin **Campus:** Global

**Major:** Psychology

**Category:** Social Sciences



Children who exhibit behavioral problems are more likely to have poor long-term and short-term outcomes (Calkins, 2002). A relationship between parenting style and childhood behavior has been established in the literature (Robinson, Mandleco, Frost Olsen, & Hart, 2001). The two parenting styles that are most commonly examined are authoritarian and authoritative parenting styles. Authoritarian parenting is characterized by aggressive parenting behaviors, cold interactions, and higher control and is associated with problem behaviors in children and more negative long-term outcomes. Conversely, authoritative parenting style is associated with high control and warm parent-to-child interactions and less problem behaviors and better long-term and short-come outcomes (Gafoor & Kurukkan, 2014). This study replicated research examining one dimension of authoritarian parenting, aggressive parenting behaviors, and its correlation to problem childhood behavior. Further, this research examined if aggressive parenting differs according to parent education in an effort to isolate the factors related to education level. The hypothesis for this study was that aggressive parenting behaviors would be associated with more problem behaviors in children, and that parents with no college education would have a higher parenting aggression score and more problem behaviors in their children. As a result of lower-than-expected participation from first sample at The Clover Park Early Learning Program a request to amend the study was submitted to the Institutional Review Board of WSU. Results are pending completion of the second round of data collection which we expect to be finished by March 7.

**Poster # 43**

# Hibernating Grizzly Bears May Be the Answer to Treating Type II Diabetes


## **Presented by:** Anna McDonald

**Mentor:** Joanna Kelley **Campus:** Pullman

**Major:** Biology

**Category:** Organismal, Population, Ecological, and Evolutionary Biology

**Co-authors:** Shawn Trojhan, Michael Saxton, Heiko Jansen, Charlie Robbins, Brandon Hutzenbiler, and Joanna Kelley



Metabolic diseases, like diabetes, in humans only have limited treatments, but no cure. Bears during hibernation become insulin resistant, much like humans with Type II Diabetes. Yet, unlike humans, bears can reverse insulin resistance upon emerging from hibernation. This phenomenon may be the key for treating diabetes. At Washington State, we have the only bear research facility in the country which allows for the testing of ideas that cannot be attempted anywhere else. For this project, we took fat, liver, muscle tissue samples from bears during hibernation where some of the bears were fed sugar and others were not. To study how sugar affects insulin response during hibernation, these tissues were analyzed using the WSU High Performance Computing Cluster to find differences in gene expression. Our predicted results will show us differences in gene expression in insulin response pathways in key metabolic tissues between the two groups. With these results, we will gain a better understand of how bears' tissues become insulin resistant during hibernation and how they return to normal which will bring us one step closer to finding a treatment for various metabolic diseases in humans.

**Poster # 44**

# Student Perceptions of Open Educational Resources (OER): Preferences, Beliefs, and Study Habits


## **Presented by:** Ruth Carroll

**Mentor:** Lee Daffin **Campus:** Global
**Major:** Psychology
**Category:** Social Sciences
**Co-author:** Lee Daffin



To help alleviate the expense incurred from being a student for at least textbooks, there is a drive to develop open source materials in various disciplines. Research indicates that students have an overall positive perception of these materials, likely due to their low cost (Lindshield and Adhikari, 2013). In this project, we surveyed 166 students in online psychology classes to learn more about their perception of OER as compared to commercially published traditional textbooks. Our questions focus on three different areas: preferences, beliefs, study habits. We also asked students about their experiences with OER in two different course formats—classes that used a single OER textbook and classes that combined a primary text with additional OER resources. The majority expressed a preference for OER that was attributable to the accessibility of materials, the quality of content, and affordability. A large portion of students agreed that OER benefits the community based on the principal of shared knowledge, and that the lower cost of OER does not equate to lower quality of content. Finally, there was little difference between study methods used with OER and traditional texts.

**Poster # 45**

# Conditional Ablation of Pgrmc1 and Pgrmc2 from the Male Germline Compromises Spermatogenesis and Male Fertility


## **Presented by:** Caroline Sirr

**Mentor:** Jim Pru **Campus:** Pullman

**Major:** Animal Sciences

**Category:** Organismal, Population, Ecological, and Evolutionary Biology

**Co-authors:** Jim Pru, Cindy Pru, Alanna Grossman, Traci Topping, Prashanth Anamthathmakula, Wipawee Winuthayanon, Griswoldbecca Craft, and Hannah Gogulski



The progesterone receptor membrane component (PGRMC) family consists of four members. Two of these members that are most closely related, called PGRMC1 and PGRMC2, are non-classical progesterone receptors with both progesterone-dependent and progesterone-independent actions. The best characterized functions of these two PGRMC proteins includes their roles in cell cycle regulation, oocyte (egg) meiosis, tumor progression, and chemoresistance in tumors. Based on conditional mutagenesis studies in mice, in which the *Pgrmc1* and/or *Pgrmc2* genes were removed from tissues of the female reproductive tract, both genes are essential for female reproductive functions and maintenance of early pregnancy. Given the absence of studies centered on PGRMC actions in the male, the present study seeks to understand a role for these proteins in the sperm-producing male germline. It is hypothesized that *Pgrmc1* and *Pgrmc2* are functionally required for the production of mature spermatozoa in the testis (called spermatogenesis) and male fertility. To test this hypothesis, we generated two mutant mouse lines in which the *Pgrmc1* gene alone or the combined *Pgrmc1* and *Pgrmc2* genes were conditionally ablated from the male germline. In comparison to *Pgrmc1* control mice ($Pgrmc1^{fl/fl}$), *Pgrmc1* conditional knockout mice ($Pgrmc1^{d/d}$) displayed a soft testis phenotype in which the sperm producing seminiferous tubules of the testis were histologically abnormal. We observed a significant increase in the number of dead or absent spermatogonia in seminiferous tubules of $Pgrmc1^{d/d}$ mice, as well as a significant decrease in cauda epididymal spermatozoa based on hemocytometer counts. These phenotypes were even more dramatic upon conditional ablation of both *Pgrmc1* and *Pgrmc2*, indicating that the two genes have redundant or overlapping functions in spermatogenesis. We also observed an absence of elongated spermatids within the seminiferous tubules of the $Pgrmc1/2^{d/d}$ testis and a dramatic reduction in the number and viability of cauda epididymal spermatozoa. This robust phenotype likely explains the near-complete infertility phenotype observed in $Pgrmc1/2^{d/d}$ male mice. In conclusion, PGRMC1 and PGRMC2 proteins play essential and likely overlapping roles in spermatogenesis and male fertility. Controlling the activity of these proteins may offer a novel approach for male contraception or may help to reverse certain forms of male infertility.

**Poster # 46**

# Extended Cases of Most Reliable Two Terminal Graphs with Node Failures


## **Presented by:** Isaac Brown

**Mentor:** Matthew Hudelson **Campus:** Pullman

**Major:** Mathematics

**Category:** Computer Science, Mathematics, Statistics, and Information Sciences

**Co-author:** Matthew Hudelson


A graph is a mathematical structure consisting of a set of vertices (or nodes) with a set of edges connecting those vertices. If the edges of a graph can be traversed in either direction, then the graph is said to be undirected. For this research, we examine what's known as two-terminal graphs which are undirected graphs with two specified target vertices.

If each non-target vertex of a two-terminal graph fails independently with the same fixed probability, then the two-terminal node reliability of the graph is the probability that there exists a path of edges connecting the two target vertices using only the vertices that don't fail. Furthermore, a two-terminal graph is said to be uniformly most reliable in a collection of graphs if its node reliability polynomial is greater than or equal to the node reliability polynomials for all graphs in the collection. The collections that we examine are restricted to graphs which have the same number of vertices and edges along with a restriction on the the distance between the two target vertices.

In this work, we show different cases of when there does and when there does not exist a uniformly most reliable graph among different collections of graphs.

**Poster # 47**

# EcoLeg: Low Cost Environmentally Friendly 3D Printed Prosthetics for Impoverished Communities

**Presented by:** Amy Chow, Karis Campbell, and Morgan Oldfield

**Mentor:** Howard Davis **Campus:** Pullman

**Major:** Bioengineering

**Category:** Engineering and Physical Sciences

In the healthcare system there are many problems needing to be addressed. However, one universal concern is assistance for those who can not afford the necessary care. This problem is exacerbated in impoverished communities where there are limited health resources and not enough aid. We identified that amputees often fall within this category of patients being suffocated by hospital bills and medical costs. Typically prosthetic can vary in price from around five thousand to fifty thousand dollars, with even the nicest prosthetics needing to be replaced every few years due to wear and fit issues the cost over a lifetime can be more than many can afford. We are 3D modeling and printing below the knee prosthetic legs that are made from interlocking pieces in order to allow easy and cheap replacement if part of the limb becomes damaged, which allows for a wider range of accessibility for patients. We have also opted for a flexible ankle joint in order to provide the user with greater range of motion for a more natural gait cycle. In order to create a more environmentally sustainable system for prosthetics we will be using either ABS or PLA filament for the printing which can be recycled and thus save on material costs and keep waste out of landfills.

**Poster # 48**

# What Does a Smile Mean? Coding Parent-Teen Interactions


## **Presented by:** Linnaea Morris

**Mentors:** Kathleen Rodgers and Cristina McAllister **Campus:** Pullman

**Majors:** Basic Medical Sciences, Human Development

**Category:** Social Sciences

**Co-authors:** Cristina McAllister and Kathleen Rodgers


Researching family communication comes with the complicated task of trying to understand complex and dynamic interactions between family members. It is imperative to understand and refine the mechanics behind communication because it allows researchers to better identify types of communication behaviors that enhance intimacy in communication. However, research on parent-teen relationships rarely examines true observations, and is more commonly based on survey reports from the teenager's perspective. This approach fails to pinpoint specific communication behaviors. What, then, can be learned from observing the interactions between parents and teens that cannot be understood solely from survey reports? With observed recorded interactions, researchers can quantitatively code behaviors to reveal interactions indicative of participant's emotional involvement and closeness. Behavioral interactions can be assessed at a micro-level, based on detailed systems of coding. These systems allow researchers to more fully understand the nonverbal immediacy between individuals. This nonverbal immediacy communicates caring, affection and the physical manifestation of internal feelings, which when combined, represent the level of intimacy within a parent-teen dyad. Nonverbal immediacy is key in how people develop and maintain relationships as it provides information on how to evaluate, interpret, and respond to behavior.

This study will show how expressions of non-verbal immediacy are exhibited in five parent-teen dyads who were audio-visually taped as they discussed music videos in a laboratory setting. The data are part of a larger study of parent-teen communication. Each person in the parent-teen dyad was coded using the Nonverbal Involvement Coding System (NICS) which has seven types of code, each linked to a specific behavior (Guerrero, 2017). The measures of the NICS were used to rate the videotaped behaviors of each participants separately using a five-point scale. Coded observed behaviors were based on the target's face and body language: global smile, frequency of smiles, frequency of glances at partner, type of gaze, frequency of eye contact, facial pleasantness and body affect. Coding of specific facial expressions allows us to more easily understand all the components and nuances of parent-teen communication, and the overall level of closeness expressed through nonverbal communication. Implications for future research will be discussed.

**Poster # 49**

# Investigation of the Texture of Alpha Uranium Nucleating Grain Boundaries in U10Mo


## **Presented by:** Jessie Schweitzer

**Mentor:** Dave Field **Campus:** Pullman
**Major:** Materials Science and Engineering
**Category:** Engineering and Physical Sciences
**Co-author:** DP Field



As part of the Treaty on the Non-Proliferation of Nuclear Weapons, nuclear reactors in the United States have felt a push to convert their reactor fuels from a high-enriched uranium source to a low-enriched uranium source. One such low-enriched source is an alloy of uranium and 10 percent molybdenum. U10Mo has been shown to be an adequate fuel source, however the eutectoid reaction forms the unwanted alpha phase of uranium. Alpha uranium has proven to have undesirable burnup characteristics, decreasing the effectiveness of the fuel. Determining the grain boundary character where alpha phase is present will improve understanding of alpha phase nucleation and provide a foundation for preventative microstructural processing. Grain boundary character can be quantified using the misorientation angle alone (one parameter), the misorientation distribution function (3 parameters), or the full five parameter description that includes both the misorientation and the boundary plane position. The ratio of the distribution of boundaries that contain alpha phase to the full distribution yields a function that shows the fraction of boundaries of a specific character that is susceptible to alpha phase formation. This will identify boundary types that should be avoided during processing of the fuels and provide a more complete understanding of the character of alpha nucleating grain boundaries.

**Poster # 50**

# The Progressive Dinner Party Restored


## **Presented by:** Kathleen Zoller

**Mentor:** Dene Grigar **Campus:** Vancouver

**Major:** Digital Technology and Culture

**Category:** Humanities


*The Progressive Dinner Party* is a collection of 39 digital-born works created by female artists in the late 90s. Over time, the websites these individual works lived on were taken down, or the software they ran on is no longer functional in contemporary browsers. This meant that scholarship could not take place regarding many of the critical works within this collection. Swift action was needed to ensure that these works were preserved for future generations to study, before they were lost forever.

In the summer of 2019, I received a $2,000 Undergraduate Summer Mini-Grant to locate all of the works, make them functional in modern devices and beyond, and place them back into a restored version of the collection. I then wrote a book about my findings and methodology, *The Progressive Dinner Party Restored*, which can be viewed for free online.

My process began with making an inventory of the works contained within the collection, taking note of which were missing and then contacting the artists for these files. My mentor, Dr. Dene Grigar, assisted me in locating these artists' contacts. My next task was to run all of the works through Rhizome's Webrecorder tool, which is used to capture the functionality of a work while converting them to .WARC files for longevity. The Webrecorder offers two main methods for conversion: the first of these involves running files through the command line WARCIT Tool, which was used whenever the local files were obtained. The second method was reserved for external files, in which the work was traversed manually through an emulated browser provided by the Webrecorder tool.

The result of this project was a restored collection of critical digital-born works made available for future generations to study by 39 important female writers. Though several of the works could not be restored due to the permanent loss of files, this project helped to develop a new process of preservation for the Electronic Literature Lab to utilize.

More about the project:

- *The Progressive Dinner Party Restored* Scalar book: https://scalar.usc.edu/works/the-progressive-dinner-party-restored/index.28
- Vimeo: https://vimeo.com/361899790
- Updated collection hosted by the ELO Repository: http://elo-repository.org/progressive-dinner-party/index.htm

**Poster # 51**

# Identification of Loci Associated with Somatic Cell Count in Holstein Cows


## **Presented by:** Abbi Prins

**Mentor:** Holly Neibergs **Campus:** Pullman

**Major:** Animal Sciences

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** J.N. Kiser, J.G.N. Moraes, G.W. Burns, T.E. Specner, and H.L. Neibergs



Dairy producers strive to produce high quality milk with low somatic cell counts (SCC), as milk with high SCC indicates an immune response in the cow resulting from an infection or disease process. High SCC cows tend to have lower milk production, and profitability than cows with low SCC. Inflammatory processes may also interfere with the establishment and maintenance of pregnancy resulting in an increase in the number of times a cow must be bred prior to conception (TBRD). Therefore, the objectives of this study were to: 1) identify loci and positional candidate genes associated with SCC in U.S. Holstein cows; 2) determine if loci associated with high SCC were more frequent in cattle with poor fertility (high TBRD); and 3) determine if loci previously associated with TBRD in these cattle were shared with loci associated with SCC. Two year old Holstein cows (n = 784) that were raised in six central Washington dairies were genotyped with the Illumina BovineHD BeadChip (777,962 SNPs). A genome-wide association analysis (GWAA) was performed to identify loci associated with SCC. After quality control for SNPs and animals, 776 cows and 625,270 SNPs remained for the GWAA. An uncorrected P value of $1 \times 10^{-5}$ > $P < 5 \times 10^{-7}$ identified 129 loci moderately associated while $P < 5 \times 10^{-7}$ identified 79 loci strongly associated with SCC. There was a positive correlation between the alleles associated with SCC and fertility at this locus; a lower SCC is associated with low TBRD and thus high fertility. A 36 kb region surrounding SNPs associated with SCC identified 94 positional candidate genes. Identifying loci associated with SCC are initial steps toward genomic selection to reduce SCC in dairy cattle. These data show that selection for low SCC may also improve fertility allowing producers to select for healthier and more productive cows.

**Poster # 52**

# Conversion of Diatomaceous Earth to Silicon for Use in High-Performance Anodes for Li-ion Batteries via Magnesiothermic Reduction


## **Presented by:** Gunnar Sly

**Mentor:** Min-Kyu Song **Campus:** Pullman

**Major:** Chemical Engineering

**Category:** Engineering and Physical Sciences

**Co-authors:** R. Mier, K. Oliver, J.N. Kiser, and H.L. Neibergs



The anode of the lithium ion battery is an area that shows great room for improvement, being traditionally comprised of graphite, a material that possesses a relatively low theoretical specific capacity (372 mAh/g). A more auspicious option, silicon, possesses a theoretical specific capacity of 3876 mAh/g, more than 10 times that of graphite. However, silicon experiences a volumetric expansion of >300% during the lithiation process which leads to electrical isolation and overall battery failure. Porous silicon structures have been shown to compensate for this expansion and can be fabricated through magnesiothermic reduction from precursors using magnesium vapor. A specific silicon precursor, diatomaceous earth, shows promise as a quickly replenishing, high-purity source of silica that, in conjunction with the shape-preserving nature of the reduction process, provides additional compensation due to pre-existing micropores created by diatoms. Current work is centered around the optimization of this process in ensuring high purity, complete conversion, and the shape preservation of the DE precursor.

**Poster # 53**

# Bioactivity of Rat Flea Attacin Antimicrobial Peptides Against *Yersinia pestis*


## **Presented by:** Claire Jacobsen

**Mentors:** Viveka Vadyvaloo and Ben Burrows **Campus:** Pullman
**Major:** Microbiology
**Category:** Molecular, Cellular, and Chemical Biology
**Co-authors:** Ben Burrows and Viveka Vadyvaloo


*Yersinia pestis*, the causative agent of modern bubonic plague, is a Gram-negative bacterium transmitted by *Xenopsylla cheopis*, the oriental rat flea vector. Upon infection, *Y. pestis* forms a biofilm in the flea foregut that blocks its ingestion of subsequent blood meals and facilitates regurgitation of bacteria into the host flea bite site. This is referred to as the blockage-regurgitation model of *Y. pestis* transmission. Whether the flea mounts an innate immune response to *Y. pestis* infection is unknown, however *Y. pestis* is only able to establish a persistent flea infection at high infectious doses while *Escherichia coli* is not able to establish an infection in fleas regardless of infectious dose. It is well established that peptidoglycan recognition proteins in model insect organisms such as *Drosophila melanogaster* recognize the Gram-negative bacterial cell wall components and activate the innate Immuno- deficiency (IMD) Pathway to combat infection. The initiation of the IMD pathway results in a complicated proteolytic cascade that eventually causes a specific transcription factor, Relish, to enter the cell nucleus and activate the expression of antimicrobial peptides from circulating hemocytes. Antimicrobial peptides such as Attacins are immune-effector molecules of the insect innate response that can inhibit Gram-negative pathogens.

Recently, gene homologs of the IMD pathway were identified from a rat flea transcriptome. Further, genes encoding proteins showing homology to *Drosophila* Attacin B were demonstrated to be induced in rat fleas upon infection with Gram-negative bacteria, *Y. pestis* and *Escherichia coli*. In this study we aimed to determine if rat flea Attacin peptides had bioactivity against Gram-negative bacteria. We first undertook *in silico* structural analysis of the peptides using bioinformatic approaches. This included BLAST homology searching, multiple sequence alignment, and protein secondary structure prediction modeling. Next, we cloned the Attacin encoding genes into a protein expression vector and compared the growth kinetics of *Escherichia coli* cells expressing the inducible *attacin* gene or a non-toxic metabolic gene over a 375-minute period. Our experiments suggest that rat flea Attacins genes are active against Gram-negative bacteria. Future SDS-PAGE and Western blot analysis that verifies Attacin peptide expression will confirm our findings.

**Poster # 54**

# Val-Cit small Drug Conjugate as Chemotherapeutic Agent for Treatment of Metastatic Prostate Cancer


## **Presented by:** Oscar Romero

**Mentor:** Cliff Berkman **Campus:** Pullman

**Major:** Biochemistry

**Category:** Engineering and Physical Sciences

**Co-authors:** C.E.Berkman, F.P.Olatunji, C.J.Choy, M.Pun, and M.Maniatopoulos


Prostate-specific membrane antigen (PSMA) is the most abundant enzyme biomarker on prostate cancer cells. The increased expression is consistent with castration resistance and metastatic disease. The leading prostate cancer treatments are focused on palliative care and are non-specific for prostate cancer, leading to a lot of off-target side effects.

Our Small Molecule Drug Conjugate (VC-SMDC) will contain a PSMA-targeting phosphoramidite-based ligand (*CTT1298, 0.9 nM for PSMA binding*), a "click" assessable DBCO-$PEG_4$ moiety, a Valine-Citrulline linker and cytotoxic payload *(Monomethyl Auristatin E, 0.502 nM for LNCaP cells*). We have synthesized the VC-SMDC; with intermediates and final compounds fully characterized by NMR, HPLC, and HRMS. The inherent design of the linker enables it to be stable at physiological pH until it gets internalized into the lysosome of the targeted PSMA prostate cancer cells; where it gets cleaved by protease-abundant cathepsin B to release the cytotoxic payload. Our sub-nanomolar IC50 data will show that our VC-SMDC readily and irreversibly binds to our target protein (PSMA). Cell viability assays carried out on LNCaP (PSMA+) and PC3 (PSMA-) – with appropriate positive and negative controls – will show the potency and specificity of our VC-SMDC.

In conclusion, we anticipate that the VC-SMDC will be evaluated for chemotherapeutic efficacy in-vivo in mice, followed by clinical trials in humans. The overall goal is the eventual progression of the VC-SMDC as a highly specific PSMA-targeting chemotherapeutic agent for the treatment of metastatic prostate cancer.

**Poster # 55**

# Size Matters: Setting Quantity to Cultivate Quality in Online Discussion Boards


## **Presented by:** Joy A. Sprague

**Mentor:** Lee William Daffin Jr. **Campus:** Global
**Major:** Psychology
**Category:** Social Sciences
**Co-authors:** Colleen M. Cotton-Betteridge and Lee William Daffin Jr.



Instructor interaction in the online classroom is paramount to student success. One of the easiest, and possibly, most effective ways to guarantee it is through participation in online discussions. In this model, the instructor poses a question or questions for students to answer and then replies to the answers to the prompt or participation posts students have made to one another. Enrollments in online psychology classes at WSU are capped at 80 students meaning that with students being required to make one discussion question response and three participation posts, and instructors making 20 posts each week, discussion forums will have approximately 340 posts for students to go through. One solution to reducing this is to break this larger class down into 10 smaller groups of 8 students each. In the fall of 2019, we did just this in select online psychology classes. About half-way through the semester, we wanted to know what students thought about the small group format. As such, a survey was developed asking about how the smaller group affects critical thinking, instructor interaction patterns, interaction with peers, and student behaviors in the discussion board. It should be noted that a survey with parallel questions was administered to students in large discussion boards classes for comparison. In all, our small groups survey had 79 participants and the large groups had 204. Results showed that students thought large group discussions encouraged more critical thinking, had more variety in responses, presented new questions or perspectives, led instructors to respond to more posts and promote more interaction, and the student received more replies from other students. That said, students believed overwhelming that the optimal group size was 8-10 students, or the small group format. In terms of the degree to which each format was liked, there was no statistical significance (a score of 6.54 (large) and 6.59 (small) out of 10). Additional findings and implications/future directions are discussed.

**Poster # 56**

# Maternal Cannabis Vapor Exposure causes Lifelong Behavioral Impairments in Offspring


## **Presented by:** Amanda Richards

**Mentor:** Ryan McLaughlin **Campus:** Pullman
**Major:** Neuroscience
**Category:** Organismal, Population, Ecological, and Evolutionary Biology
**Co-authors:** Halle V. Weimar, Hayden R. Wright, Timothy G. Freels, and Ryan J. McLaughlin



In recent years, the use of cannabis during pregnancy has increased dramatically in the United States. Many women believe that there is little to no risk in using cannabis products once or twice a week during pregnancy. Although research on the effects of prenatal cannabis exposure has been very limited, human studies have indicated potential effects on the brain and behavior of offspring across the lifespan. However, interpretation of these data is limited by confounding environmental factors that obscure the direct causal effects of cannabis on the developing offspring. Animal models are advantageous in this respect; however, studies involving rodents have typically not administered cannabis using the route of administration most common in human users, which limits their translational value. In this study, we used a novel animal model of vaporized cannabis exposure to examine the long-term effects of maternal cannabis exposure on the emotional, social, and cognitive profile of the offspring. We hypothesized that prenatal cannabis exposure will have lifelong impacts on the behavioral profile of the offspring. Long Evans rat dams were exposed to whole-plant cannabis extract vapor, vehicle vapor, or no vapor for one hour twice daily, beginning upon mating and continuing throughout gestation. On postnatal day (PND) 6, 10, and 13, isolation-induced ultrasonic vocalizations (USV) were assessed, followed by tests of social behavior and anxiety-like behavior on PND 26 and 27, respectively. In adulthood (~PND 70), a separate cohort of offspring were tested for anxiety-like behavior or trained in an automated attentional set-shifting task designed to assess cognitive flexibility. Our results indicate that prenatal cannabis exposure increases the frequency of isolation-induced USVs, decreases social investigation specifically in juvenile male offspring, and increases anxiety-like behavior in adult female offspring. Furthermore, cannabis-exposed adult offspring exhibited significant impairments in behavioral flexibility, as indicated by an increase in the number of regressive and never-reinforced errors committed in the set-shifting task. These data collectively indicate that maternal cannabis vapor exposure causes lifelong behavioral alterations in the offspring. Results of this research can be used to inform the public of potential risks associated with the use of cannabis during pregnancy.

**Poster # 57**

# A Computational Cross-bridge Model to Help Explain the Frequency-Dependent Stiffness Response of Ca[2+]-activated Human Myocardial Strips


## **Presented by:** Krista Brutman

**Mentor:** Bertrand Tanner **Campus:** Pullman

**Major:** Mathematics

**Category:** Computer Science, Mathematics, Statistics, and Information Sciences

**Co-authors:** Peter O. Awinda, Kenneth S. Campbell, and Bertrand Tanner



Sinusoidal analysis has been used for almost 50 years to study the mechanical properties of striated muscle. Small sinusoidal length perturbations (typically ~0.25% muscle length peak to peak) are applied at one end of the muscle, and the force response is measured at the other end. It is then separated into components that are in phase (the elastic response) and 90° out of phase (the viscous response). The frequency-dependent stiffness response is produced by repeating sinusoidal perturbations over a range of frequencies; the Nyquist plot for the muscle preparation is generated by plotting the viscous moduli against the elastic moduli. We utilized sinusoidal analysis to characterize chemically permeabilized human myocardium from organ donors under maximally activated conditions (pCa=4.8) at 17°C and 37°C (the latter of which represents physiological temperature). The low frequency data points between ~1-3 Hz have negative viscous moduli and represent conditions where the muscle is generating active power during the sinusoidal perturbations. The points for frequencies above ~3 Hz have positive viscous moduli due to the muscle absorbing power from the apparatus. A number of research groups have contributed to the current understanding of Nyquist plots in muscle biophysics, as well as the cross-bridge theory underlying these work producing and work absorbing transitions. Here, we will be utilizing Myosim (www.myosim.org; a mathematical modeling software package to simulate muscle contraction) to perform simulations based on experimental data, and we will develop an algorithm to optimize rate constants to obtain a closer simulated fit to our measured modulus-frequency data. Once the model and training algorithm are developed, they will be extended to other sets of data that have been preemptively collected to better understand how myosin function changes due to heart failure and muscle length variation. This project is significant because computer simulations of viscous and elastic moduli can be utilized to test mechanisms of the heart to benefit patient care, such as heart failure drugs like Mavacamten.

**Poster # 58**

# Impact of Help-Seeking Attitudes and Perceived Social Support on College Psychological Service Utilization


## **Presented by:** Kelly Ngigi

**Mentor:** Michael Cleveland **Campus:** Pullman
**Major:** Psychology
**Category:** Social Sciences
**Co-author:** Michael Cleveland



University mental health services have experienced a recent increase in demand. It is unclear whether this growth is due to a rise in prevalence of disorders or a rise in students seeking professional help. Some colleges have implemented peer support prevention and intervention programs to meet increased need. The goal of implementing these programs is to alleviate the demand on psychological support staff as well as to provide students with an additional support service.

This study examines the relationship between help-seeking attitudes and service utilization among college students. A sample of university students will complete a survey that includes established measures of help-seeking attitudes and perceived social support and campus psychological service utilization. Demographic characteristics will include sex, race/ethnicity, first-generation, and international student status. Data analyses will proceed in a stepwise manner. First the association between help-seeking attitudes and service utilization among the entire sample will be examined. Moderation analyses will test if the association between help-seeking attitudes and service utilization differs by demographic characteristics. The last step will examine if students' perceived social support also moderates the association between help-seeking and service utilization

This study has clear implications for future planning of university services. Increased demand for counseling and psychological services must be addressed in a manner that will best serve students as well as best fit within the limitations and capacity of mental health services on campuses. The utilization of peer support interventions has the potential to alleviate the demand along with educating the student population. Our results will inform efforts to effectively develop and implement such types of interventions.

**Poster # 59**

# Second Generation Phosphoramidate Derivates as Controlled-release Prodrugs of L-Dopa


## **Presented by:** Cresencia Talley

**Mentor:** Clifford Berkman **Campus:** Pullman

**Major:** Biochemistry

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Feyisola P. Olatunji, Brittany N. Kesic, Cindy J. Choy, and Clifford E. Berkman



L-Dopa has continued to be a mainstay in the symptomatic treatment of Parkinson's disease (PD). However, extensive peripheral metabolism, a short systemic circulation half-life and development of motor complications called dyskinesia prevents its long-term utilization as a PD therapeutic.

We recently reported a series of L-Dopa Phosphoramidates with the ability to slowly hydrolyze and release L-Dopa over an extended period at physiological pH. Herein, we report a second-generation library to display the tunability of this scaffold and the different rates at which the scaffold can release L-Dopa at physiological conditions. We hypothesize that the pKa of a proximal carboxylic acid on a serine/threonine moiety has a direct correlation with the rate of hydrolysis of the L-Dopa Phosphoramidate prodrug. We would vary the pKa of the amido group on the serine/threonine moieties by selecting acids in the pKa range -2 and 5. Hydrolysis half-lives will be reported for each compound and correlated with the pKa values of the carboxylic acids.

In conclusion, the proven tunability of this scaffold should inspire its diverse use in prodrug design, controlled-release formulations and drug-eluting stents.

**Poster # 60**

# Targeted Regional Genomic Sequencing


## **Presented by:** Derek Freitag

**Mentor:** Micheal Phelps **Campus:** Pullman

**Major:** Microbiology


**Category:** Molecular, Cellular, and Chemical Biology


Genome sequencing has been incredibly influential in understanding DNA functions. It has created massive possibilities and knowledge into researching disease and genetic changes. Currently targeted sequencing of large DNA regions is expensive and inefficient, limiting many research and clinical applications. Primer pools have been used previously, but the primer pools grab more than just area interest and can latch on to each other creating too many products. My research is developing a new technology for grabbing and sequencing specific large regions of DNA. This advance in technology will be useful in many ways, because it can grab areas of interest for studying variation in DNA sequences, without having to sequence the whole genome. The technology that I am developing utilizes CRISPR directed cutting and Gibson assembly processes. CRISPR cas9 is used to cut out a region of interest. Adapters are then placed on both ends of the DNA through a Gibson assembly process. These adapters are protecting a specific strand of DNA from degradation of exonucleases, isolating the pure DNA for sequencing. If successful, my research will provide a new quick and cost-effective way to research specific segments of a genome. We are also developing methods of sharing the targeted CRISPR sequencing resources. The sequenced DNA segments will be put in a large database. This will make the technology available to anyone wanting to research genes in an organism of interest, removing the need to sequence whole genomes. In the future, low cost targeted sequencing, such as the CRISPR-based technology, will open new exciting doors into understanding how changes in DNA sequence contribute to differences in phenotype, adaptability or disease susceptibility in organisms.

**Poster # 61**

# Characterizing the Expression Profile of a Plant-specific Microtubule Binding Protein Family, MACET.


## **Presented by:** Zoe Ferguson

**Mentors:** Sharol Schmidt and Andrei Smertenko **Campus:** Pullman
**Major:** Microbiology
**Category:** Molecular, Cellular, and Chemical Biology
**Co-authors:** Sharol Schmidt and Andrei Smertenko



With nearly 7 billion people on earth, a question that arises is: How can we keep up with dwindling renewable resources? One of the key renewable resources is wood biomass. The current need for lumber exceeds new growth, especially in underdeveloped nations, which leads to deforestation and global climate shifts. Wood is composed of specialized vascular cells that conduct water and nutrients, called xylem. Xylem cell walls are reinforced with lignin which provides structural support. The thick, lignified cell wall means land plants adapted a unique mechanism for cell division and growth. Plant cell division relies on synthesis of a partition between daughter cells, called the cell plate, which gradually mature into the cell wall. Cell plate building material is trafficked to the division site by a specialized structure - the phragmoplast. The phragmoplast's functions depend on microtubules. Microtubule organization in the phragmoplast is governed by the specialized proteins. Our research addresses plant-specific proteins that bind microtubules in the phragmoplast. To this end, we have identified a family of seven plant-specific microtubule binding proteins in the phragmoplast named MACET. My research focuses on characterizing the spatial and temporal expression pattern of MACET family members. Expression of a gene is driven by the promoter. When the promoter is activated, the gene is translated to mRNA and then transcribed to a functional protein. I have been using the GUS gene reporter approach to identify activity of MACET promoters in *Arabidopsis thaliana*. I have shown that MACET promoters are predominantly active in meristematic tissue, differentiating cells, and the vascular system. By further studying intracellular localization of MACET proteins, we can determine the role of MACET in cell division. This information will advance our understanding of how the phragmoplast functions and consequently engineer plants with faster cell division and therefore greater biomass production.

**Poster # 62**

# Comparison of Determination of Dietary Starch in Animal Feeds by Alpha Amylase Digestion (AADM) and Standard Enzymatic-Colorimetric Methods


## **Presented by:** Sarah Dreger

**Mentor:** Donald Llewellyn **Campus:** Pullman

**Major:** Animal Sciences

**Category:** Applied Sciences

**Co-authors:** Gary Rohwer and Donald Llewellyn



Determination of dietary starch in animal feeds is an important part in ruminant nutrition. Historically, starch analyses have been cumbersome and expensive. The focus of this research was to develop a rapid method for starch determination in feeds by an alpha amylase digestion. The standard starch analysis procedure employed in this study was AOAC Official Method 2014.10, an enzymatic-colorimetric method. In contrast, an alpha amylase digestion method (AADM) measures starch in dry ground feed samples gravimetrically by difference. In AADM, the starch is gelatinized in boiling water and treated with alpha amylase (enzyme) to convert insoluble starch molecules into soluble starches (amylodextrin, erythrodextrin, and achrodextrin). The enzyme breaks down the substrate to smaller starch components. A water insoluble fraction (IS) is measured for each feed and a subsample is boiled and subjected to the enzyme treatment followed by a water rinse. The enzyme treated water insoluble fraction (AIS) is subtracted from the water insoluble fraction (IS). In theory, the difference is the starch content of the sample. Results indicate that the measured starch was higher in all grain samples than the amount removed by the AADM method. In the case of higher protein grains (i.e. wheat and triticale), the amount removed was less than the amount removed from corn AADM. On average, only 53% of the measured starch was recovered by AADM. For forages, AADM recovered approximately 2.7 times the amount of starch measured by the standard method. Likewise, for ensiled forages, AADM recovered twice the amount of starch as compared to the standard method. Linear regression of the measured starch predicted from the AADM had an adjusted $R^2$ of 0.55. Based on the results of this study, the utility of the AADM gravimetric method as a replacement for the standard method is not justified at this time. Further research will be required to determine why grains reacted differently than forages to the new starch determination procedure.

**Poster # 63**

# Exploring the Assumed Socio-cultural Shift in Non-gendered Referential Tagging Through Political News Reporting


## **Presented by:** Micah Ramos

**Mentor:** Michael Thomas **Campus:** Pullman
**Majors:** English, Political Science
**Category:** Social Sciences
**Co-author:** Michael Thomas


Over the last couple years, there has been an increase in socio-cultural sensitivity to the assignment of gendered pronouns or reference tags to a person, more commonly known as gender tagging. Along with this perceived increased sensitivity, there has also come a push for gender-neutral tagging, such as the increase in popularity of the 3rd person singular pronoun *they*, which was Merriam-Webster's word of the year for 2019. There is a generational shift currently occurring in our society that supports using non-gendered pronouns when discussing an individual of unspecified or unknown gender. In this study, online written political reporting is analyzed for the hypothesized sensitivity to gender tagging when writing about an anonymous individual.

Utilizing the events surrounding the "Ukrainegate Scandal" of Fall 2019, news articles from multiple websites of various political affiliations were reviewed. All instances of referential tagging, which referred to the anonymous ""whistleblower,"" were documented and analyzed. Instances of referential tagging were separated into 4 groups (he, she, they, and non-gendered title). Any variation of the aforementioned tags were also counted in the documentation. For example, instances of "him," "his," "himself" etc. were all documented under the "he" tag, whereas instances of "them," "their" were documented under the "they" tag and instances of "her," "herself" were documented under the "she" tag.

By analyzing the instances of referential tagging found in the news articles, the results show that the majority of referential tagging occurred as non-gendered title tags. These tags are defined in the case of this study as nouns which referred to the whistleblower individual without denoting gender, such terms included: "the whistleblower," "the individual," "client," "the official," and "the person."

While initial analysis of the findings does suggest a political sensitivity to gendered tagging when the individual in reference is of unknown gender, further documentation and analysis is necessary for the hypothesis to be supported.

**Poster # 64**

# KEJ Medical Devices

**Presented by:** Eshna Prakash, Jordan Edwards, and Karen Cabacungan

**Mentor:** Howard Davis **Campus:** Pullman

**Major:** Bioengineering

**Category:** Engineering and Physical Sciences

**Co-author:** Howard Davis

Every year in the US, approximately 1.6 billion patients develop health-care associated pressure ulcers resulting in $3.3 billion in annual costs. Unrelieved pressure for long periods of time damages the skin and any underlying tissue. Pressure ulcers that develop on the nasal bridge of patients can be avoided with a clinician's attention to proper placement and fit of the mask. Pressure ulcers that occur from the use of oxygen masks are generally higher in elderly patients or those who are unconscious for prolonged periods.

KEJ Medical Devices has designed a preventative measure to reduce the risk of pressure ulcers on the nose. There have been many reported complications that the use of facial masks have resulted in ulcers. Generally, these occur when a patient isn't provided with any formal monitoring or relief from the mask. Currently there is no solution to aid in avoiding nasal bridge ulcers in long term situations.

We have determined that due to the lack of fat on the bridge of the nose, that area is more susceptible to pressure ulcers from oxygen masks. Currently the only prevention measures being used for pressure ulcers specifically on the nasal bridge is the use of surgical gauze or a cotton soaked in a numbing gel. These may aid in providing temporary relief and comfort, but it is not a long-term solution.

The solution KEJ Medical Devices is proposing is a foam like material attachment that will be placed around the area where the bridge of the nose meets the oxygen masks. Having a cushion to help relieve this pressure aims to ultimately relieve the pressure that would result in sores. The prototype includes a foam attachment that will be placed on a standard adult oxygen mask (approx. 5.06 in x 3.06 in x 2.56 in).

Our solution of a foam attachment fits the existing problem of patients developing pressure ulcers on the nasal bridge from oxygen masks. Between the cost of the solution and its impact on the problem, our device fits onto existing oxygen masks already in use by hospitals and patients.

**Poster # 65**

# Determining an Alternative for Fetal Bovine Serum in Expansion Medium for Cytotoxic T Lymphocytes


## **Presented by:** Chloe Nichol and Madeline Curtis

**Mentor:** Bernard Van Wie **Campus:** Pullman
**Major:** Chemical Engineering
**Category:** Molecular, Cellular, and Chemical Biology
**Co-author:** Kitana Kaiphanliam



Fetal bovine serum (FBS) is an important ingredient in traditional cell medium recipes that helps promote cell growth. The sugars present in this natural growth supplement are poorly characterized and vary from batch to batch; therefore preventing the performance of kinetic studies that require near-zero known concentrations of glucose. There are alternatives currently available, including serum-free medium solutions and FBS substitutes. However, some of these alternatives also contain glucose, making them non-viable solutions for low-glucose-concentration studies. In our laboratory, kinetic studies are important to determine the optimal amount of glucose for rapid expansion within our bioreactor system. These studies need to be able to be conducted at low levels of glucose to produce a more reliable kinetic model. In order to solve this problem, we are conducting a study to compare these alternative solutions and find the best one for T-cell expansion in our lab. Two serum-free medium solutions and one FBS substitute were ordered and compared. The glucose levels within the medium replacements were deemed too high to be a viable solution for use in the kinetic studies. The FBS substitute was used in a study growing cytotoxic T-lymphocytes (CTLs) and was compared to our traditional medium recipe containing FBS. From this, we were able to find a new medium recipe that can be used in our kinetic studies. This is important because in order to be able to optimize the growth of CTLs in our bioreactor, we need to find optimal growth conditions. Optimization of CTL expansion in a bioreactor system through kinetic modeling can enhance cancer immunotherapy applications, as high cell densities are needed for treatment.

**Poster # 66**

# Is There a Bias Against Free Things? OER vs. Commercial Textbooks


## **Presented by:** Sarah Wilson and Tatum Corbin

**Mentor:** Amy Nusbaum **Campus:** Pullman

**Majors:** Human Development, Psychology

**Category:** Social Sciences

**Co-authors:** Abby Marley, Catherin Schisler, Veronica Powell, and Amy Nusbaum


Since 2006, tuition rates at public universities have increased over 62% (Bureau of Labor Statistics, 2016). Along with the cost of tuition, fees for required course materials such as textbooks have increased significantly, with prices rising over 87% (Bureau of Labor Statistics, 2016). To ameliorate the financial burden of textbook purchases, many institutions have begun utilizing Open Educational Resources (OER); which are free and openly licensed course materials (Abramovich & McBride, 2018). However, the adoption of OER materials may be impaired by preconceptions or biases about the value of these products. For instance, Abromovich and McBride (2018) surveyed students and instructors utilizing OER materials to determine beliefs about the value and quality of the texts. While the majority of participants gave the materials equal or higher quality ratings compared to traditional textbooks, approximately half believed that OER had less financial value.

Opinions regarding product value may be due to internalized beliefs about how price is related to quality (Niemand, Mai, & Kraus, 2019), as many consumers associate a price of zero with a low-quality product. On the other hand, Shampanier, Mazar, and Ariely (2016) found that individuals often experience positive emotions toward the free option and over-value the offer when given a choice between priced and free products. Thus, it is unclear how cost affects perceptions of OER.

This study examined value perceptions before and after information about cost is supplied. Participants were given an excerpt to read from either an OER or commercial textbook, then asked to rate the material using the Textbook Assessment and Usage Scale Next, they were given information regarding the cost and production methods of the text and asked to provide secondary ratings.

We hypothesized that participants would rate OER and commercial textbooks similar on their quality before having information about cost and production and then exhibit a bias against free products and lower their ratings. Our hypothesis regarding quality ratings was supported. However, after information about cost was provided, participants exhibited a bias against high cost products – when told materials were pricey they lowered their ratings of that text.

**Poster # 67**

# Splatt Table


## **Presented by:** Kris Kha and Sarah Rosenthal

**Mentors:** Robert Krikac and Lisa Johnson **Campus:** Pullman

**Majors:** Animal Sciences, Interior Design

**Category:** Arts and Design

**Co-authors:** Robert Krikac and Lisa Johnson


At SURCA 2019 this team's poster described the initial development of this table and defined next steps that saw the table being put to use "...in classrooms, offices, and other locations to encourage a sense of belonging and foster collaboration."

This 2020 poster describes the process of taking this student-concept project to the next level: obtaining Commercialization Gap Funding (CGF) and plotting a course to production of a finalized furniture piece.

The Splatt Table is designed to eliminate any single head of table, foster equal power dynamics, and facilitate different scales of group work simultaneously. The team arrived at its design using prototypes with input from informal focus groups and professionals.

In the summer and fall of 2019, the team went through the Commercialization Gap Funding process and was successful in being awarded $42,508 to bring this concept to reality. The process required verification of copyright protection, was vetted through three rounds of proposal submission and an oral presentation to a committee of over 15 people. It required market analysis of the competition and identifying potential partners, while determining a one-year design and business development budget.

The Spring of 2020 sees the modification of the design in an effort to address the feedback obtained in the CGF process. The prototype has been modified and will be reevaluated with new informal focus groups and input from professionals. Next, a design patent will be applied for while beginning a search for a third-party manufacturing and distribution partner. Concurrently, the team will build a more durable prototype to place in the SPARK building and test the hypothesis that this shape supports collaboration and creates a sense of belonging. After finding a third-party partner, the table will be tested for durability and liability, the design refined, and the table brought to market. The final design will be installed in the SPARK building in 2021, fostering collaboration and a sense of belonging on the WSU campus.

**Poster # 68**

# Validation of the Outpatient Complication Risk Tool: Preventing Readmission


## **Presented by:** Janae Leach

**Mentor:** Tamara Odom-Maryon **Campus:** Spokane

**Major:** Nursing (BSN)

**Category:** Social Sciences


**Introduction:** Unplanned readmissions after discharge from traumatic injury are frequent and are often related to severity of the injury (e.g. length of stay, injury severity score, etc.) and patient factors (e.g. socioeconomic measures, support at home, comorbidities, etc.). To decrease the likelihood of readmission, these contributing factors should be recognized and addressed before a patient is discharged. The Outpatient Complication Risk Tool (OCRT) was created by a trauma nurse coordinator at regional medical referral center in the Pacific Northwest to document the presence/absence of 16 risk factors before a patient is discharged and then to use this information to decide on follow-up care after discharge.

**Purpose:** The main goal of this thesis project was to evaluate the validity and usefulness of the OCRT in identifying patients at risk for readmission within 30 days.

**Methods:** A retrospective chart review was conducted. The OCTR was completed for 100 former regional medical referral center patients by abstracting the data from the medical charts. Half of the patients had been readmitted within 30 days and half had not been readmitted within 30 days.

**Results:** Our study did not find a correlation between the total number of risk factors present for a patient and 30-day readmission. Higher injury severity score ($p=0.05$) and longer length of stay ($p=0.02$) were the only two risk factors associated with 30-day readmission.

**Conclusions:** The findings were surprising as we expected the total number of risk factors present to be predictive of readmission within 30 days. A larger study is needed, as the small sample size was a limitation. Use of the OCTR by trauma nurses as a checklist for helping to decide on follow-up care post-discharge may be useful.

**Poster # 69**

# Investigation of a Locus Associated with Dog Aggressiveness Towards People in Golden Retriever Dogs


## **Presented by:** Larson Smith

**Mentor:** Holly Neibergs **Campus:** Pullman

**Major:** Animal Sciences

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** R. Mier, K. Oliver, J.N. Kiser, and H.L. Neibergs



In Golden retrievers, a friendly disposition is a desirable trait, whereas aggression toward people is undesirable. The objective of this study was to identify DNA regions (loci) associated with aggressiveness in Golden retrievers to assist breeders in identifying these dogs at a young age. This study consisted of pet Golden retrievers (n = 12) that live in and near Pullman, Washington. Dog owners completed a detailed questionnaire regarding their dog's behavior. DNA for genotyping was obtained from buccal swabs, extracted and subsequently genotyped using the Illumina CanineHD BeadChip. The CanineHD BeadChip produced 220,853 genotypes that were used for a genome wide association analysis (GWAA). After quality control for genotypes and animals, 141,964 genotypes and all 12 dogs remained for the analysis. Significance of an association was based on Wellcome Trust recommendations. An uncorrected P-value of ($1 \times 10^{-5} < P < 5 \times 10^{-7}$) identified a moderately associated locus and ($P < 5 \times 10^{-7}$) indicated loci that were strongly associated with aggressiveness. Two genotypes were identified as moderately associated with aggressive behavior towards people in Golden retrievers near the membrane metalloendopeptidase (*MME)* gene on chromosome 23. The product of *MME* degrades enkephalins which have been implicated in mood, anxiety, reward, euphoria and pain. *MME* has also been associated with anxiety in humans. The identification of a locus associated with aggressive behavior towards people in Golden retrievers provides a foundation for further study of the roles of *MME* in human-dog interactions, and selection for more docile Golden retrievers.



Keywords: aggressiveness, golden retriever, GWAA

**Poster # 70**

# Optimizing Host-independent Growth of "*Candidatus* Liberibacter asiaticus"


## **Presented by:** Christina Webster

**Mentor:** Haluk Beyenal **Campus:** Pullman

**Major:** Bioengineering

**Category:** Engineering and Physical Sciences

**Co-authors:** Banafsheh Molki, Phuc Ha, David Gang, Ruifeng He, Anders Omsland, and Haluk Beyenal



Citrus greening disease, also known as Huanglongbing (HLB), causes large production loss to the global citrus industry. In the United States, there has been about a 60% loss in overall citrus production over the past 15 years. This bacterial infection affects the citrus tree's ability to take in nutrients, resulting in smaller and unripe fruit that cannot be utilized by farmers. HLB is transmitted through Asian citrus psyllids and African citrus psyllids which are difficult to control. To effectively prevent and control this disease with long-term solutions, a pure culture of the bacteria associated with HLB, "*Candidatus* Liberibacter asiaticus" ("*Ca*. L. asiaticus"), is needed to further study the disease. This project is pursuing the development of a pure culture of "*Ca.* L. asiaticus" to help us better understand how the disease spreads and discover prevention methods. Preliminary observations suggest that "*Ca*. L. asiaticus" grows at slower rates compared to other bacteria in the mixed culture. In addition, the use of selected antibiotics reduces competitive growth to allow for "*Ca*. L. asiaticus" enrichment. Early experiments have shown significant "*Ca*. L. asiaticus" growth in some samples when given a longer growth period. "*Ca*. L. asiaticus" DNA was detected using quantitative polymerase chain reaction (qPCR). Further experiments will be conducted to quantitively compare bacterial growth over different culture times and treatments to find which optimizes the growth of "*Ca*. L. asiaticus" to continue pursuing a pure culture.

**Poster # 71**

# Perception of News Truthfulness as Impacted by Political Ideology and Evaluative Feedback


## **Presented by:** Kaitlyn Freeland and Veronica Oelerich

**Mentor:** Amy Nusbaum **Campus:** Pullman
**Majors:** Political Science, Psychology
**Category:** Social Sciences
**Co-author:** Amy Nusbaum



During the 2016 US Presidential campaigns, an unprecedented level of attention was drawn to fake news, and the salience of the issue continues to rise. Though not a new concept, the term "fake news" gained an extraordinary amount of attention through social media. According to Vosoughi, Roy, and Aral (2018), individual tweets or retweets about true news stories rarely reached more than 1000 people, whereas the top 1% of individual tweets or retweets about fake news stories routinely reached between 1000 and 100,000 people. In other words, fake news stories spread much faster than true news stories on social media.

The present study explored whether belief of fake news headlines is motivated by a partisan bias (as in Pennycook and Rand, 2018) and whether belief bias can be mediated by feedback (as in Ball, 2013). In order to assess political ideology, participants completed the 12-item Social and Economic Conservativism Scale (Everett, 2013). Then, participants were exposed to a variety of true and fake U.S. news headlines, some aligning with partisan Democratic beliefs and some with partisan Republican beliefs. For each headline, participants reported whether they had heard of the story, how accurate the story was, and whether they would consider sharing the news article on social media. Half of the participants were then given feedback on whether their evaluation of the truthfulness of the article was correct, while the other half of the participants were not.

The results of the study indicate a significant difference for participants scoring low in conservativism between Democrat and Republican trials both when they were true and false. Specifically, these participants were more accurate on Democrat than Republican true trials, and more accurate on Republican than Democrat false trials. There was no such difference in these trial types for participants high in conservativism. This indicates a potential bias within those low in conservativism as a significant factor in the evaluation of news headlines. The results indicated no significant effect of evaluative feedback on accuracy, but did indicate a significant effect of feedback on confidence wherein those in the no feedback condition were more confident.

**Poster # 72**

# Functional Characterization of Microtubule Associated Protein MACET4


## **Presented by:** Tara Goble

**Mentor:** Andrei Smertneko **Campus:** Pullman

**Major:** Forestry

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Sharol Schmidt, Joshua Storey, Breanne Searing, and Andrei Smertenko



Plant cells are surrounded by a cell wall composed of a rigid oligosaccharide matrix. The cell wall necessitates a unique mechanism of plant cell division (cytokinesis) that utilizes a plant-specific structure known as the phragmoplast. The phragmoplast facilitates division between cells by construction of a new cell plate. Cell plate formation begins in the center of the cell and the phragmoplast expands outward to meet the both sides of neighboring cells. This method of cytokinesis allows for divisions of large and physically stable cells in trees. The phragmoplast is composed of microtubules, which are 25 nanometer thick tubes composed of α and β tubulin dimers. Tubulin dimers assemble to lengthen the microtubule or disassociate to shorten the microtubule, these processes support dynamic microtubule behavior. In the phragmoplast, microtubules operate together with microtubule-associated proteins (MAPs), which regulate dynamicity as well as nucleation of new microtubules. A previously identified plant-specific microtubule-associated protein, MACET4, has been reported to bind to microtubules in the phragmoplast. The mechanisms of MACET4 function remain unknown. MACET4 includes three highly conserved domains in plants: I, II, and III. Here we use *in vitro* and *in vivo* analyses to determine functions of conserved domains. Polymerization of tubulin in the presence of MACET4 forms microtubule asters comparable to animal microtubule nucleation centers. Within these same conditions, microtubules formed from MACET4 are on average shorter than the control. *In vivo* analysis of microtubule dynamics indicates that overexpression of MACET4 leads to stabilization of microtubules. Our data demonstrates that conserved domains II and III are required for aster formation, inhibiting microtubule elongation *in vitro*, and slowing microtubule depolymerization *in vivo*.

**Poster # 73**

# Characterizing the Role of Insulin-mediated Immune Signaling During West Nile Viral Infection in diabetic *D. melanogaster* Models


## **Presented by:** Ezra Mead

**Mentor:** Alan Goodman **Campus:** Pullman

**Major:** Genetics and Cell Biology

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Chasity Trammel, Alan Goodman, and Sophie Mackinnon



The mosquito-borne West Nile virus (WNV) poses a global health threat. The mosquito vector, most commonly *Culex* mosquitos, have developed natural immunity to infection. Insulin plays an important role in the antiviral immune response to WNV infection in *Culex* mosquitoes. During infection, insulin signaling suppresses the RNAi antiviral pathway and activates MAPK which induces the JAK/STAT antiviral pathway. It was observed, when WNV first made landfall in North America in 1999, that human diabetics were statistically more likely to acquire severe West Nile disease. A readily accessible *D. melanogaster* line that models type-1 diabetes encodes a mutation in a gene known as *Limostatin* (*Lst*), which disrupts insulin production and secretion. We hypothesize that we can use this diabetic *D. melanogaster* animal model to further characterize the role of insulin in immune signaling. The aim of this study is to characterize the mechanism of insulin-mediated immunity during WNV infection using *Lst* diabetic *D. melanogaster*. Following infection with WNV, adult female *D. melanogaster* mortality was counted over a thirty-day period for both the *Lst* mutant line and control lines. Plaque assays were used to determine virus replication rates of infected *Lst* flies compared to the infected control lines. Additionally, we determined if adding insulin to fly food would decrease virus replication in the *Lst* mutant flies. This study is novel in its linking of diabetes to WNV susceptibility at a molecular level. Examining the role of insulin signaling during WNV infection will have a direct impact on improving therapeutics for diabetic individuals.

**Poster # 74**

# Peak Shifts in Green Polymer Microspheres Under Pressure


## **Presented by:** Leah Snyder

**Mentor:** Matthew McCluskey **Campus:** Pullman

**Majors:** Mathematics, Physics and Astronomy

**Category:** Engineering and Physical Sciences



Green polymer microspheres (6 microns in diameter) have a peak in the visible light spectrum at around 500 nm, when illuminated by a 405nm (violet) laser. When these spheres are put under pressure this peak shifts to longer wavelengths. In order to reach the pressures necessary to shift the green polymers' spectral peak, a Diamond Anvil Cell (DAC) was used. The DAC is a chassis that allows a sample to be placed between two diamonds and compressed. The surface areas of these diamonds are so small that even a modest amount of pressure applied to the cell creates significant pressures on the sample (~1-5 gigapascals). In order to evaluate what pressure the DAC was at, ruby microspheres, whose peak shift pressure equation has already been established, were combined with the green polymer microspheres in a medium of mineral oil in the DAC. Screws on the exterior of the DAC allow for controlled increase in pressure. By tightening the screws and using the 405 nm laser on the pressurized ruby, pressures were determined, and spectra of the green polymer spheres were recorded at each measured pressure. These data were then fit with Gaussian curves to determine consistent peaks at each measured pressure. Once normalized with the spectral peak of a non-pressurized green polymer microsphere (still in the DAC), the peak shift was plotted as a function of pressure. That data set was fit with a Langevin equation. The Langevin equation fit the recorded data with an R-squared value of 0.99798. This process will be repeated with water as a medium in place of the mineral oil. The results will be compared with previously tested 147-micron polymer microspheres. Data fit correlation determination will be evaluated across all experiential sets and Langevin mod equations will be cross examined and statistically evaluated. These data could provide the basis for a new pressure calibration.

**Poster # 75**

# #PaidAd; Investigating Consumer-Generated Advertising, Persuasion and Impulsive Decision Making


## **Presented by:** Emily Paup

**Mentors:** Paul Whitney and John Hinson **Campus:** Pullman
**Majors:** Marketing, Psychology
**Category:** Social Sciences
**Co-authors:** Amy Nusbaum and Anthony Stenson


When deciding what to buy, eat, or wear, younger people depend more on recommendations from other consumers than previous generations, and are increasingly impervious to traditional advertising techniques (Libanda & Nzorubara, 2017). In response to this shift in consumer judgment, companies are increasingly utilizing consumer-generated advertising (CGA), which looks like honest recommendations from fellow consumers on social media platforms but are often funded by the company the post promotes. Some research has indicated there is not a significant difference in consumer evaluation of a sponsored CGA (with appropriate labeling) and a similar image posted by the company itself (Steyn, Ewing, Heerden, Pitt, & Windisch, 2011), while others have shown the exact opposite (Johnson, Potocki, & Veldhuis, 2019). There has also been a lack of research on what internal factors impact a consumer's evaluation, and if there is a connection to the consumer's decision-making trends, specifically measures of impulsivity. Previous research has supported that participants who recognize CGA as ads through labeling resist the sponsored content and start to experience negative thoughts about it, but we don't know who is more likely to do this in the population or their decision-making strategies (van Reijmersdal et al, 2016).

This study investigates two main research questions; 1) how consumers evaluate labeled CGA as opposed to traditional advertising and 2) if there is a connection between a consumer's measure of impulsive decision making and their evaluation of CGA. To determine how consumers evaluated the CGA, we utilized five questionnaires after the participants viewed stimuli labeled as CGA or as traditional ads. To measure impulsivity, we implemented a delay discounting task and a questionnaire on reported measures of impulsivity. For our first research question, we hypothesize that consumers will respond more positively to an advertisement labeled as a CGA instead of a traditional advertisement. For our second research question, we hypothesize that consumers who show more impulsive decision making will have a more negative response to recognized CGA than someone who does not, as they may be more likely to strongly resist the ad if it has been indicated as an advertisement.

**Poster # 76**

# Influence of Tellurium Inclusions on Detector Resolutions of Cadmium Zinc Telluride


## **Presented by:** Jasdeep Singh

**Mentor:** Santosh Swain **Campus:** Pullman

**Majors:** Materials Science and Engineering, Mechanical Engineering

**Category:** Engineering and Physical Sciences



Cadmium Zinc Telluride (CdZnTe) is room temperature radiation detector, with its primary application in nuclear security and medical imaging. Though many applications lie ahead for CdZnTe, defects such as Tellurium (Te) inclusions formed during crystal growth downgrade the spectroscopic performance of the material. This research will incorporate detailed analysis of the effects of Te-inclusions on the performance of single-crystal CdZnTe specimens with aid of infrared (IR) microscopy. CdZnTe specimens analyzed were grown using a Modified Vertical Bridgman method (MVB) accompanied with an Accelerated Crucible Rotation Technique (ACRT). Performance of each detector will be compared to the inclusion distribution in the crystal and a correlation analysis will be performed to determine the extent of influence of second phase particles on detector performance. Correlation analysis will be composed of the effects of mean diameter, count density, and volume percent of Te-inclusions within a (~7.5x3.0x2.5)$mm^3$ area of CdZnTe specimens from various crystal growths.

**Poster # 77**

# 3D Printing of Structural Scaffolds with Controllable Mechanical Properties for Articular Cartilage Tissue Engineering


## **Presented by:** India Dykes

**Mentor:** Arda Gozen **Campus:** Pullman

**Major:** Bioengineering

**Category:** Engineering and Physical Sciences

**Co-authors:** India Dykes, Arda Gozen, Bernard Van Wie, Nehal Abu-Lail, Mahmoud Amr, Haneen Abusharkh, Olivia Reynolds, Joshua Kernan, and Juana Mendenhall



Osteoarthritis, also called degenerative joint disease, is the most common form of arthritis and affects millions of adults annually. It is characterized by irreversible damage to the articular cartilage in the joints, most commonly hips, hands, and knees. Current treatments include pain killers, cortisone injections, and total knee replacement, yet there are no effective long-term solutions. We aim to address this problem by engineering articular cartilage to mimic the native cartilage tissue. Our work focuses on providing an effective replacement for damaged articular cartilage by 3D printing biodegradable, porous hydrogel scaffold matrices suitable for cartilage cell culture. Our overarching hypothesis is that the heterogeneous structure of the native articular cartilage can be achieved through a 3D-printed structure consisting of a structural scaffold with varying mechanical properties and porosity and a cell-laden hydrogel with a variety of cell-type and growth factors to mimic the native articular cartilage. My work focuses on achieving controlled mechanical properties of the structural scaffold within the range of native articular cartilage using a novel tri-component hydrogel (gelatin, gum Arabic and sodium alginate) through varying hydrogel composition, chemical crosslinking, and printing parameters such as speed and infill density. Hydrogel printability was achieved by optimizing the sodium alginate, gum arabic, and gelatin composition, and by implementing a heated nozzle and cooled print bed to regulate hydrogel physical crosslinking during printing. A range of mechanical properties was achieved through varying chemical crosslinking times using $CaCl_2$ and N-(3-Dimethylaminopropyl)-N’-ethylcarbodiimide hydrochloride/N-Hydroxysuccinimide (NHS-EDC), and a range of macro-porosity through varying infill density of the printing pattern. Our next steps include studying the biocompatibility of the scaffolds by culturing bovine articular cartilage cells in the scaffold and performing degradation tests on scaffolds with a range of chemical crosslinking times. The scaffolds will be cultured both statically and in a bioreactor to mimic the forces of the joint during cell growth.

**Poster # 78**

# The effects of within- and Transgenerational Plasticity on Life History Traits in the New Zealand Mud Snail (*Potamopyrgus antipodarum*)


## **Presented by:** Mary Whalen

**Mentor:** Mark Dybdahl **Campus:** Pullman

**Major:** Biology

**Category:** Organismal, Population, Ecological, and Evolutionary Biology

**Co-authors:** Katie Nielsen, Abby Hudak, and Mark Dybdahl



Phenotypic plasticity is important in that it is a potential mechanism for phenotypic variation within a population. This can result in positive or negative effects on species success under varying conditions, which is important concerning climate change. There are two different forms of plasticity: within-generational plasticity (WGP) and transgenerational plasticity (TGP). An individual's own environmental conditions are determinants for WGP, while TGP is a result of the ancestral or in this case parental environment. When both of these are present, they can interact with each other, changing the phenotype in differing ways than if they were additive. This can have a substantial impact for species survival under changing conditions. The New Zealand mud snail (*Potamopyrgus antipodarum*) was used because it is an asexually reproducing organism. The parents (F1) of these snails were exposed to either low salinity (5ppt) or high salinity (12ppt). The offspring of these parents (F2) were then subjected to a high temperature treatment, which consists of 24 $^{o}$C rather than the benign at 18 $^{o}$C. Once they had reached 50 weeks old, they were removed from heat and placed into benign conditions. Life history traits, specifically growth, was measured. This was used to determine whether WGP/TGP is present. Preliminary results suggest that there is no TGP in regards to growth, but there is WGP. Further growth measurements are still being taken to verify these results. These results suggest that WGP is present for some life history traits, which could have implications for the invasion success. Species success in new environments could be reliant on WGP or/and TGP, and is relevant in invasion success, and species migration. This examination of phenotypic plasticity proves vital to further research in conservation biology, due to the now rapid alteration of the environment.

**Poster # 79**

# Promoting Development of Biofilm Treated with Wastewater Using a Polarized Electrode


## **Presented by:** Maria Pham

**Mentor:** Haluk Beyenal **Campus:** Pullman
**Major:** Bioengineering
**Category:** Engineering and Physical Sciences
**Co-authors:** Eduardo Sanchez, Abdelrhman Mohamed, and Haluk Beyenal



Electrochemically-active microorganisms are able to utilize solid inert electrodes as an electron donor or electron acceptor. Electrochemically-active microorganisms have been used in applications in industry and environmental sustainability such as more energy conversion, wastewater treatment, and electrosynthesis of valuable bioproducts. The enrichment and isolation of novel electrochemically-active microorganisms can expand the scope of their applications. In a mixed culture, the electron transfer between an electrode and microorganisms promotes the growth of electrochemically-active microorganisms and increases their relative abundance. Currently methods to enrich electrochemically-active biofilm are limited by slow start-up time and low selectivity. When biofilms are enriched from a mixed-culture inoculum, to increase the abundance of electrochemically-active microorganisms and to decrease start-up time, we propose sequential enrichment from existing biofilm electrode cultures. This work focuses on the development of an efficient oxygen reducing biocathode culture that can be utilized in wastewater treatment or biofuel cell applications. The biofilms are enriched on polarized electrodes, where we apply a fixed potential to promote reducing conditions. In this work, a bioelectrochemical enrichment reactor was set up using a mixed culture collected from a local wastewater treatment plant located in Moscow, Idaho. The enrichment reactor consisted of a three-electrode system where the potential of the working electrode was controlled using a potentiostat. Chronoamperometry was used to monitor the rate of oxygen reduction. We showed that the enrichment of biofilms on the electrode catalyzes oxygen reduction, as evidenced by increasing reduction current over time. We used cyclic voltammetry to study the effect of applied electrode potential on oxygen reduction rate. Our initial cathodic enrichment results showed a start-up time of 10 days. We found that sequential cathodic enrichment reduced the start-up time.

**Poster # 80**

# Pediatric Concussion Research in the Nursing Discipline: Publishing Trends from 1994 to 2018


## **Presented by:** Cassidy Boyd

**Mentor:** Janessa Graves **Campus:** Spokane
**Major:** Nursing (BSN)
**Category:** Social Sciences
**Co-authors:** Janessa M. Graves and Electra Enslow



**Purpose**: The purpose of this study was to describe the trends and characteristics in literature on pediatric concussion published in the nursing discipline over the last 25 years.

**Background**: Concussions affect over 40,000 youth each year, and their incidence has been increasing over time. Recovery from a concussion can last from several days to weeks, but cognitive impairment may resolve in 3-6 months. Nurses play a key role in patient education, initial treatment planning, and long-term recovery following concussion. School nurses, in particular, assist families and school personnel ensure a child's successful return to school after concussion. To improve knowledge in nursing, it is important to understand the evidence that has been published in the peer-reviewed literature.

**Methods**: This bibliometric analysis involved searching the published nursing literature for MeSH terms and keywords relevant to concussion (pediatric OR child*) AND ("concussion*", "mild TBI", "mild traumatic brain injur*", "mild head injur*", OR "minor head injur*") in CINAHL, PubMed, Eric, and PsychINFO. The following inclusion criteria were employed: English language, focus in the US, and published between 1994 and 2018. Articles focusing solely on severe TBI, adult populations, animal studies were excluded. Deduplication was conducted in Zotero, after which citations were transferred and managed in Rayyan QCRI (software designed for systematic reviews). In Rayyan, articles were coded based on type of study (e.g., epidemiological, policy evaluation, review article), mechanism of injury (e.g., sports), and phase of injury (e.g., prevention, acute care, recovery).

**Results**: A total of 128 articles were included and coded. The most common phases of injury were treatment of acute injury with 65 articles (50.7%) and recovery with 51 articles (39.8%). Eighty-six articles (67.2%) had no specified mechanism of injury and 38 articles (29.7%) were related to sports/recreation participation. Trends show an increase in publications in the last decade; 82.8% of articles were published after 2009.

**Implications**: An examination of the extant literature about pediatric concussions published in nursing journals exposed gaps in the research. Articles with a specific mechanism focused on sports-related injury and epidemiological and policy studies were largely lacking. Additional research is warranted in these areas.

**Poster # 81**

# The Relationship of CHP1 and GPAT9 Complex in Lipid Biosynthesis


## **Presented by:** Shelby Jarvis

**Mentors:** John Browse and Jesse Bengtsson **Campus:** Pullman

**Major:** Genetics and Cell Biology

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Jesse Bengtsson, John Browse, Jim Wallis, and Daniel Luann



Plant lipids are an important molecule to understand gene functions in similar structures. In a recent study, a regulator CHP1 binds to GPAT4 through an important link called myristoyl, this enables lipid synthesis in mammals. The loss of CHP1 or myristoyl reduced fatty acid incorporation in making oils and storage in cells.(1) Comparing the evolutionary relationships through a homologue, *Arabidopsis thaliana*, to understand the relationship of CHP1 on GPAT9. (GPAT4 and GPAT9 are similar structures primarily in mainly the N-terminus region of DNA) and function. Firstly, we wanted to determine the effect of CHP1 by knocking down (decreasing transcription), knocking out (complete removal of CHP1), seed specific overexpression (more CHP1 expression in seeds). Then determining the change with the loss of the linkage(myristoyl), which is an essential linkage for function in mammals. This will allow to understand if the complex is an essential function in plants and what relationship role CHP1/GPAT9 complex does in comparison to the mammal homologue.


**References:**


(1) Zhu, X. G., Puthenveedu, S. N., Shen, Y., La, K., Ozlu, C., Wang, T., … Birsoy, K. (2019, March 4). CHP1 Regulates Compartmentalized Glycerolipid Synthesis by Activating GPAT4. Retrieved from https://www.sciencedirect.com/science/article/pii/S1097276519300577

**Poster # 82**

## Hotels for Seniors: Ideal Workplace for Gen Z?

**Presented by:** Anastasia Smoak, Jennifer Warren, and Siena Stephens

**Mentor:** Kelvin Chiang **Campus:** Pullman

**Majors:** Hospitality Business Management, Winemaking (Viticulture and Enology)

**Category:** Social Sciences

**Co-authors:** Cooper Stone, Desmond Chia, Dylan Sterling, Eleanor Markewicz, Julia Day, Klint Demetrio, Mary Bartlow, and Shelby Ruiz

Senior living is the emerging frontier of hospitality. Facing a global aging population, the hospitality industry is taking the lead in this social movement of aging gracefully. By 2050, there will be 8.75 million older adults living in various senior living facilities (SLF) across the United States (Pizam, 2014). The anticipated influx of Baby Boomers has left the senior living industry with major challenges. According to the National Investment Center for Senior Housing and Care, leadership development is the most critical issue that the senior living industry is currently facing (NIC 2019). Previous literature revealed that stigma, defined as the assignment of negative worth based on devalued group or individual characteristics and the lack of awareness, has been the reason for the stagnant development and the high senior living workforce and leadership turnover. This study aims to find out if Generation Z has a preference between the various hospitality industries, namely hotels, airlines, restaurants, cruise lines, theme parks, car rental agencies, and senior living. Seven hypotheses were established based on the seven reflective items of the Willingness to be Employed (WTE) scale. An online survey was administered via Amazon Mturk with respondents aged 18 to 25 (N=221). Results revealed that a significant difference ($p < .001$) in preference exists among those in Generation Z to choose the hotel industry over the senior living industry. The hotel industry was ranked significantly higher than the senior living industry in each WTE category, namely (1) compensation and benefits, (2) career development opportunity, (3) industry reputation, (4) work environment, (5) working hours, (6) career adaptability, and (7) amount of uncertainty. Based on the research findings, we recommend senior living practitioners to promote their industry as an attractive career path among Generation Z because they will grow to become industry leaders catering the Baby Boomers influx. Action items such as increasing presence at university career fairs, establishing comprehensive management trainee programs, and emphasizing reasonable working hours are all measures to enhance recruitment effectiveness. Besides the practical implications that suggest Generation Z should be targeted, this study also adds to the body of literature in the hospitality perspective.

**Poster # 83**

# Addressing the Opioid Crisis: Does Pain Make Opioids More Rewarding?


## **Presented by:** Evan Skaanes

**Mentor:** Rebecca Craft **Campus:** Pullman
**Major:** Psychology
**Category:** Organismal, Population, Ecological, and Evolutionary Biology
**Co-authors:** Rebecca Craft and Hannah Gogulski



The opioid crisis is a devastating health dilemma in the U.S., and it is largely due to prescription opioid misuse by chronic pain patients. Women are more likely than men to suffer from chronic pain, and to use and become addicted to prescription opioids. Additionally, pain can alter opioid reward, which may increase an individual's risk of addiction. It is unknown whether pain alters opioid reward differently in males vs. females, perhaps contributing to sex differences in addiction. The present study uses a conditioned place preference test to determine if opioid reward is altered by pain differently in male and female rats. Persistent inflammatory pain was induced by a hindpaw injection either of mineral oil (no-pain control) or Complete Freund's Adjuvant. Rats were injected with either physiological saline (control) or 3.2 mg/kg morphine. Treatments were counterbalanced across days and sides of the apparatus (morphine was paired with either "black" or "white" chamber of the apparatus). It was hypothesized that rats in pain will develop a greater opioid-induced place preference than those not in pain, and that female rats will develop a greater opioid-induced place preference than male rats. Results showed that a single morphine-place pairing produced a significant preference for the morphine-paired place, but only in rats that received morphine paired with the "black chamber" (morphine x chamber interaction: [$F(1, 82) = 4.802$, $p < 0.031$]). This preference did not differ between males and females or between rats in pain and not in pain. Three morphine-place pairings also produced a significant preference for the morphine-paired place [$F(1, 82) = 14.583$, $p < 0.0001$], and again, rats showed a greater preference if morphine was paired with the "black chamber" [$F(1, 82) = 11.975$, $p < 0.001$]. But these preferences did not differ between males and females or between rats in pain and not in pain. These results suggest that opioid reward – at least at the single morphine dose tested – is not altered by pain and there is no difference between males and females. However, it seems that opioid reward is altered by the environment in which morphine is experienced.

**Poster # 84**

# Effects of Mavacamten on Contraction and Cross Bridge Kinetics in a Transgenic Mouse Model of Hypertrophic Cardiomyopathy


## **Presented by:** Marissa Watanabe

**Mentor:** Bertrand Tanner **Campus:** Pullman

**Major:** Microbiology

**Category:** Organismal, Population, Ecological, and Evolutionary Biology

**Co-authors:** Yemeserach Bishaw, Peter O. Awinda, Katarzyna Kazmierczak, Danuta Szczesna-Cordary, and Bertrand C.W. Tanner



Cardiac muscle contraction plays a vital role in healthy physiological function, allowing the heart to pump blood throughout the body. Cardiovascular disease is a growing threat to the global population and therefore new heart failure treatments are needed. A new pharmaceutical molecule called Mavacamten, which targets the sarcomere proteins, is under development and requires further investigation to understand its physiological effects. Mavacamten is a potential treatment for a heart disease called Hypertrophic Cardiomyopathy (HCM). HCM is the leading cause of sudden cardiac death in young adults and children.

Previously, our control study looked at the biophysical effects of Mavacamten using human cardiac tissue from organ donors. Our current study investigated the biophysical effects of Mavacamten in two transgenic mouse lines. The control group consisted of wild type mouse cardiac tissue expressing human myosin regulatory light chain (WT-RLC). The HCM model group expressed the human RLC with a point mutation, N47K. This point mutation is one of many that occur in the human RLC gene that lead to a hyper-contractile phenotype typical of HCM.

For both the WT-RLC and the N47K groups, skinned transgenic mouse cardiac muscle fibers were $Ca^{2+}$-activated in the absence or presence of 0.3 µM Mavacamten, and the contractile muscle tension was measured. Additionally, the rate of actin-myosin cross bridge cycling was measured as a function of ATP concentration. Our results suggest that Mavacamten decreases maximum tension and $Ca^{2+}$-sensitivity of tension in both groups. Furthermore, as the concentration of ATP decreased, the cross-bridge attachment rate remained the same and the detachment rate increased by ~20% in both groups. Therefore, these decreases in tension could stem from Mavacamten decreasing the time that cross-bridges generate force. These findings indicate that Mavacamten has the potential to be an effective treatment for patients with heart diseases that express a hyper-contractile phenotype.

**Poster # 85**

# Teaching the Teacher: Suicide Prevention Education Policies for School Educators and Staff


## **Presented by:** Rachel Nelson

**Mentor:** Janessa Graves **Campus:** Pullman
**Majors:** Neuroscience, Psychology
**Category:** Social Sciences
**Co-author:** Janessa M. Graves



**Background:** Suicide is the second leading cause of death for individuals aged 10-34 in the United States, second only to unintentional injury. Estimates indicate that four of five teens who attempt suicide express clear warning signs, of which teachers and school personnel may be in some of the best situations to identify. The Surgeon General and Jason Flatt Act have established guidelines for policies, but no true national legislative standard exists for training school personnel in topics related to suicide prevention and awareness. The purpose of this cross-sectional, legal epidemiology study was to quantify school personnel training efforts in youth suicide prevention and awareness and describe the similarities and differences across state policies.

**Methods:** Multiple legal databases (e.g., LegiScan, Open States, individual state legislature databases) were searched to identify the most recent policy for all 50 states and Washington DC as of July 2019. Policies were coded based on year of adoption, training duration and frequency requirements, student and personnel targets, and type of policy.

**Results:** Most states (96%) have adopted a policy related to suicide prevention and awareness training for school personnel, but there is wide variation in key characteristics. Only 30% of current state policies specify a target student age for personnel training. Most policies either require training for personnel that work with all grades or do not specify a grade range. The policies that did not specify grades were grouped with those listing all grades due to ambiguous language. Additionally, 47% of adopted policies state that all personnel should be trained without specifying training for employees with limited student contact, such as cafeteria or janitorial staff.

**Conclusions:** Although most states are using legislation to attempt to combat teen suicides, the data suggest limited consistency among policies. There appears to be notable variation in targets for training (e.g., students or staff). Policy adoption is not an indication of compliance by individual school districts, so future research should measure compliance by surveying the Superintendent of Public Instruction of each state and/or individual school districts.

**Poster # 86**

## Developing an Ergonomically Improved Hydraulic Service Cart

**Presented by:** Anna Estabrook, Colton Williams, Kiera Lucas, Matthew Winchell, Micah Manago, and Shaelyn Huot

**Mentor:** Lynne Cooper **Campus:** Pullman

**Majors:** Biology, Entrepreneurship, Management Information Systems, Mechanical Engineering, Political Science, Strategic Communication

**Category:** Engineering and Physical Sciences

**Co-authors:** Celeste Harms, Dean Richely, and Torin Sundburg

Hydraulic service carts are used by aircraft manufacturers and operators to test an aircraft's hydraulic systems while the plane is on the ground. These carts are large, cumbersome, and require users to spool and unspool heavy hydraulic hoses and power cables above the head and below the knee each time the cart is used to test a plane. Numerous injuries, mainly to backs and shoulders, occur as a result of the design of the cart. Our project investigates ways to modify the carts in order to reduce the number and risk of injuries associated with the carts.

Our project explored multiple options for external modification of the hydraulic service carts and hangar environment. We evaluated each approach by assessing feasibility, potential for reducing injuries, operational impact, functional performance, ease of integration, and implementation cost and reality.

The most promising designs were then prototyped as both CAD and physical scale models and evaluated through technical, ergonomic, and cost criteria. This poster presents the results of our design and analysis efforts and offers several viable options for improving performance and reducing injuries.

**Poster # 87**

# Finite Element Modeling of Fluid Flow and Heat Transfer in Desktop Learning Modules


## **Presented by:** Chase Llewellyn

**Mentors:** David Thiessen and Bernard Van Wie **Campus:** Pullman
**Major:** Chemical Engineering
**Category:** Engineering and Physical Sciences
**Co-author:** David Thiessen



Desktop Learning Modules (DLM) are small, portable, and transparent versions of industrial equipment like heat exchangers, flow meters, and pipes that allows engineering students to explore concepts of heat transfer and fluid dynamics in a hands-on classroom environment. Four specific DLMs are currently being developed including pipe flow, venturi flow meter, double-pipe heat exchanger, and shell-and-tube heat exchanger. The pipe flow and venturi meter modules illustrate principles of fluid mechanics involving hydraulic loss and the Bernoulli effect, while the heat exchanger modules teach the practical application of heat transfer principles. In this research, the DLMs were modeled by the finite element method (FEM) using COMSOL, to understand and improve their performance and to produce 3D illustrations of the detailed flow and thermal fields to help improve student understanding. The 3D CAD files used to produce the injection-molded cartridges were imported to COMSOL for simulation. Simulations were carried out for flow velocity and temperature conditions corresponding to those seen in the DLMs in classroom implementations. The models were validated by comparing predicted performance to experimental measurements on the DLMs. Image analysis tools were implemented in the study using a high-speed camera to trace fluorescent particles progressing through the DLMs. By analyzing the displacement of the particles suspended in the flowing water and comparing the distance travelled to the image acquisition rate of the camera, images displaying the trajectory and velocity of the particles were created. These image sequences can be utilized by students to help conceptualize the fundamentals of the conservation of mass, as well as reveal the presence of vortices formed for flow through an expanding channel.

**Poster # 88**

# Risk Factors Associated with Child Sexual Abuse


## **Presented by:** Carolina Ruiz

**Mentor:** Marsha Quinlan **Campus:** Pullman

**Major:** Biology


**Category:** Social Sciences


Child maltreatment is a relatively new area of study. Child sexual abuse (CSA) is a type of maltreatment that is considered a global issue. I conducted a literary analysis confined to research done in the United States within the last 20 years and found common factors associated with children's at risk of CSA including: family dynamic, perpetrator relationship, maternal sexual abuse, and race, ethnic, and cultural background of the child. There are additional less-researched risk factors (e.g., parent mental retardation and child learning disability) but these were investigated along with some of the previous risk factors. There is some disparity among the studies about the impact of each risk factor. Most of the research lies in the psychological effects of varying aspects of the CSA. Understanding the risk factors associated with CSA could help to prevent CSA from occurring to the young population of the United States. While much research examines race and ethnicity as factors, research that includes socioeconomic status a risk factor was rare, though it seems a likely confound with minority status. Socioeconomics could be an important area of focus for future studies.

**Poster # 89**

# Effect of Induced Stress on Neck Muscle Activation and Postural Sway


## **Presented by:** Keaton Zimbelman

**Mentor:** Anita Vasavada **Campus:** Pullman
**Major:** Neuroscience
**Category:** Applied Sciences
**Co-author:** Anita Vasavada



Postural control and neck muscle activity are adaptive processes that can change rapidly due to the initiation of stress. More specifically, neck pain has been observed in individuals who work daily in a seated office setting. In fact, compared to the general population, the prevalence of neck pain is 65% greater in office workers, and stressors only exacerbate this pain. The aim of this study is to determine how induced stress affects postural sway and neck muscle activity in individuals in a seated computer setting. To provoke stress in the participant, we used the Montreal Imaging Stress Test (MIST), a computer task that involves fast paced mental math and social evaluative threat (SET). Ten young adults performed the task under two conditions. One condition asked the participant to complete the arithmetic task at their own pace, without extensive feedback on their progress. The other condition included the same arithmetic difficulty, but included time constraints, an accuracy bar, and SET initiated by telling the participant they need to score above 75%-80% correct for their data to be included, when the true average is closer to 25%-45% correct. Neck muscle activity (electromyography), head and trunk acceleration, and heart rate data were collected throughout the process as well as intermittent stress and discomfort questionnaires. Results are currently being analyzed, with results expected to show increased muscle activity and decreased postural sway with increased stress. The study will further advance existing research into the physiological relationship between stress and neck pain in the workplace.

**Poster # 90**

# A Brief Intervention to Assess Attitudes and Preparation about End-of-Life


## **Presented by:** Fatima Zubedi

**Mentor:** Raven Weaver **Campus:** Pullman

**Major:** Neuroscience

**Category:** Social Sciences

**Co-authors:** Amelia Vanmeter and Raven Weaver



Introduction: Individuals typically avoid talking about death and dying, which contributes to anxiety and discomfort. About one-third of individuals in the U.S. have completed a written statement of their wishes, yet advance care planning (ACP) enables individuals to define and discuss their goals/ preferences for future medical care. In general, planning for the end-of-life is overlooked, suggesting a need to promote the value of ACP earlier in the life course, particularly among young adults. Our project aims to assess attitudes, raise awareness about the benefits of advanced care planning, and reduce anxiety about the future.

Methods: We assessed the effectiveness of a brief intervention designed to reduce anxiety and increase comfort among a college-aged population about anticipating end-of-life and communicating end-of-life preferences and wishes. Undergraduate students (N=188) completed a survey online, randomized into one of three conditions. Participants were asked to read a brief narrative (Level 1), were asked to read the same brief narrative and write a reflection (Level 2), or did not receive an intervention (Control). All participants then completed a battery of scales.

Results: Individuals in either treatment level were less likely to worry about not getting enough care ($X^2$=6.154, p =.046) compared to the control group. Level 2 individuals were more likely to anticipate having verbal conversations about ACP within the next 3 months, compared to the control group ($X^2$=12.007, p=.002). Regardless of condition, individuals who indicated previous awareness of ACP had significantly lower scores on several scales measuring domains of anxiety and fear about death and dying.

Conclusions: Raising awareness about the value of ACP is crucial to reduce anxiety and fear about death and dying. ACP promotes a sense of control at the end-of-life. This study demonstrates the value of a brief intervention to increase young adults' willingness to engage in verbal ACP, which is an initial step towards engaging in formal ACP (i.e., advance care directives). Further research is required to determine how to increase willingness to engage in written ACP to further enhance preparation for the end-of-life.

**Poster # 91**

# Tissue-specific RNAi of Fatty Acid Desaturase Genes


## **Presented by:** Henry Harrison

**Mentor:** Jennifer Watts **Campus:** Pullman

**Major:** Genetics and Cell Biology

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Jason Watts and Jennifer Watts



Unsaturated fats in the diet are essential to maintaining human health. In contrast, the typical American diet is high in saturated fats, which are linked to cardiovascular issues, strokes, and elevated risk of heart attack. Unlike humans, the roundworm *Caenorhabditis elegans* can synthesize all its own polyunsaturated fatty acids (PUFAs) through fatty acid desaturation and elongation. This allows us to study the physiological effects of specific unsaturated fatty acids after RNA interference (RNAi) is used for systemic genetic knockdown of fatty acid desaturase genes *fat-1* and *fat-4*. To understand RNAi susceptibility, we used *C. elegans* mutant strains with RNAi activity localized to specific tissues such as skin, muscle, intestine, and germ line. Preliminary results indicate that desaturase activity occurs in intestinal tissues and in the germ line, but not in muscle tissues. These studies will reveal which animal tissues are most important for the production of unsaturated fatty acids. While these studies are highly relevant to mammal physiology, they cannot be easily performed in mammals, and thus *C. elegans* is used as a model organism to understand how desaturated fat levels affect cellular signaling and maintaining overall health.

**Poster # 92**

# Investigating the Role of LEF1 in Papillary Fibroblasts During Skin and Hair Follicle Morphogenesis


## **Presented by:** Gracelyn Fine

**Mentor:** Ryan Driskell **Campus:** Pullman
**Majors:** Genetics and Cell Biology, Microbiology
**Category:** Molecular, Cellular, and Chemical Biology
**Co-author:** Ryan Driskell


Did you know that you are born with all of the hair follicles that you will ever have? Hair follicles generate the hair fiber that grows out of our skin. Hair follicle formation (morphogenesis) occurs during embryogenesis, but mammals lose the ability to reform hair follicles shortly after birth. For example, deep and large wounds do not reform hair follicles in the scar. Consequently, reforming hair follicles in scars is a central step to achieving skin regeneration.

The Driskell Lab is particularly interested in understanding the mechanisms of fibroblast heterogeneity in the context of skin regeneration. Fibroblasts are the mesenchymal cells of the skin that are sometimes thought of as homogenous cells that secrete the Extra-Cellular-Matrix (ECM) of the skin. In contrast, we have shown (1) that fibroblasts are a heterogenous population with non-overlapping functions. For example, papillary fibroblasts (from the papillary dermis) support hair follicle growth and regeneration, while reticular fibroblast (from the reticular dermis) secrete ECM and differentiate into adipocytes. We have identified that the Wnt transcription factor, Lef1, is specifically expressed in the papillary fibroblast lineage.

**Poster # 93**

# Incremental Validity of Neuropsychological Endophenotypes as a Predictor of Continuous and Dichotomous Measures of Attention-Deficit/Hyperactivity Disorder


## **Presented by:** Kailey Garrigus

**Mentor:** Tammy Barry **Campus:** Pullman

**Majors:** Neuroscience, Psychology

**Category:** Social Sciences

**Co-authors:** Tammy D. Barry, Robyn S. Herbert, and Karin Fisher



**Background:** The genetic vulnerability of ADHD, a highly heritable neurodevelopmental disorder characterized by patterns of inattention and/or hyperactivity-impulsivity, results in heterogeneous behavioral expressions and may stem from neuropsychological endophenotypes (e.g., executive functioning). Several behavioral assessments are currently used to formally diagnose ADHD, but there is limited literature indicating whether specific measures of neuropsychological endophenotypes add incremental validity to test batteries.

**Hypotheses**: We hypothesized that disinhibition, response time variability, and working memory each would significantly predict unique variance in the prediction of both parent and teacher ADHD behavioral ratings. We also hypothesized that the inclusion of measures of disinhibition, response time variability, and working memory would show incremental validity in the classification of an ADHD diagnosis, with significantly improved distinction between ADHD and non-ADHD participants, compared with using behavioral rating scales alone.

**Method:** The sample used to conduct this study was drawn from a larger archival data set, in which executive functioning in 84 participants aged 11 to 17 years old ($M$ = 13.44; $SD$ = 1.81) was measured using in-lab neuropsychological tests including (1) a go/no-go task and (2) a digit span task. Additionally, parent ADHD ratings were collected for all participants, with a subset of 40 participants also having teacher ADHD ratings. Hierarchal multiple regression and binary logistic regression analyses were used to evaluate the hypotheses.

**Results:** Results indicated that endophenotypes of ADHD (i.e., disinhibition, reaction time variability, rote memory, working memory) were significantly related to teacher-reported symptoms of inattention ($p < .04$). Additionally, reaction time variability was significantly correlated with teacher-reported ($p = .006$) and parent-reported ($p = .01$) hyperactivity, and disinhibition was significantly correlated with parent-reported hyperactivity ($p = .02$). The four measures of endophenotypes predicted a significant amount of variance in teacher-rated total ADHD symptoms ($p = .04$) and inattention ($p = .033$); however, no measures predicted significant unique variance. Endophenotypes were not found to significantly predict parent-reported symptoms of inattention, hyperactivity, or total ADHD.

**Conclusions:** These findings indicate that the involvement of neuropsychological endophenotypes in ADHD diagnoses significantly increases the incremental validity of predicting teacher-reported symptoms, which is instrumental in the diagnosis of ADHD.

**Poster # 94**

# Cannabis for Treating Anxiety: Do THC and CBD Interact?


## **Presented by:** Irie McCaughran

**Mentor:** Rebecca Craft **Campus:** Pullman

**Majors:** Philosophy, Psychology

**Category:** Organismal, Population, Ecological, and Evolutionary Biology



Anxiety disorders are becoming more common in the United States. Delta-9-tetrahydrocannabinol (THC) and cannabidiol (CBD), two predominant cannabinoids in the cannabis plant, are regarded as natural treatments for anxiety due to their calming, inhibiting effects reported by many users. However, the limited scientific literature in humans shows THC acting as an anxiogenic at high doses, while CBD appears to have little effect on anxiety, although CBD may block some effects of THC. Animal studies suggest that CBD and/or THC may reduce anxiety-related behaviors in rodents that are stressed or in pain, and that this effect may contribute to cannabis' pain-relieving effects. Thus, the goal of my study is to determine the effects of CBD and THC given together on anxiety-related behavior in rats that are in chronic pain. Male and female rats were given a hindpaw injection of placebo (mineral oil) or CFA (a mycobacterium that induces inflammation and pain). Twice-daily for three days, rats were injected with a combination of CBD and THC (0, 0.1, 1.0, or 2.0 mg/kg of each drug). Behaviors were then scored in an open field apparatus, a common test used to measure anxiety-related behaviors in rodents. Our preliminary results show that females are more active than males, and that pain decreases behaviors in the open field test. Treatment with cannabinoid drugs did not restore pain-suppressed behaviors in either sex, and there is no indication that cannabinoid drugs decrease anxiety in this test. A limitation of this study is that sample sizes are small, and we have tested a limited range of doses. In future studies, a wider range of drug doses, plus testing each drug given alone would be helpful to better understand the interactions of THC and CBD on rats' anxiety-related behaviors.

**Poster # 95**

# Can Supercontinents Form Without Plate Tectonics?


## **Presented by:** Theresa Czech

**Mentor:** Catherine Cooper **Campus:** Pullman

**Major:** Earth Sciences (Geology)

**Category:** Engineering and Physical Sciences

**Co-author:** C.M. Cooper



Plate tectonics with deep subduction is believed to be how Earth formed supercontinents about 3 billion years ago. However, geologic evidence for this theory is limited so we are using geologic and physics constraints to explore the option of weak or shallow plate tectonics to create supercontinent structures. Our model uses time dependent 2D models to represent the Earth's mantle and crust conditions of billions of years ago. If it was possible to deform the Earth's crust without strong subduction then that would change how we view the interaction between the mantle and crust in a young Earth. The topic of when plate tectonics began on Earth is still greatly debated and finding that the first supercontinents are not definitive evidence for this could change how we view the beginning of this unique process. Our preliminary models are promising that it is possible for the primitive crust to deform enough to create a supercontinent without strong subduction. The next step in this research project is to build off of our current 2D models to create 3D models that better represent the Earth's interior.

**Poster # 96**

# Participatory Design and Service Learning: Designing for Dispute Resolution - Royal City Library Park


## **Presented by:** Caedwyn Jones and Jaime Kemple

**Mentors:** Robert Krikac and Michael Sanchez **Campus:** Pullman

**Majors:** Interior Design, Landscape Architecture

**Category:** Arts and Design

**Co-authors:** Michael Sanchez and Robert Krikac


As we move into the 21st century, the design industries are becoming increasingly cognizant of the value of unique, local character in development projects. One approach to addressing this need is participatory design. Participatory design is an approach to the design process that involves actively engaging all the stakeholders in a project, to ensure that the needs and character of a community are addressed, and to increase community support.

The Rural Communities Design Initiative (RCDI) explored how participatory design can be utilized to facilitate dispute resolution in The City of Royal City, WA. The city had become polarized over a debate between two potential sites available for the development of a new library and park. The two sites were a city-owned downtown site adjacent to Royal City's current park, and a neighborhood site, donated by a resident.

A group of interdisciplinary students guided by WSU faculty were able to facilitate consensus in the community using the participatory design method. The sites were analyzed and studied through a series of public workshops led by the students and faculty involving community stakeholders.

Participatory workshops led the community through the debate and allowed them to come to consensus. The first of these workshop sessions began with a presentation of the issues, followed by community input about wants and needs, and finally development of preliminary conceptual designs. RCDI then created feasibility studies to illustrate how these intentions could be designed into each site. In design exploration and research, the library was integral to each site and leveraged exterior and interior relationships. The second workshop presented the two sites, debated the pros and cons of each, and the assembled group determined that the downtown site was the best location for development. Using this input, RCDI completed a conceptual design plan for the downtown site that Royal City is continuing to develop and fundraise for the new library building and park.

Using participatory design workshop sessions, RCDI was able to graphically communicate the stakeholders' wants, needs, and concerns for each site allowing a community consensus on the best direction for the town to proceed.

**Poster # 97**

# Environments for Learning; Learning about Environments: Ecological Design at Meyers Point Environmental Field Station

**Presented by:** Caedwyn Jones, Jaime Kemple, Josiah Pearson, and Nicole Dryer

**Mentors:** Michael Sanchez and Robert Krikac **Campus:** Pullman

**Majors:** Interior Design, Landscape Architecture

**Category:** Arts and Design

**Co-authors:** Michael Sanchez and Robert Krikac

As global temperatures continue to rise, understanding the impacts on sensitive wetland habitats is becoming increasingly important. Human impact on those habitats can be devastating, therefore it is imperative that access for academic and scientific research be carefully considered and intentionally designed. Ecological Design is an approach that considers the habitat as paramount to the human endeavor.

The Rural Communities Design Initiative engaged with members of the WSU community to consider Ecological Design methods for increasing access and functionality at the Meyers Point Environmental Field Station near Olympia, WA. Several interconnected, fragile ecosystems exist on this site, including tidal salt marsh, temperate forest, aquatic, riparian, and other wetlands. Due to the sensitive nature of the site, several techniques were explored for providing enhanced access, while minimizing environmental impact.

A master plan was developed for the site that included a phasing plan for construction, modification of existing residential buildings, increased parking, accessibility and ADA access, and boardwalk to key research areas. The phasing plan explored potential research opportunities and placement of associated infrastructures. Wetland designations determined that new construction would not be possible on most of the site, and an Ecological Design approach through Adaptive Reuse of existing buildings and minimally invasive new construction was explored as an acceptable alternative for providing educational classroom and research facilities. Conceptual designs for parking and ADA accessibility were developed to take advantage of previously disrupted areas and minimize negative impact on the site. Methods for introducing a boardwalk system that would limit human interference with existing habitats while allowing continued and enhanced research and educational access to habitats were proposed as part of the design.

These endeavors culminated in an illustrative report that uses data and graphics to discuss the challenges, opportunities, methods, and next steps for increasing the research opportunities on the site. The application of an Ecological Design method guided RCDI to the development of conceptual planning designs that support human endeavors on the site as well as protect fragile environmental habitats.

**Poster # 98**

# Solutions to Aquaculture Nutrition through Fatty Acid Synthesis Research in Transgenic Arabidopsis Thaliana


## **Presented by:** Sydney Almgren

**Mentor:** Phil Bates **Campus:** Pullman

**Major:** Environmental and Ecosystem Sciences

**Category:** Molecular, Cellular, and Chemical Biology

**Co-author:** Phil Bates



Fish are a healthy source of omega-3 fatty acids, such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA); however, the world's oceans are being unsustainably overfished. While aquaculture, the farming of aquatic animals for food, has the potential to alleviate strain placed on oceanic fisheries, more sustainable feed ingredients must be utilized. Vegetable oil is a promising alternative to fish oil used in aquaculture feeds, and transgenic plants producing the same omega-3 fatty acids found in natural fish diets have even greater potential as a sustainable replacement. Yet engineering plants to contain higher levels of fatty acids is difficult, as the lipid assembly pathways used by plants to create them are not yet fully understood. This research aims to further investigate the roles of two oil biosynthetic enzymes, phospholipid:diacylglycerol acyltransferase (PDAT) and acyl-CoA:diacylglcerol acyltransferase (DGAT) on EPA and DHA accumulation in the seeds of transgenic *Arabidopsis thaliana*. Genetically mutated plant lines not containing PDAT or DGAT were initially crossed with EPA and DHA producing transgenic lines in order to examine how the absence of these enzymes affects the fatty acid accumulation in the seed oil. Analysis of a homozygous *pdat*/EPA mutant/transgenic line did not indicate a statistically significant change in overall EPA content, suggesting that PDAT is not directly related to EPA/DHA accumulation in seed oil. Additional segregating populations of *pdat*/DHA, *dgat*/EPA, and *dgat*/DHA crosses will be screened to obtain additional homozygous lines whose oil contents will be analyzed. By better understanding how these enzymes utilize different fatty acid containing substrates, we will be able to engineer better transgenic plants containing higher levels of EPA/DHA. These plants can then be used in aquaculture feeds to not only help mitigate oceanic overfishing by lessening the aquaculture industry's reliance on fish oil, but create fish products that are richer in omega-3s.

**Poster # 99**

# Instructor & Student Perspectives on Discussion Board Format: Small vs. Large Group Discussions


## **Presented by:** Colleen M. Cotton-Betteridge

**Mentor:** Lee William Daffin Jr. **Campus:** Global
**Major:** Psychology
**Category:** Social Sciences
**Co-authors:** Joy A. Sprague and Lee William Daffin Jr.



Instructor interaction in the online classroom is paramount to student success. One of the easiest, and possibly, most effective ways to guarantee it is through participation in online discussions. In this model, the instructor poses a question or questions for students to answer and then replies to the answers to the prompt or participation posts students have made to one another. Enrollments in online psychology classes at Washington State University (WSU) are capped at 80 students meaning that, with students being required to make one Discussion Question (DQ) response and 3 participation posts, and instructors making 20 posts each week, discussion forums will have approximately 340 posts for students to go through. One solution to reducing this is to break this larger class down into 10 smaller groups of 8 students each. In the fall of 2019, we did just this in select online psychology classes. In all, three instructors kept journals in which they recorded their impressions of the small groups discussion format. Two of the three instructors also had classes in the large group discussion format, making a direct comparison possible. The online program at WSU also includes Instructional Teaching Assistants (ITAs) in which senior online psychology students are trained in proper methods of online instruction and then run two discussion boards throughout the semester. The ITAs typically just serve in one class, however in the fall, we had an ITA who facilitated discussions in two classes, one in each format. This gave us the opportunity to have not only instructor feedback, but ITA feedback as well. Additionally, this individual was a student in each class format as well. Feedback from ITAs and instructors will be discussed as well as implications and future directions of this new teaching method for online discussions.

**Poster # 100**

# Adverse Maternal Birth Outcomes in Washington State: Differences Across Race and Birth Location


## **Presented by:** Haley McRae

**Mentor:** Ekaterina Burduli **Campus:** Spokane
**Major:** Nursing (BSN)
**Category:** Social Sciences
**Co-author:** Ekaterina Burduli



**Background:** The United States is experiencing a devastating rise in maternal mortality rates, with Native American and non-Hispanic Black women having mortality rates that are 2.5-3.3 times higher compared to non-Hispanic White women. While Washington State's mortality rate is lower than the national average, the racial and ethnic disparities are on par with national statistics. Maternal mortality is often caused by one or more maternal morbidity indicators (i.e. severe perinatal complications such as hemorrhage, infection, eclampsia). Out-of-hospital births have become increasingly popular, specifically in the Pacific Northwest. Recent studies have shown that planned out-of-hospital births have significantly lower odds of maternal morbidity than planned hospital births. However, limited studies have explored adverse maternal outcomes across birth location and race/ethnicity in a large, state-wide dataset.

**Aims:** To examine differences in maternal morbidity across race/ethnicity and birth location in Washington State between 2010- 2016.

**Methods:** We analyzed n=611,182 records between 2010-2016 in Washington State. Using multiple logistic regression and adjusting for covariates, we compared odds of adverse maternal outcomes across a) birth location (Hospital vs. Birth Center vs. Home); and b) Race/ethnicity (1) non-Hispanic White vs. 2) non-Hispanic Black vs. 3) Native American vs. 4) Hispanic). Participants with existing prenatal risk factors and those who ended up giving birth in a location different than originally planned were excluded from analyses.

**Results:** Compared to hospital births, home births revealed a 37% decrease in the odds of having adverse maternal outcomes (95% CI 0.51, 0.78, $p = < .01$), and birth center births showed a 21% decrease in the odds having adverse maternal outcomes (95% CI 0.63, 0.99, $p = < .05$). Hispanic women were 1.24 times more likely to experience adverse maternal outcomes compared to non-Hispanic White women (95% CI 1.12, 1.40, $p = < .01$). No other significant differences across birth location and race/ethnicity were noted ($p < .05$).

**Conclusion:** While adverse maternal outcomes were uncommon overall**,** home and birth center births demonstrated decreased odds of adverse maternal outcomes compared to hospital births, while Hispanic women showed increased odds of adverse maternal outcomes when compared to non-Hispanic White women.

**Poster # 101**

# Experimental Considerations in Testing Low-Cost Air Filtration Systems for Vulnerable Communities to Fine Particulate Matter Pollution


## **Presented by:** Yoni Rodriguez

**Mentor:** Von Walden **Campus:** Pullman

**Major:** Biochemistry

**Category:** Engineering and Physical Sciences



The purpose of this study is to create a scientifically sound and cost-effect solution to decrease the environmental health risks of particulate matter (PM) in low-income and rural communities. Numerous studies have shown positive associations between PM <2.5 (0.2 to 1 micrometer) exposure (wildfire events, wood smoke, urban pollution, etc.) to respiratory and cardiovascular diseases. This study will utilize standards set by The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) to design a testing apparatus that allows for the classification of these low-cost filtration systems. PM removal and the cost will serve as the metrics for the domain. An alpha sense optical particle counter (OPC) and commercial DustTrak® were used to determine size distributions (0.02 - 0.3 micrometers) and particle counts, respectively, to monitor winter inversions of PM2.5.

**Poster # 102**

# Can Human Pain be Modeled in a Rat?


## **Presented by:** Jenna Pederson

**Mentor:** Rebecca Craft **Campus:** Pullman

**Major:** Social Sciences: General Studies

**Category:** Organismal, Population, Ecological, and Evolutionary Biology



Experimental findings from rodent studies do not always translate to human medicine, particularly in regard to pain. In humans, pain severity is often assessed by the extent to which it disrupts normal daily activities such as going to work, exercising, etc. One activity that rats normally engage in on a daily basis is burrowing. Thus, the goal of the present study is to determine whether pain can be reliably measured by deficits in burrowing behavior, and whether commonly used pain relievers can reverse pain-suppressed burrowing in rats. The first experiment was designed to determine the time course of pain-suppressed burrowing in rats of both sexes. Subsequent experiments examine whether pain-suppressed burrowing can be reversed with standard pain-relievers. In the first experiment, half of rats were given a hindpaw injection of mineral oil (no–pain control) and the other half were given CFA to induce inflammation and pain. Gravel burrowed out of a tube within the first hour and second hour was measured in grams, daily for 7 days. CFA treatment suppressed burrowing almost completely on the first day. Burrowing then recovered over time and was near to levels in control rats on the fifth day. Subsequent experiments attempted to reverse pain-suppressed burrowing with standard pain-relievers. A placebo (physiological saline), or the opioid morphine (0.1-3.2 mg/kg), or the non-steroidal anti-inflammatory drug (NSAID) ketoprofen (0.32-3.2 mg/kg) was injected once daily for 5 days, 30 minutes before measuring burrowing for 1 hour. Morphine reversed CFA-suppressed burrowing in males but was only effective at 1.0 mg/kg. Morphine significantly altered CFA-suppressed burrowing in female rats as well, but the only dose that significantly altered burrowing was 3.2 mg/kg, which *decreased* burrowing. With approximately half of the planned sample tested, ketoprofen appears to be increasing pain-suppressed burrowing in both sexes, but the effect is not statistically significant. These results show that burrowing activity is a reliable model to measure pain and the suppression of this activity by CFA injection can be reversed with pain-relievers. Further studies will examine the cannabis-derived drugs THC, CBD, and combinations of the two, as pain-relievers.

**Poster # 103**

# Effects of Social Stress and Physical Traits on Holstein Heifer Haptoglobin Concentrations


## **Presented by:** Emma Atkinson and Siena Mandy

**Mentor:** Amber Adams-Progar **Campus:** Pullman
**Major:** Animal Sciences
**Category:** Organismal, Population, Ecological, and Evolutionary Biology
**Co-author:** Amber Adams-Progar



Stress reduces milk production and animal welfare in dairy cows, so it is important for researchers to identify accurate biomarkers for stress in dairy cattle. Reducing stress through improved management practices improves welfare, maximizes milk production, and increases profit in dairy cows. Acute phase proteins are utilized as biomarkers of physical stress in dairy cattle, but it is unknown whether acute phase proteins can be used as biomarkers of social stress.

The objectives of this study were to determine whether heifer serum haptoglobin concentrations are affected by: 1) social stress caused by regrouping heifers or 2) heifer age, weight, or height. At 3 months of age, nine Holstein heifers were housed in groups of three until 6 months of age. Each group of three heifers (novel group) was moved to a larger heifer pen that housed up to twelve additional heifers (existing group). A total of three regroupings occurred. Blood samples were collected via venipuncture of the coccygeal vein of each of the nine monitored heifers pre-regrouping and post-regrouping. The blood samples were analyzed for haptoglobin concentrations using an enzyme-linked immunosorbent assay. Pearson's correlations, mixed model ANOVAs, and regression statistical analyses were conducted.

No relationship was detected between serum haptoglobin concentrations and heifer age ($P = 0.69$) or weight ($P = 0.41$). A positive relationship was detected between serum haptoglobin concentrations and heifer height ($P = 0.05$). Regrouping did not affect serum haptoglobin concentrations ($P = 0.47$). These preliminary results indicate that heifers with a greater height have higher haptoglobin concentrations, but social stress such as regrouping may not influence haptoglobin concentrations in heifers. Previous research has shown that heifers with a greater height have a lower age at first estrus. The potential relationship between serum haptoglobin concentrations and heifer fertility should be explored in future research.

**Poster # 104**

# Additive Manufacturing with Polymeric Bio-Inks


## **Presented by:** Caitlin Grover

**Mentor:** Arda Gozen **Campus:** Pullman

**Major:** Materials Science and Engineering

**Category:** Engineering and Physical Sciences



Bio-inks, such as hydrogels used for the additive manufacturing of bioresorbable materials, have great potential in being utilized for drug delivery. This research focuses on advancing the technology needed to create personalized drug delivery vehicles via layer-by-layer additive manufacturing. Current three-dimensional (3D) printing methods cannot effectively print below 100 microns, which is the resolution needed to sustain the mechanical properties required for the vehicle use. Issues preventing the additive manufacturing of such products include rapid ink-drying, flow rate inconsistencies, and printing extruder (nozzle) clogging. As a solution to this problem, we have designed a humidity-controlled extruder system to test alongside decreasing nozzle sizes. The humidity system provides a printing environment needed for reduced nozzle clogging and optimal print consistency, while the smaller nozzles allow for a greater print resolution.

**Poster # 105**

# Nutrition's Place in WSU Education


## **Presented by:** Sean Nooney

**Mentor:** Amy Heile **Campus:** Pullman

**Major:** History

**Category:** Social Sciences



Obesity in America has been dramatically rising over recent decades and the practice of proper nutrition has become more and more of a rare phenomenon. According to Ingrid Strauch under the review of Dr. Robert Jasmer in an article titled "Obesity in America" by *Everyday Health*: "…21 percent of adolescents ages 12 to 19 are also considered obese." The tangible benefits of being taught proper nutrition likely will make students more willing and able to accept the intangible benefits of academic study. As a result, universities and colleges, including Washington State University, which are the foundations of our future, should accept their responsibilities and embrace some form of applicable and well-rounded nutrition modules. Based on the research I conducted and presented in the literature review titled, "Nutrition's Place in the College Classroom," I concluded that making nutrition courses more digestible and relatable to college students' everyday lives rather than overly emphasizing the mathematical and scientific aspects would be the most effective way to help prevent nutritional deficiencies in our modern society. University is all about enriching the mind with new ideas and habits, but the mind does not exist in a vacuum. To have a healthy mind, one must also have a healthy body that will feed a hard-working mind. As I argue in my paper, I believe that Washington State University (WSU) students would receive and retain greater nutrition knowledge if WSU implemented a relatable, short, and digestible nutrition seminar similar to "Green Dot". If nutrition was taught as a mandatory seminar at WSU during new student orientation much like the health-related seminars "Green Dot" and "Booze, Sex, and Reality Checks," then all student would receive a better understanding of what healthy eating looks like and be better prepared to make proper decisions when it comes to their nutrition.

**Poster # 106**

# Off-Grid DC Microgrid Comparison


## **Presented by:** Jacob Hnatiak

**Mentor:** Noel Schulz **Campus:** Pullman

**Majors:** Computer Engineering, Electrical Engineering

**Category:** Engineering and Physical Sciences

**Co-authors:** Rabia Kahn and Noel Schulz


Microgrids are a type of power grid that can be useful for rural electrification. With renewable resources, such as solar cells and battery storage, microgrids can be created for individual communities that previously had no access to electricity. These microgrids have small carbon footprints while providing communities with energy to help improve their vitality.

In this research work, two systems were modeled, simulated, and compared for a theoretical community in Kisumu, Kenya. The first system had load components of a refrigerator, two water purifiers (WP), and a cell phone charging station (CS), while the second had the same load components, with an additional ten WP's, ten LED's, and a computer. The critical components are the refrigerator and two WP's. These components are powered the longest in the load shedding program. Load shedding is a critical process, dictating which components are powered depending on the gap between energy available and the demand.

The first system's results showed that it could provide power to both critical components consistently and the CS for twenty-three hours a day under optimal conditions. If the power generation decreases by 50% for long periods of time, the system can power only the refrigerator for seventeen hours a day. The system has enough storage to last two days and fourteen hours while powering the refrigerator and two WP's without any new power generation.

The second system's results showed that it can provide power to both critical components, the additional ten WP's, and CS consistently, while powering the LED's and computer for eight hours a day under optimal conditions. If power generation decreases by 50% for long periods of time, the system can power the refrigerator consistently and the two WP's for seventeen hours a day. The system has enough storage to last nine days and four hours while powering the refrigerator and two WP's without any new power generation.

This presentation will discuss the different features of the two systems for a variety of conditions and compare the reliability and economic trade-offs.

**Poster # 107**

# Phenotypic Effects of Various Rhizobia Strains on the Biomass Allocation of *Trifolium barbigerum*


## **Presented by:** Natalie Sanchez

**Mentor:** Chandra Jack **Campus:** Pullman

**Major:** Biochemistry

**Category:** Organismal, Population, Ecological, and Evolutionary Biology

**Co-authors:** Chandra Jack, Brett Younginger, Renee Petipas, and Maren Friesen



Leguminous plants such as the *Trifolium* species are able to form nodules with symbiotic bacteria called rhizobia. Rhizobia are best known for their ability to convert $N_2$ gas from the air into $NH_4^+$, a plant usable form, in a process called nitrogen fixation. Sufficient nitrogen levels in the soil are vital to plant success and nitrogen fixing bacteria are able to raise those levels. Different strains of rhizobia perform differently and have differing effects on the host plants, such as forming more nodules or delivering more nitrogen to their hosts. In this experiment, 1200 *Trifolium barbigerum* plants were inoculated with one of 80 different strains of rhizobia, a nitrogen treatment, or buffer. The plants were grown in vermiculite with a top layer of sand for five months. The plants were harvested and the dry masses of the roots and the shoots were measured separately. Six strains were identified that induced significantly greater than average growth in their hosts compared to the controls ($p = 0.0268$). Six strains that reduced the growth of their hosts were marginally significantly different from the controls ($p = 0.0591$). In addition, several strains influenced the allocation of resources to the aboveground or belowground portions of the plants, known as the root to shoot ratio ($p = 0.0023$, $p < 0.001$, high and low strains, respectively). This project also assessed the ability of different strains to increase the fitness of their host so that further studies can explore how plants choose which rhizobia to partner with. The average total mass was found to be positively correlated with the number of seeds ($R^2 = 0.712$), indicating that the strains that increased biomass also increased host fitness as measured by fecundity.

**Poster # 108**

# Boundless WebVR


## **Presented by:** Christian Denny and Holly Slocum

**Mentor:** Dene Grigar **Campus:** Vancouver

**Major:** Digital Technology and Culture

**Category:** Arts and Design

**Co-authors:** Dene Grigar, Younghwan Cha, and Min-Kyu Song


Virtual reality (VR) is one of the most exciting areas of technology; however, the lack of access to that technology continues to be a formidable roadblock for research and development. Despite advancement in hardware technologies, creating a 3D VR experience is still time intensive, technically exclusionary, expensive, and reliant on proprietary rendering engines such as Unity or Unreal. My project, Boundless WebVR, is a new approach to VR that combines the newly released WebXR Device API and the WebGL API to create a web-based, virtual 3D environment that bypasses the need for advanced programming knowledge, a proprietary rendering engine, and a distributor. By removing these obstacles, the project begins to increase accessibility and establish an early framework for future developers to incorporate VR hardware into web-based 3D environments.

The World Wide Web Consortium (W3C) and the Immersive Web Working Group released the editor's draft of the WebXR API in September 2019, signaling that the API is becoming permanent and stable. As an open source API, it is strengthened by researchers and developers' continued contributions to its improvement, meaning that it is solving the problem of accessibility. In addition to Boundless WebVR's implementation, it includes a published file called a library that will help other developers access the WebXR API more quickly and easily.

Because Boundless WebVR is a website that can directly access VR capable devices, it eliminates the need for developers to pay royalties to an engine such as Unity or Unreal. Removing proprietary rendering engines not only removes royalties, but also the need for more advanced programming knowledge in C languages. In addition, the ability to host VR content on a website means developers no longer have to pay Steam, the industry's distribution platform, to distribute content to users for download. While the API is still new and is not yet stable enough to support large scale VR projects, Boundless WebVR not only provides a framework that contributes to the development of web-based VR with the WebXR API, but also makes it easier for anyone with mid-level JavaScript skills to create and publish a 3D virtual reality experience.

**Poster # 109**

# Phenotypic Trade-off in Wing Polyphenic *Gryllus firmus*


## **Presented by:** Kendrick Griffin

**Mentor:** Laura Lavine **Campus:** Pullman

**Majors:** Basic Medical Sciences, Journalism and Media Production

**Category:** Organismal, Population, Ecological, and Evolutionary Biology

**Co-authors:** Laura Lavine, Mark Lavine, and Abigail Hayes



The phenotypic trade-off between flight muscles and ovaries in wing polyphenic crickets, such as *Gryllus firmus*, has been the focus of a number of studies, as it is an observable example of the life history trade-off between migration and reproduction (Zera, et al, 1997; Guerra and Pollack, 2008). Current understanding is that upon adult eclosion long wing morphs have large, pink flight muscles and small, poorly-developed ovaries while short wing morphs have small, non-functional white flight muscles and large, well-developed ovaries (Zera et. al, 1997). However, past studies have failed to show whether this trade off occurs in 100% of individuals or if some organisms within the population can possess both functional flight muscles and large ovaries (or vice versa). Furthermore, it is unknown if this trade-off is reversible through histolysis of flight muscles in adult long wing morphs, with the ability to use the energy from flight muscle histolysis to catch up in ovarian growth relative to the short wing morphs. In response to this gap in knowledge, we developed a dissection protocol to measure the wet weights of flight muscles and ovaries as compared to total body weight of *G. firmus,* and monitored the maintenance of these two tissues over the course of the adult female lifespan, for both long and short winged individuals.

**Poster # 110**

# Lichens and Mosses as Biological Indicators of Nitrogen Deposition in North Cascades National Service Complex


## **Presented by:** Alida Melse

**Mentor:** R. Dave Evans **Campus:** Pullman

**Majors:** Genetics and Cell Biology, Microbiology

**Category:** Organismal, Population, Ecological, and Evolutionary Biology

**Co-authors:** Meaghan Petix and R. Dave Evans



Excess nitrogen (N) deposition can have adverse effects on ecosystems, leading to species loss and decline. N content and N isotope composition in lichens and mosses can be used to determine deposition levels and sources. This study focused on N deposition in the North Cascades National Service Complex (NOCA) using mosses and lichens. We hypothesized that a N isotope composition ($\delta^{15}N$) gradient would be found reflecting fossil fuel emissions on the western side of NOCA and agricultural activities on the eastern side of NOCA. We further hypothesized that $\delta^{15}N$ measured in mosses would match that of the nearest anthropogenic nitrogen source more closely than $\delta^{15}N$ in lichens. Eight samples each of one moss species and three lichen species were collected from 15 locations spatially distributed across NOCA. N content and isotope composition were measured in each sample. Preliminary data shows that a $\delta^{15}N$ gradient occurs from west to east in both the lichen and moss species. The western plots had more negative $\delta^{15}N$ values that are associated with agriculture whereas the $\delta^{15}N$ values for the eastern plots were more positive. We also observed an elevational gradient where $\delta^{15}N$ values were more negative at lower elevations and more positive at higher elevations. Overall, this data does not support our hypothesis in that the observed $\delta^{15}N$ gradient indicated more contributions from fossil fuels on the eastern side of NOCA and more contributions from agriculture on the western side of NOCA.

**Poster # 111**

# Reasons for Adolescents' Use of Social Media: Relations to Psychosocial Functioning and Self-Perception


## **Presented by:** Jacob Briggs

**Mentor:** Chris Barry **Campus:** Pullman
**Major:** Psychology
**Category:** Social Sciences
**Co-author:** Chris Barry



Previous research has noted a relation between social media use and adolescent mental health concerns (Barry, Sidoti, Briggs, Reiter, & Lindsey, 2017). However, little is known about whether this connection is based on reasons that adolescents use social media. This study investigated reasons adolescents use social media in relation to parent-reported mental health concerns and adolescent self-reported self-perception.

Participants were 202 parent-adolescent dyads (aged 14-17) from across the United States. Adolescents completed measures of social media engagement, self-esteem, loneliness, and fear of missing out (FoMO). Reasons for social media use assessed were to post photos/videos; express emotions; connect with others; relieve stress; and to keep up with news/celebrities. Parents completed a 33-item that assessed their adolescent's inattention, anxiety, and depressive symptoms.

Adolescents' number of social media accounts was correlated with parent reported attention problems $r = .29$, $p < .01$, depression $r = .26$, $p < .01$, and anxiety $r = .23$, $p < .01$, as well as self-reported (lower) self-esteem $r = –.17$, $p < .05$, loneliness, $r = .18$, $p < .05$, and FoMO, $r = .43$, $p < .001$. Similarly, adolescents' frequency of checking social media was correlated with parent-reported attention problems $r = .26$, $p < .01$, depression $r = .27$, $p < .01$, anxiety $r = .29$, $p < .01$, and self-reported (lower) self-esteem $r = -.16$, $p < .05$, loneliness $r = .19$, $p < .01$, and FoMO, $r = .34$, $p < .001$.

Further correlational analyses considered adolescents' reasons for using social media in relation to mental health concerns and self-perception. Using social media to relieve stress was correlated with self-reported (lower) self-esteem $r = –.24$, $p < .05$, loneliness $r = .34$, $p < .001$, and FoMO $r = .27$, $p < .001$. Using social media to express emotion was correlated with parent reported inattention $r = .16$, $p < .05$, anxiety $r = .15$, $p < .05$, depression $r = .20$, $p < .01$, and self-reported (lower) self-esteem $r = –.18$, $p < .05$, loneliness $r = .17$, $p < .05$, and FoMO $r = .36$, $p < .001$.

This research may provide further understanding of adaptive and maladaptive uses of social media for adolescents, with non-emotion-based functions being relatively less problematic.

**Poster # 112**

# Snowshoe Hare Population Ecology: Correlating SECR "True Density" to Pellet Counts


## **Presented by:** Ottie Holcomb and Rosemary D'Andrea

**Mentors:** Daniel Thornton and Paul Jensen **Campus:** Pullman

**Major:** Wildlife Ecology and Conservation Sciences

**Category:** Organismal, Population, Ecological, and Evolutionary Biology

**Co-authors:** Daniel Thornton and Paul Jensen



The snowshoe hare (*Lepus americanus*) is a key prey species in the boreal forest ecosystem in North America, and its population is a reliable indicator of the health of this forested environment. Snowshoe hare are also the main food source for the Canada lynx (Lynx canadensis), a federally threatened and Washington state-endangered cold-weather predator. The health and abundance of the hare population are in tandem with that of the Canada lynx. Despite their importance, we have a poor understanding of hare densities at the southern extent of their range. The most reliable way to estimate snowshoe hare densities is to live trap and use spatially explicit capture-recapture (SECR) models, but this process is expensive, disruptive to the species, and difficult to apply at a larger scale. This project evaluates how well pellet counts, a less costly and non-invasive technique, can reliably relate to SECR densities at thirteen 10.25ha sites in Northcentral Washington. Because previous studies have validated indexes relating pellet counts to true density in other regions, we expected to find a similar but unique relationship in this area. On each of the thirteen sites, we live-trapped for ten days and counted pellets at 64 evenly spaced locations within each site. Results of SECR densities range from 0.22 to 1.44 hare/ha and show a significant ($p < .05$) and very strong correlation with pellet counts ($R^2 = 0.89$). We reject the null hypothesis that no correlation exists between true-density and pellet-counts. These results suggest that pellet counts can provide a useful and non-invasive method for estimating hare density. The regression formula we developed could convert pellet counts to density estimates for hare in other parts of Washington. Additionally, we found pockets of high hare densities which indicate a healthy boreal forest system, even at the southern extent of the snowshoe hare range.

**Poster # 113**

## Mitigating Charge Accumulation on Mars

**Presented by:** Carl Johnson, Daniel Alderson, Emma Wall, Hogan Leffel, and Rhoddy Jensen

**Mentor:** Lynne Cooper **Campus:** Pullman

**Majors:** Accounting, Chemical Engineering, Management Information Systems, Mechanical Engineering, Strategic Communication

**Category:** Engineering and Physical Sciences

**Co-authors:** Katarzyna Kazmierczak, Peter Awinda, Yemeserach Bishaw, Danuta Szczesna-Cordary, and Bertrand Tanner

Any material used for habitats, tools, or operations on Mars will need to function in an environment that is cold, dry, and dusty. Under these conditions, the build-up and discharge of static electricity poses a threat to sensitive electronics as well as future human explorers. Because 3D printing will be a key component for any permanent settlements on Mars, it is important to understand how 3D printed objects will perform relative to electrostatic discharge (ESD) and dust adhesion due to electrostatic charging.

We hypothesize that different finishing processes may change the ESD-related performance of 3D-printed materials. We therefore propose an experiment that evaluates two types of 3D printing materials (plastic-based and metal-based) with a suite of finishing processes to compare (1) electrostatic discharge and (2) adhesion. Our experiment will take place in a custom-made test chamber that will allow us to approximate the Martian environment in terms of pressure, temperature, humidity, and atmospheric composition. We will use a Mars analog to approximate the dust present in the atmosphere at ground level during conditions ranging from clear to a planetary-scale dust storm. Coupons of 3D printed materials will be physically moved through the chamber to accelerate electrostatic charging and dust adhesion. We will then analyze measurements of ESD potentials and mass of dust adhering to the coupons to test our hypothesis.

**Poster # 114**

# Laboratory Attentional Control Tasks Predict Real-World Executive Function Difficulties


## **Presented by:** Amelia VanMeter

**Mentors:** John Hinson and Paul Whitney **Campus:** Pullman
**Majors:** Human Development, Psychology, Spanish
**Category:** Social Sciences
**Co-authors:** Anthony Stenson, Paul Whitney, and John Hinson



Attentional control is one of the processes that fall under the larger umbrella of executive functioning, which guides goal directed behavior under dynamic situational demands in every-day life. In the laboratory, attentional control tasks are used to evaluate individuals' ability to utilize environmental cues in order to produce advantageous behavior under different environmental constraints. By using expectation-driven processes, individuals anticipate the likely advantageous response given a certain context, allowing them to act more quickly and accurately. A primary objective of the current study was to examine if two laboratory measures of attentional control could predict self-reported daily difficulties of executive control. This study used two attentional control tasks, the AX-Continuous Performance Task (AX-CPT) and a novel measure of flexible attentional control (FACT). A sample of healthy adults, from the Washington State University subject pool, performed the attentional control tasks that assess attentional control strategies and completed a questionnaire about self-reported struggles in everyday life that may result from problems associated with executive functioning. We hypothesized that attentional control indices on the laboratory tasks would be predictive of scores on the self-report questionnaire. Additionally, a secondary objective was to identify if individuals would adopt different attentional control strategies under differing environmental challenge in our novel task. We hypothesized that in conditions where simple stimulus recognition was more difficult, individuals would use more top-down control.

We found that there was not a significant relationship between performance indices on the two laboratory measures of attentional control. Although performance indices of expectation-driven processing on our novel task was not a significant predictor of real-world executive dysfunction, performance on the AX-CPT was predictive of executive dysfunction. Additionally, we found there were no significant differences in the use of expectation-driven strategies between levels of stimulus obscuration, despite individuals in the condition of the most obscuration having significantly worse scores during trials without predictive cues. Overall, the results from this experiment suggest that real-world individual differences in executive functioning are related to the ability to engage in top-down attentional control.

**Poster # 115**

# Service Dogs in Labs: A Critical Need for Future Research


## **Presented by:** Madison Lucas

**Mentor:** Phyllis Erdman **Campus:** Pullman

**Major:** Chemistry


**Category:** Social Sciences


Service animals are dogs or, in limited cases, miniature horses, specifically trained to perform tasks to aid individuals with disabilities. Service animals can perform a wide range of tasks to assist with a variety of physical and mental disabilities, and each animal is trained specifically to assist the individual with which the animal is paired. Since dogs are the most common type of service animal, our project focuses specifically on canines. As service dogs become more prevalent, the need to accommodate them in academic laboratories continues to increase (Schoenfeld-Tacher et al., 2017). Often, students' needs for their service dogs extend into laboratory spaces beyond the typical classroom setting. Most academic institutions within the United States are required to adhere to federal standards as outlined in the Americans with Disabilities Act (ADA) of 1990 (U.S. Department of Justice, 2011), requiring service dog access in most public locations with few exceptions. However, due to a lack of formal training, school administrators and instructors are often unaware of or misinformed about their legal obligations to accommodate service dogs. When a service dog's presence is required, educators must make decisions on how to best accommodate the dog's presence while maintaining an adequate level of safety within the lab. These decisions periodically lead to improper exclusion of the animal from the lab space, violating the law outlined within the ADA for individuals with service animals. The internet could be a valuable tool to acquire information on service animal policy and avoid violating federal law, but online resources are limited and difficult to find. Our goal was to evaluate the existing literature on service dogs in laboratory settings. We used specifically curated terms and criteria to search internet databases and search engines for resources on this topic. We found most search results were unrelated to the search terms. This lack of relevant information suggests a serious need for more research to assure compliance with ADA laws for dogs in lab settings. Such research will allow reasonable and lawful access for students, as well as to provide protection for the service animals involved.

**Poster # 116**

# Effective Recruitment and Retention Strategies for the Strengthening Families Program


## **Presented by:** Kayli Elwyn

**Mentors:** Brittany Cooper and Gitanjali Shrestha **Campus:** Pullman
**Majors:** Human Development, Psychology
**Category:** Social Sciences
**Co-authors:** Brittany Cooper and Gitanjali Shrestha


Recruitment and retention strategies (R&R) are an important aspect of successful prevention programs, especially those aimed at families. Challenges with R&R can limit a program provider's ability to achieve positive family outcomes. Previous research shows that families may not participate because of fear of invasion of privacy, limited transportation, scheduling difficulties, and cost of the programs. Thus, program providers use a combination of strategies to recruit participants and to maintain their participation over time. However, additional research is needed to understand the most effective ways to improve R&R in order to improve the overall quality of programs.

In this study, we draw upon the experiential knowledge of program providers in Washington State to identify the most and least helpful R&R strategies in an evidence-based substance use prevention program called the Strengthening Families Program (SFP). Out of 60 respondents to our online survey, 89% percent were female; 77% were White and 16% were Hispanic/Latino; 79% had a bachelor's degree or higher; 48% had worked as a family educator for more than 5 years. Seventy-nine percent of respondents lived in the same community as their program. Sixty-seven percent reported that their program was taught in English, 3% used the Spanish version, and 30% used both.

As a part of this survey, respondents were given a list of 17 R&R strategies and asked to rate their helpfulness from (1) not at all helpful to (5) extremely helpful. Results indicate that all 17 R&R strategies were helpful to some degree with a mean rating of 3 (helpful) or higher. Three of the most helpful strategies were: a) providing childcare (M=4.63, SD=0.80), b) providing meals (M=4.61, SD=0.78), and c) personally inviting families to participate (M=4.45, SD = 0.91). The least effective strategies were: a) developing and implementing fundraising/sponsorship activities (M=3.09, SD=1.38), b) facilitating parent information sessions (M=3.37, SD=1.15), and c) advertising at community events (M=3.39, SD=0.97). These results are important to consider in order to increase R&R for SFP in the future. By doing so, program developers can increase the external validity and overall effectiveness of the program.

**Poster # 117**

# Utilization of Videos in the Building Science Education Classroom


## **Presented by:** Halle Colf

**Mentors:** Julia Day and Shelby Ruiz **Campus:** Pullman

**Major:** Construction Management

**Category:** Social Sciences



The utilization of video content in the higher education classroom is commonplace. Videos help students visualize content that is difficult or otherwise unsafe to demonstrate within a traditional lecture setting. Additionally, it can be a challenge to arrange opportunities that provide experiential learning for large groups.

In construction education, videos are less common. Construction is a complex and always advancing industry; presenting essential material that prepares students for their career can be difficult, as many core learning objectives are experience based. The technology that goes into today's buildings is highly sophisticated and can be difficult to portray to large classes of students using within the traditional classroom tools and teaching formats. Familiarization of these systems is best done in person where the learner is able to experience and visualize how the system connects to the building and its surrounding structure. Unfortunately, in classes of over 100 students, it can be unsafe and difficult to coordinate jobsite tours to see these systems in real life. For some students, there may not be any accessible job sites or high performance buildings to conduct tours in, or ultimately learn from. To find answers to challenges like this, a literature review was conducted to determine how construction education methods, pedagogical theories, and existing highly-educational video content can supplement this gap in construction education. Because of the diverse educational needs of building science students, a lack in existing quality content, and an ever-changing construction industry, this paper serves to define the qualities of educational videos that would deliver content to engage and inform viewers.

**Poster # 118**

# Estimating Methane Emissions from Beef Cattle


## **Presented by:** Hannah Goodspeed

**Mentor:** Eric Russell **Campus:** Pullman

**Major:** Civil Engineering

**Category:** Engineering and Physical Sciences

**Co-authors:** Alicia Iwanicki, Eric S. Russell, Jennifer Michal, Shelley Pressley, and Kris Johnson



Methane (CH4) is a greenhouse gas that has 40 times the warming potential of carbon dioxide. Ruminants contribute 14.5% of CH4 emissions to the earth's atmosphere. The objective of this study is to use eight empirical models to estimate how much methane is being emitted by grazing beef cattle on cover crop from two sites, one in St. John, WA and one in Genesee, ID. Empirical models estimate CH4 emissions using equations derived from measurements of key drivers, such as Gross Energy Intake (GEI), Dry Matter Intake (DMI), Organic Matter, and non-Fibrous Carbohydrates. From research done in other continents like North America, Europe, and Australia, empirical models with those key drivers were developed to predict how much CH4 beef cattle are producing when grazing cover crop. This study focuses on just two inputs; a) DMI, which is derived from the amount of food a cow needs and the weight of the crop when fully dried, and b) GEI, which is a measure of how much heat/calories are in the crop. Sixteen samples were collected at both St. John and Genesee during June-August 2019. Those samples will be analyzed for DMI and GEI and used in the eight empirical models. We expect a negative slope for GEI over time because all the nutritional value of the crop is located at the top of the stem and as the season progresses the crop height shortens due to grazing. The DMI should be a fairly consistent measurement over time as the cows' diets should not change much during the season. By comparing CH4 emissions across both sites, we expect the data will be variable due to the differences of GEI, DMI, different models used, and different cover crops. This data will help estimate the general range of methane production of cattle grazing on a variety of cover crop in this region.

**Poster # 119**

## Maxwell Stress Excitation of Difference-frequency Vibrations

**Presented by:** Sterling Smith

**Mentor:** Philip Marston **Campus:** Pullman

**Major:** Physics and Astronomy

**Category:** Applied Sciences

**Co-authors:** Philip Marston and Timothy Daniel

In physical acoustics, it has been shown that excitation of targets can occur at the sum and difference frequency of two chosen input signals. From derivations of Maxwell's Equations, it is theoretically possible for an electromagnetic excitation in similar circumstances at the acoustic counterpart. Using a coil and wire system, current through the wire will excite the flexural mode if a magnetic field is present, either in a steady state magnetic field and an oscillating current at the resonance frequency or if the sum or difference frequency between the field and current are at the resonance frequency. In this experiment, this effect has been documented this for both sum frequency excitation, with input frequencies in the range of half that of the first resonance frequency of the system, and the difference frequency excitation, with input frequencies in the range of ten times that of the first resonance frequency of the system.

**Poster # 120**

# Comparative Nationalism: The Southeast Asian Example


## **Presented by:** Bjorn Knoblauch

**Mentor:** Shawna Herzog **Campus:** Pullman

**Major:** History

**Category:** Humanities


European imperialism has in large part shaped the modern world. Massive colonial projects over the course of the nineteenth and twentieth centuries created modern national borders, and laid the foundations that define current inter and intracultural relations in former colonies across the world. The collapse of western empires after WWII ushered in a time of titanic upheaval. Millions of formerly colonized people now faced the herculean task of forming new nations within the arbitrary borders established by their former overlords. (Reid, 1-2) The cases of Vietnam and Indonesia demonstrate that revolutionary leaders who were able to draw upon a more culturally and historically rooted national mythos were better equipped to attain truly cohesive nationalism.

Representing two extremes, Vietnam and Indonesia's fight for independence and decolonization efforts illustrate the importance of a unifying ideology. Due to Chinese expansionism, the Vietnamese have a cultural memory of resisting foreign invaders going back over two thousand years. For example, the Trung sisters, leaders of a Vietnamese revolt against Chinese rule in 40 CE, are folk heroes to this day. (Womack, 31-33) Conversely, Indonesia's immensely diverse population is spread throughout the archipelago, and is home to hundreds of different languages and cultures, making the formation of a unified identity nearly impossible. Unlike Vietnam, at times Indonesia's diversity and fragmented history impeded local independence and decolonization efforts.

This research analyzes how nationalist leaders like Ho Chi Minh and Sukarno utilized local history and nationalist rhetoric to either revive or create a shared identity among their people to resist colonial occupation. Minh applied what historian Anthony Reid, in his book *Imperial Alchemy*, defines as "ethnie nationalism," appealing to Vietnam's long history of collective resistance. Sukarno, however, drew on what Reid describes as "anti-imperial nationalism," which used Indonesian's shared experience under the oppressive yoke of colonialism as a unifying factor (Reid, 7-9). This project explains the role nationalism played in Southeast Asian independence and helps us better understand the importance of strategic rhetoric in postcolonial statecraft.

**Poster # 121**

# Analysis of Grocery Consumption in SNAP Eligible Populations


## **Presented by:** Brandon Bullard

**Mentor:** Richard Iles **Campus:** Pullman

**Major:** Economic Sciences

**Category:** Social Sciences

**Co-authors:** Richard Iles, Annie Roe, and Cassandra Partridge



When students take introductory microeconomics one of the principles they learn is that market participants make informed and rational choices. This assumption is appropriate for understanding concepts like supply and demand, but it breaks down when real behavioral is observed. Real-world decision making is subject to influences and behavioral biases, and the focus of this project was to understand how income insecurity affects how people making food purchasing decisions and their cognition.This research question has seminal ties in Dr. Iles' previous work with farmers in rural Kenya. There, he observed that droughts have a negative effect on the mental capacity for farmers to make rational farm-investment decisions like planting crops. The objective of this pilot study was to observe how grocery shopping as a decision-making activity can induce stress in low-income populations and effect cognitive ability on heuristic tests. These tests measure pattern recognition (fluid intelligence) and ability to remember numbers and shapes (memory). The team gathered participants from food banks in the greater Moscow area and scheduled a grocery shopping trip where the a survey was taken and cognition tools were used before and after the shopping trip. Photos of participants' receipts were also collected. Participants also volunteered a saliva sample before and after the shopping trip to measure a change in cortisol levels. After data was collected over 2 months with two shopping trips for each participant, Dr. Iles completed the analysis. It was found that the time since the food stamp benefit was received was a good predictor of fluid intelligence and amount spent on groceries. This tracks with the initial hypothesis that income stressors (distance from receiving food stamp benefit) will have an adverse affect on cognitive function. My contribution to the initial findings is looking at the composition of food purchased relative to these same cognitive factors, income, and demographic information. I demonstrate a relationship between income, food stamp benefit, and discretionary spending on different food categories in the same SNAP-eligible population.

**Poster # 122**

# Exploring Cannabinoid Interactions with Hunger Neurons


## **Presented by:** Shane Watson

**Mentor:** Jon Davis **Campus:** Pullman

**Majors:** Neuroscience, Psychology

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Emma Wheeler, Julianna Brutman, Claudia Mohr, David Rossi, and Jon Davis



Cannabis is one of the most commonly used drugs in the world, and its legalization in the United States has further proliferated its use. While cannabis has commonly been used for recreational purposes, there is a growing interest in its potential use in medicine. Specifically, cannabis is known to increases appetite, which may be used therapeutically to treat people who suffer from anorexia such as cancer patients. In this context, our lab has shown that vapor cannabis exposure promotes appetite in rodents. Additionally, vapor cannabis increases the blood concentrations of the appetite-stimulating hormone ghrelin, and we have determined that ghrelin action on agouti related peptide (AgRP) neurons in the hypothalamus is required for cannabis-induced feeding. Importantly the cannabinoid-1 receptor (CB1R), the primary receptor mediating cannabis-induced appetite, is expressed on inhibitory neurons in the hypothalamus that form functional contacts onto AgRP neurons. This observation raises that possibility that inhaled cannabis may directly stimulate appetite by modifying activity of AgRP hunger neurons. The goal of the current project was to determine the functional relevance of CB1R activation for AgRP neuronal activity. To accomplish this, we used patch-clamp electrophysiological techniques to measure inhibitory post synaptic potentials (IPSC's) onto AgRP neurons. Specifically, AgRP-CRE mice (n=9) were injected with a CRE-dependent virus expressing a green fluorescent protein (GFP) reporter. Subsequently GFP-stained AgRP neurons were identified from hypothalamic brain slices for recording. In this experiment, we recorded IPSC's onto AgRP neurons in the presence and absence of the CB1R agonist WIN 55,212-2. Results indicate that WIN treatment led to a significant reduction in IPSC frequency onto AgRP neurons without impacting peak amplitude. These results indicate that CB1R activation reduces inhibitory tone onto AgRP neurons and suggest that cannabis may directly target hypothalamic hunger neurons to promote appetite.

**Poster # 123**

# *Drosophila melanogaster* STING and Dredd Caspase Interact to Protect Against *Coxiella burnetii* Infection


## **Presented by:** Olivia Hayden

**Mentors:** Alan Goodman and R. Marena Guzman **Campus:** Pullman
**Major:** Biochemistry
**Category:** Molecular, Cellular, and Chemical Biology



The Gram-negative bacterium *Coxiella burnetii* is the causative agent of Query (Q) fever in humans and coxiellosis in livestock. There is currently no vaccine against Q fever available in the United States; therefore, new therapeutic approaches are needed to reduce infection in reservoir animals, such as ticks, and control the spread of *C. burnetii* to humans. Our lab has demonstrated that the fruit fly, *Drosophila* melanogaster, is a suitable animal model for studying *C. burnetii infection*. Preliminary data indicates that *C. burnetii* produce cyclic dinucleotides, molecules known to induce a STING-dependent immune response. Since *Drosophila* contain a STING ortholog (dmSTING), we hypothesize that dmSTING stimulates an immune response during *C. burnetii* infection. We show that dmSTING-null flies have significantly higher mortality to *C. burnetii* infection compared to control flies. We also show that dmSTING interacts with Dredd, a caspase known to induce antimicrobial peptides in fruit flies. Furthermore, we show that Dredd-null flies have significantly higher mortality to *C. burnetii* infection in addition to significantly higher bacterial replication at 6 days post-infection compared to control flies. Next, we will analyze antimicrobial peptide induction in both dmSTING and Dredd-null flies during *C. burnetii* infection in order to measure the host immune response in the presence or absence of these genes. Altogether, our project shows that both dmSTING and Dredd play important roles in the immune response during *C. burnetii infection*, and that we may uncover a new mechanism by which protection occurs through the interaction of dmSTING and caspase Dredd.

**Poster # 124**

# Increasing Food Safety of the Poultry Industry Through Vaccination


## **Presented by:** Nathan Michellys

**Mentor:** Michael Konkel **Campus:** Pullman

**Major:** Biochemistry

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Prabhat Talukdar and Michael Konkel


**Introduction:** *Campylobacter jejuni* is a microaerophilic, Gram-negative bacterium that colonizes chickens and is one of the leading contributors of gastrointestinal diseases in humans in the United States. *C. jejuni*-mediated infection (campylobacteriosis) is characterized by gastrointestinal inflammation, severe diarrhea, and fever. *C. jejuni* surface-exposed membrane adhesion proteins mediate host cell invasion during infection.

**Hypothesis:**

We hypothesize that vaccinating chickens with FlpA from *C. jejuni* will more effectively prevent *C. jejuni* colonization of chickens than a *E. coli* generated protein vaccine due to potential translational modification.

**Methods:** To accomplish our goal, a pET-24b expression vector containing FlpA was introduced into the *E. coli* BL21(DE3) isolate by electroporation. A separate shuttle vector containing FlpA fused to polyhistidine affinity tag (His-tag) was introduced into a clinical *C. jejuni* wild-type isolate (strain F38011) by conjugation. Bacterial isolates were verified by immunoblot analysis using an antibody reactive against the His-tag. The FlpA protein synthesized in *E. coli* BL21(DE3) and *C. jejuni* F38011 isolates was purified by immobilized metal affinity chromatography column. The purity of the protein was assessed by SDS-PAGE and immunoblot analysis.

**Results:** Immunoblot assay confirmed FlpA protein production from transformed *E. coli* BL21(DE3) and *C. jejuni* F38011 isolates. The FlpA protein was purified from *E. coli* BL21(DE3) isolate. Recombinant FlpA protein will be purified from the genetically modified *C. jejuni* F38011 strain.

**Importance:** Although *C. jejuni* is commensal in chickens, it's pathogenic when introduced to a human host. *C. jejuni* FlpA is a surface-exposed protein that plays a role in cell adherence and invasion of human epithelial cells. As a potential vaccine candidate, purified FlpA can be used in poultry to reduce *C. jejuni* colonization in the chicken intestine while increasing food safety.

**Future Work:** Protection studies, whereby chicks immunized with purified FlpA protein and challenged with *C. jejuni*, will be performed. We will determine if *C. jejuni* challenged chickens that are vaccinated with *C. jejuni* derived FlpA will have a reduced *C. jejuni* intestinal load compared to chickens immunized with purified FlpA from *E. coli*.

**Poster # 125**

# Bridging the Gap, Embracing Technology in the Classroom


## **Presented by:** Danica Miller

**Mentors:** Julia Day and Shelby Ruiz **Campus:** Pullman

**Major:** Architectural Studies

**Category:** Social Sciences

**Co-authors:** Julia Day and Shelby Ruiz



The learning styles and attention spans of younger generations (end of Millennials to the beginning of Gen Z) are vastly different than that of their predecessors. To enhance learning outcomes, instructors are creating more engaging content and provide different ways of learning the same material. This paper presents ways in which higher-education instructors are working to create learning environments that foster understanding and curiosity, strategies to help students learn, and ways educators are beginning to bridge technological gaps.


Gaps in how technology is viewed and utilized can cause frustrations in the classroom. Traditional teaching has focused on visual, auditory, and kinesthetic learning styles (VAK), however, these methods are no longer meeting the dynamic engagement needs of students in higher education. Technology in the classroom has changed the way that students and professors interact with the material that is presented, and educators have more ways than ever adapt and improve communication of the material. Through an extensive interdisciplinary literature review, this paper explores modern teaching styles, generational differences in learning. Findings from this review suggest that differences in how generations learn is complicated. The findings of this literature review suggest that educators and students alike need to find common ground and learn from each other to create a more enjoyable learning environment for all.

**Poster # 126**

# Enhancing Performance of Solid Oxide Fuel Cell via Nickel Nanoparticle Infiltration Method for Anode Fabrication


## **Presented by:** Wendy Yu

**Mentor:** Su Ha **Campus:** Pullman

**Major:** Chemical Engineering

**Category:** Engineering and Physical Sciences

**Co-authors:** Martinus Dewa and Su Ha



Hydrogen fuel cells are amongst the most promising source of alternative energy as it has the ability to create the most efficient, cleanest, and sustainable form of electrical energy. As one of the most versatile types of hydrogen fuel cells, solid oxide fuel cell has the ability to convert the chemical energy of fuel into electrical energy at a minimum of 60% efficiency without using precious metals or corrosive acids that are found in other fuel cells. However, traditional solid oxide fuel cell performance can increase by improving its electrode design. Many methods have been studied to address this topic and one of them is introducing small Ni nanoparticles over the porous matrix to increase the number of active sites for electrochemical reactions. For my research, the liquid infiltration method of nickel nanoparticles into a porous yttria-stabilized zirconia matrix was investigated to create a high-performance anode. Solid oxide fuel cells created by the infiltration method can potentially produce a higher power density than the conventional anode. The depth and quantity of infiltrated nickel nanoparticles were observed using scanning electron microscopy (SEM) and the performance of infiltrated cells and their results were compared to conventional Ni-YSZ cells. The results generated so far showed a lower power density in infiltrated cells of 90 $mW/cm^2$ compared to traditional Ni-YSZ cells of 170 $mW/cm^2$. The lower performance of infiltrated cells can be explained by the poor distribution of Ni nanoparticles over the surface of the porous matrix shown by SEM images. As future work, I will improve the infiltration method by optimizing its process parameters including the Ni precursor concentration and infiltration time.

**Poster # 127**

# Electrochemical Technologies to Prevent Urinary Tract Infections

**Presented by:** Chloe Strupulis and Max McDaniel

**Mentors:** Haluk Beyenal, Gretchen Tibbits, and Abdelrhman Mohamed **Campus:** Pullman

**Majors:** Bioengineering, Management

**Category:** Engineering and Physical Sciences

**Co-authors:** Abdelrhman Mohamed, Alex Batson, Gretchen Tibbits, Lindsey du Toit, Michael Derie, and Haluk Beyenal

The incidence of urinary tract infections (UTIs) remains the highest of all healthcare associated infections (HAIs) accounting for an estimated 40 percent of all HAIs reported internationally. UTI's have a significant impact on the quality and morbidity of treatment, and the microbial biofilms responsible can be difficult and expensive to treat. While preliminary research shows progress toward clinical application of electrochemical treatments for biofilm reduction in wounds, the causative bacteria and growth conditions associated with UTI's requires more assessment. Through the deposition of $CaCO_3$- *Proteus vulgaris* can readily grow on urinary catheters and in the bladder causing a UTI. Previously it has been shown that localized electrochemical generation of hydrogen peroxide ($H_2O_2$) will reduce or eliminate many pathogenic biofilms' abilities to grow and survive. We hypothesize that localized generation of $H_2O_2$ will prevent *P. vulgaris* biofilms and $CaCO_3$ deposition. We developed a model system which resembles that of a typical UTI. The biofilms were characterized by imaging and counting colony forming units. We expect that proposed electrochemical treatments can be adapted to control this biofilm and have potential to act as a more cost-effective method of treatment for UTIs in the future.

**Poster # 128**

# Synthesis and *in vitro* Activity of Beta-Lactamase-Directed Immunostimulants


## **Presented by:** Andrew Staten

**Mentor:** Rock Mancini **Campus:** Pullman
**Major:** Chemistry
**Category:** Molecular, Cellular, and Chemical Biology
**Co-authors:** Austin Ryan and Rock Mancini



Multidrug-resistant (MDR) bacteria have been an arising issue because they can develop resistance to commonly used antibiotics like penicillins and cephalosporins. One mechanism of drug resistance in MDR bacteria is the expression of β-lactamase – an enzyme that hydrolyzes the β-lactam ring of these antibiotics rendering them ineffective. The β-lactamase catalyzed hydrolysis of β-lactam rings has previously been exploited for use in drug delivery by conjugating *cytotoxic* drugs to cephalosporins. Following enzymatic hydrolysis, an electron cascade reaction leads to the release of the cytotoxic payload. This project will expand on this concept by attaching an *immunostimulant* payload to a cephalosporin. Resiquimod (RSQ), an *immunostimulant* that activates Toll-like receptors (TLR) 7 and 8 in immune cells, was chosen as a model immunostimulant payload. RSQ was chosen for its nanomolar potency and well characterized structure-activity relationship that allows for modulation of immune cell activity. We plan to test the release of RSQ from our RSQ-cephalosporin prodrug in the presence of β-lactamase. The *rationale* for this project is that coupling the release of an *immunostimulant* to the activity of β-lactamase will provide a new way to target an immune response to MDR bacteria.

**Poster # 129**

# Histological Analysis of Tissues with Digital Pathology


## **Presented by:** Michelle Pappalardo

**Mentors:** Michael Skinner and Eric Nilsson **Campus:** Pullman

**Major:** Biology

**Category:** Organismal, Population, Ecological, and Evolutionary Biology

**Co-authors:** Eric Nilsson, Jennifer L.M. Thorson, Lawrence Holder, Pegah Mavaie, and Michael Skinner



Digital pathology is a sub-field of pathology that focuses on the imaging of a tissue slide and then analyzing the image on a computer. A high-resolution camera is attached to a camera-compatible microscope in order to image the slides, then software is used to process the images. The current project investigates testis and prostate tissues imaged at a resolution of 4x, and ovary and kidney tissues imaged at a resolution of 10x. For each tissue slide, multiple images were taken and then stitched together to create a composite image. A photo editing software is used to mark the image, pinpointing abnormal morphology. Histopathology slides were reanalyzed from a previous project using this new digital pathology procedure, and then compared to the results from the traditional on-microscopic analysis. This digital pathology process allows for greater accuracy and quality control comparison of disease calls between pathologists and immediate recall of the location of abnormalities in tissues. Digital pathology allows for adjustment for area of the tissue when identifying abnormalities. These quality control measures are not available in the traditional histology method. A method is being developed where the same digital pathology analyses are being transferred into Deep Learning and Machine Learning computational approaches. This computerized automation will allow the more accurate and rapid detection of pathology abnormalities. These new digital and artificial intelligence protocols for pathology analysis will produce a significant improvement for future histology and disease detection.

**Poster # 130**

# Identification of Environmental Adaptations of the Malaria Vectors *Anopheles gambiae* and *Anopheles coluzzii* Populations Across Sub-saharan Africa Using Genome-wide Environmental Association

**Presented by:** Lauren Doellinger and Tana Smithsakol

**Mentor:** Omar Cornejo **Campus:** Pullman

**Major:** Biology

**Category:** Organismal, Population, Ecological, and Evolutionary Biology

**Co-authors:** Jennifer Warren, Joel Nelson, Siena Stephens, and Omar Cornejo

*Anopheles* is a prominent biological vector of malaria, resulting in over 500,000 deaths each year. Despite efforts to mitigate population growth of *Anopheles* with the use of insecticides, genetic evidence suggests the continued adaptation towards insecticide resistance and varying abiotic environments. Though previous studies have identified specific genes along the genome that confer insecticide resistance, little is known about the underlying adaptive genetic variation that persists across multiple environmental variables. Current understanding of the relationship between genetic variation and the underlying environments have been limited to only two regions of the genome, which are the 2La and 2Rb inversions. These inversions are known to play a significant evolutionary role towards the survivability in savannah and forested habitats throughout Africa. However, our understanding of genetic environmental associations outside of these chromosomal inversions is severely lacking and warrants further investigation. Here, we use the combination of full genome data (765 individuals sampled over eight populations), with seven different environmental variables to test for specific gene-environment associations throughout the natural range of *Anopheles*. Throughout the genome, we identified a total of 3727 single nucleotide polymorphisms showing a significant association with environmental variables. Most of these polymorphisms were associated to precipitation and temperature, which explain most of the variation in our environmental variables. In concordance with other studies, we found strong associations within chromosomal inversions, further validating our findings. We have also identified regions of the genome strongly associated to isothermality. Our results strongly suggest that there are environmental gradients that impact patterns of genetic variation within the *Anopheles* genome. Whether these gradients act synergistically or antagonistically with human selective pressures is something that still needs to be determined to better predict the spread of insecticide resistance in Africa.

**Poster # 131**

# Modeling Growth Kinetics of Cytotoxic T Lymphocytes to Optimize Growth in a Centrifugal Bioreactor with Applications in Cancer Immunotherapy


## **Presented by:** Monika Cewe and Sara Moore

**Mentors:** Bernard Van Wie and Kitana Kaiphanliam **Campus:** Pullman

**Majors:** Bioengineering, Chemical Engineering, Electrical Engineering

**Category:** Engineering and Physical Sciences

**Co-authors:** Anna Crowley, Baran Arslan, Brenden Fraser-Hevlin, Chloe Nichol, Kitana Kaiphanliam, Madeline Curtis, William Davis, and Bernard Van Wie



This research is consistent with the forefront of cancer cell therapies in providing therapeutic T cells, which have been proven to destroy cancer cells to effectively treat cancer by identifying target cancer cells in malignant tumors. One of the major hurdles in using cytotoxic T lymphocytes (CTL) for cancer immunotherapy is T cell expansion; therapy consists of growing large number of CTLs *in vitro* prior to being administered to a patient. In order to maximize CTL expansion, a kinetic model will be designed to estimate growth rate dependence on the concentration of substrates such as glucose and metabolites including lactate and ammonium. It is well known that increasing lactate and ammonium ion concentrations not only hinder growth rate but also result in a lower culture pH, which further prevents cell proliferation. Yet, there has not been enough research on the kinetic modeling of CTLs' growth. The main goal of this study is to develop a kinetic model of CTLs isolated from a bovine model as a proof of concept for next-step expansion in a centrifugal bioreactor (CBR) system. This will be achieved by determining the rate of formation of secreted waste products such as ammonium and lactate and the consumption rate of glucose in the cell culture medium over a series of kinetic studies. To date, we have conducted three variations of the glucose growth rate experiment, which has allowed us to determine the maximum specific growth rate and Monod constant. Once the inhibition factors are known, a mathematical model can be put together for CTLs to optimize their growth *in vitro* in the CBR.

**Poster # 132**

# Differential Triacylglycerol Utilization Increases Establishment in Hydroxy-fatty Acid Accumulating Arabidopsis


## **Presented by:** Anh Le

**Mentor:** Daniel Lunn **Campus:** Pullman
**Major:** Biochemistry
**Category:** Molecular, Cellular, and Chemical Biology
**Co-authors:** Anh Le, Daniel Lunn, and John Browse



Oilseed plants store an abundance of triacylglycerol in the embryo to ensure successful establishment of the subsequent generation. Upon germination, emerging seedlings are heterotrophic, relaying on stored oil for the transition to photoautotrophic growth. To release these energy reserves enzymes known as lipases utilize storage lipid by sequentially removing fatty acids for breakdown via β-oxidation. We endeavor to reveal the biochemical intricacies of triacylglycerol mobilization, by producing non-native oil substrates. Expression of a castor bean hydroxylase in Arabidopsis seed (RcFAH12) creates a hydroxyl group at the Δ12 position of oleic acid (18:1). Subsequent incorporation of hydroxy-fatty acids into triacylglycerol allows for tracing throughout seed and seedling development. Expressing *RcFAH12* in Arabidopsis led to plants with low seed oil and seedling establishment. Further, analysis showed reduced novel oil mobilization particularly in species containing hydroxy-fatty acid moieties. We hypothesized these oils persisted in absence of a lipase with substrate preference towards hydroxy-containing storage lipid. However, lines with far greater hydroxy-fatty acid accumulation displayed higher establishment levels, indicating another layer of complexity. Analysis of lines co-expressing *RcFAH12* and triacylglycerol assembly enzymes increased establishment levels but many still arrested during the transition to photoautotrophic growth. Further, during seed maturation these lines increased the proportion of oil absent in hydroxy-fatty acids, leading to greater resources and by extension seedling survival. Lastly, we find that a shift in stereochemistry provides further oil availability due to higher utilization of hydroxy-containing triacylglycerol. These data provide crucial insights into enzyme preferences and the site of lipase action on triacylglycerol.

**Poster # 133**

# Granulin Cloning for Use in *in vitro* Neuron Studies


## **Presented by:** Erin Templeton and Nickolas Starks

**Mentors:** Alla Kostyukova and Dmitri Tolkatchev **Campus:** Pullman

**Major:** Bioengineering

**Category:** Molecular, Cellular, and Chemical Biology

**Co-author:** Richard Gomulkiewicz



A protein called progranulin, comprised of seven and a half homologous domains called granulins, has recently become a focus of extensive research. This is mainly due to its association with frontotemporal dementia (FTD), a fatal neurodegenerative disease related to Alzheimer's disease, but developing at an earlier age. Our long-term goal is to understand the effects of the individual granulin proteins and their relationship with neuron apoptosis. To be able to study the relationship between granulin and neuron functions, we need to develop ways to produce granulins at scales that would allow controlling the quality of the preparations by physico-chemical methods, while also allowing their effects to be studied in biological assays. For this, granulins were cloned into two different vectors, one for expression in neurons (pCAGGS), and another in a pET21b-based vector for large scale production of granulins in *E.coli*. In *E.coli*, granulins are cloned as fusion proteins with an onconase tag used for high-yield protein expression and facile purification . Two different approaches were used for cloning. For cloning granulin into pCAGGS, the Gateway cloning approach (Invitrogen) was used, whereas to create the E.coli vector two successive traditional cloning protocols were performed. Expression of granulins was confirmed both in neurons and in *E.coli*. The next steps in this research are purifying granulins for structural studies and studying effects of granulins expression on neuron apoptosis, viability, differentiation and morphology.

**Poster # 134**

# An Analysis of the Cost Associated with Dairy Employee Injuries and Illnesses


## **Presented by:** Joseph Ochoa

**Mentor:** Amber Adams Progar **Campus:** Pullman
**Major:** Animal Sciences
**Category:** Humanities
**Co-author:** Amber L. Adams Progar



In 2018, the total injury and illness rate for employees on dairy cattle and milk production operations (6.3/100 full-time employees) in the United States was more than double the injury and illness rate reported for all private industries (2.8/100 full-time employees; Bureau of Labor Statistics). Annually, the number of injuries and illnesses occurring on dairy operations is increasing; including an increase of 900 reported cases from 2017 to 2018 (Bureau of Labor Statistics). This study analyzed the costs associated with these injuries and illnesses on dairies. Dairy employee injury and illness data were collected from governmental and private agencies. The data collected included the types of injuries and illnesses that occurred, the workers compensation costs, employee retraining costs, the cost of labor lost based on days away from work with cattle as a source of injury or illness, and the quantity of full-time employees within dairy cattle and milk production operations. It seems that the amount of injuries and illnesses that occurred on dairy operations, along with the workers compensation costs and retraining costs are increasing. For Washington State, the total worker compensation cost reported by the Washington Sate Department of Labor and Industries increased by 29.90% between 2017 and 2018. For 2020, the premium rate for workers compensation in Washington state increased by 12%, as reported by the Washington State Department of Labor and Industries. Nationally, the annual number of full-time employees has been increasing, along with the annual number of injuries and illnesses reported on dairies cattle and milk production operations, but the total rate of injuries and illnesses occurring on these operations is decreasing. Dairy cattle are implicated as being one of the top sources of injuries. In 2017, bruising, fractures, soreness, and pain were the most common types of injuries caused by dairy cattle that resulted in days away from work on dairy operations. More research into the severity of these injuries is warranted. These results present an opportunity for the development of Extension programs aimed at creating a training curriculum to help dairy employees learn about these safety risks and, ultimately, prevent dairy employee injuries.

**Poster # 135**

# The Role of Astaxanthin in Environmental Stress Tolerance of Diet-manipulated Tidepool Copepods *Tigriopus californicus*


## **Presented by:** Asiamay Diaz

**Mentor:** Wes Dowd **Campus:** Pullman
**Majors:** Spanish, Zoology
**Category:** Molecular, Cellular, and Chemical Biology
**Co-author:** Wes Dowd



Changes in the environment often prove to be stressful to organisms. This can be difficult to quantify at a cellular level, especially in living animals. The main objective of this experiment is to understand how tidepool copepods (*Tigriopus californicus*) are affected by environmental stressors *in vivo* using microscopy techniques. Copepods have a reddish-brown pigment that provides physiological functions such as protection from ultraviolet radiation. The pigmentation arises from conversion of a chemical in the diet to astaxanthin; therefore, dietary levels of the precursor could be important in physiological performance of copepods. The pigmentation is an antioxidant; therefore, this molecule may function in other forms of realistic variation of environmental stressors such as varying dissolved oxygen levels and temperature. The goal of this project is to quantify antioxidant presence and whether the molecule is oxidized (responding to stress) or reduced in various environmental scenarios. This would provide a non-lethal indicator of the animal's stress level. Confocal microscopes can quantify these parameters by exciting the pigmentation at a specific wavelength and measuring accurately the time lag for the light to be returned as a different color. This technique is known as Fluorescence Lifetime Imaging Microscopy (FLIM). The research will be conducted by exposing one animal with a constant diet, either a control (Instant Algae, Shellfish Diet 1800), carotenoid-free diet (nutritional yeast), or carotenoid-restored (zeaxanthin plus nutritional yeast) , to specific stressors and observing which stressors (or combinations of stressors) induce a change in fluorescence indicating an increase in stress. For each diet, the sample population will be split into three treatment groups: control, temperature stress (heat baths), and oxidation (varying concentrations of hydrogen peroxide). The expected results are the animals reared on the carotenoid-restored diet will show higher survivability coupled with higher levels of oxidized astaxanthin following stressful exposures. If successful, this tool could be used to repeatedly monitor biochemical stress levels in living copepods under a variety of conditions. Thus far, offspring of copepods reared with the carotenoid-free diet lack the reddish-brown pigmentation. Compared to the control group the copepods on the diets that include nutritional yeast are yielding more offspring.

**Poster # 136**

# Effects of a Fungal Biopesticide on the Honey Bee


## **Presented by:** Riley Shultz

**Mentors:** Nicholas Naeger and Jennifer Han **Campus:** Pullman

**Major:** Biochemistry

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Nicholas L Naeger, Jennifer O Han, Walter S Sheppard, and Lori M Carris



Honey bee health has been declining; annual hive loss have exceeded 30% in recent years. While there are many factors that contribute to honey bee population reduction, *Varroa destructor*, an ectoparasitic mite of honey bees, is the most commonly reported cause of hive decline. Washington State University's Entomology and Plant Pathology programs have worked to develop a new strain of entomopathogenic fungus in the genus *Metarhizium* that kills mites. Previous research suggests treatment with fungal spores that are nonpathogenic to bees results in an increase expression of immune function genes in honey bees. Caged bees were treated with varying doses of *Metarhizium* (low, medium, or high) or uninoculated growth medium and incubated at 33 °C. *Varroa* and honey bee mortality was tracked for 20 days. The high dose treatment did not significantly increase mite mortality; however, bees treated with a high dose lived significantly longer than control bees (t-test $p = 0.01$). RNA was extracted from the honey bees and gene expression of immune related genes will be analyzed using quantitative Polymerase Chain Reaction (qPCR).

**Poster # 137**

# Digital Curation of the UNESCO Sukur World Heritage Site Language Documentation Project

**Presented by:** Cooper Stone, Desmond Chia, Eleanor Markewicz, Klint Demetrio, Mary Bartlow, Micah Ramos, and Rebecca Stern

**Mentor:** Michael Thomas **Campus:** Pullman

**Majors:** Anthropology, English, Foreign Languages and Cultures, Humanities: General Studies, Social Sciences: General Studies, Spanish

**Category:** Social Sciences

**Co-authors:** Andrew Wood, Celeste Harms, Dean Richey, Torin Sundberg, and Michael Thomas

This project from the WSU Linguistics Club aims to create an online introduction of the rich cultural and linguistic heritage of the Sukur people and assist the Sukur community efforts to preserve and maintain their language.

The Sakun language is spoken by approximately 20,000 people in and around the UNESCO Sukur World Heritage Site in Adamawa State, Nigeria. Sakun is a member of the Biu-Mandara group of Chadic languages and as is the case with many minority languages in the region, Sakun is under serious pressure from Hausa. In addition to the general pressure on local languages posed by Hausa, the entire community was recently internally displaced by Boko Haram militants. While the Sukur have returned to the UNESCO site, the threat of militants returning remains.

Although still in its preliminary stages, the project team is preparing a selection of video texts collected during the Sakun (Sukur) Language Documentation Project, archived at the School of Oriental and African Studies, University of London. The videos, transcriptions and translations are formatted using the ELAN digital annotation package and need to be converted into subtitled video suitable for streaming online without special software or skills. A webpage curating these videos is also being developed by this project.

In addition to developing and presenting the videos, this project is working with the Simon Waida, Chief Museum Guide of the Sukur World Heritage Site, Lawu Zera of the Nigerian National Commission on Museums and Monuments, The Sakun Development Association and the Kinjir Foundation in Adamawa State, Nigeria, to explore online modalities for preserving and developing the Sukur language, prepare materials for mother tongue literacy initiatives and language study materials targeted to members of the Sakun diaspora living outside Sakun speaking enclaves.

**Poster # 138**

# Nutrient Limitation in 4 Freshwater Streams in the Cascade Mountain Range


## **Presented by:** Jeannette Lilly

**Mentor:** Sarah Roley **Campus:** Tri-Cities

**Major:** Environmental and Ecosystem Sciences

**Category:** Organismal, Population, Ecological, and Evolutionary Biology

**Co-authors:** Erica A.H. Bakker, Carmella Vizza, and Sam Vandeberg



Nitrogen (N) fixation is the microbial conversion of N2 to bioavailable N, and is essential to ecosystem productivity. While extensive research has been conducted on N2 fixation by cyanobacteria in the ocean, estuaries, and lakes, comparatively little is known in freshwater streams. Because agricultural or urban streams receive large amounts of N from fertilizer or pollution, N2 fixation rates are assumed to be negligible. However, N2 fixation could be an important source of N for low-nutrient streams in the Pacific Northwest, especially in systems with declining marine-derived nutrient inputs due to smaller salmon runs. Nutrient limitation occurs when the growth or development of an organism is limited by the amount of a nutrient. We hypothesized that Cascade Mountain stream organisms would be limited by N and that N2 fixation would be a significant N source in these streams. In addition to measuring N2 fixation, we used nutrient-diffusing substrates (NDS) to assess the nutrient limitation of autotrophs (i.e., algae and cyanobacteria) and microbial heterotrophs, or organisms relying on autotrophs for food, in 4 Cascade Mountain streams. We utilized eight different nutrient addition treatments, which included a control (no nutrients added), two different forms of N (i.e., ammonium or nitrate), phosphorus (P), and every possible combination of N and P. For each treatment, we used two substrates to select for different organisms: 1) glass for autotrophs and 2) cellulose sponge for heterotrophs. NDS were deployed for 2-3 weeks, and we measured chlorophyll-a (autotroph abundance), photosynthesis, and respiration after retrieval. We discovered that generally N and P were not limiting for autotroph abundance or metabolic processes. However, in two of the streams, there was a tendency towards P limitation for autotrophs and N inhibition for heterotrophs. The unexpected lack of N limitation in these streams may explain why N2 fixation rates were so low. In light of the observation that higher N2 fixation occurred in the stream with the highest iron availability, this micronutrient may be limiting for cyanobacteria in these streams. Measuring nutrient limitation provided important context for understanding N2 fixation rates in the Cascading Mountain region.

**Poster # 139**

# Circadian Rhythm in Retinal Neuron Vulnerability to Alcohol Damage in a Zebrafish Model of FASD


## **Presented by:** Kiersten Holguin

**Mentor:** Michael Varnum **Campus:** Pullman

**Major:** Neuroscience

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Owen Canterbury, Kemal Donlic, Tshering Sherpa, Peter Meighan, and Michael Varnum



The ubiquitin system is essential for protein homeostasis (proteostasis), controlling the lifetime of normal proteins and disposal of abnormal proteins via proteasomal or lysosomal degradation. Cone photoreceptor neurons, which are necessary for high acuity vision, function under immense biogenic and metabolic demands, making them susceptible to disturbances of proteostasis. Cones have intrinsic circadian rhythms, with differences in dopamine and melatonin expression during light and dark phases, and rhythms in the production of ubiquitin-system proteins and activity. We recently established a zebrafish model for fetal alcohol spectrum disorders (FASD), in order to investigate the mechanisms underlying ethanol damage to neurons. Alcohol abuse is associated with disruption of several neuroprotective mechanisms. We hypothesize that binge-like ethanol exposure disrupts fundamental protein turnover mechanisms in photoreceptor neurons, undermining proteostasis and leading to visual impairment, implicating prenatal alcohol exposure in the visual deficits seen in FASD. Our earlier studies demonstrated loss of visual function following an ethanol insult mimicking third trimester exposure in humans, with impaired optomotor response (OMR) visual performance and reduced retinal electroretinogram (ERG) signals. We also observed evidence of disturbed proteostasis and functional rescue via pharmacological enhancement of protein turnover pathways. Although there is a proposed relationship between circadian rhythms and protein turnover pathways, the susceptibility of cone photoreceptors to damage by ethanol during the day versus night has yet to be elucidated. We treated wild-type zebrafish larvae at 5 days post fertilization with 1% ethanol in 12 hour bouts over two or three days. After recovery, visual function was measured using OMR assays. We observed a significant difference in the visual performance between light and dark treated groups ($p < 0.05$), with larvae more vulnerable to damage during the day. Since melatonin is high at night and might serve a neuroprotective role, we co-treated larvae exposed to ethanol during daytime with 1 μM melatonin. Melatonin did not mitigate loss of visual function following ethanol exposure, suggesting the mechanism may be more complex than initially hypothesized. Understanding cone photoreceptor susceptibility to ethanol damage based on their circadian rhythms is essential to developing treatment strategies to rescue these neurons and prevent retinal degeneration.

**Poster # 140**

# Occupational Perspectives and Experiences of Spoken Language Medical Interpreters


## **Presented by:** Nicole Ross

**Mentor:** Janessa Graves **Campus:** Spokane
**Major:** Nursing (BSN)
**Category:** Social Sciences
**Co-author:** Janessa Graves



**Background:** Across the United States, spoken language medical interpreters play a vital role in communicating, fostering understanding, and ensuring safety and transparency in healthcare for patients with limited English proficiency (LEP). Interpreter services help to bridge gaps in communication between medical providers and patients in a variety of settings, including clinics, hospitals, nursing homes, and mental health facilities. To date, there is limited research regarding the work-related quality of life and experiences of spoken language medical interpreters. The purpose of this research was to gain an understanding of factors contributing to the work-related quality of life among spoken-language medical interpreters.

**Methods:** A web-based survey was administered to all interpreters registered with the National Board of Certification for Medical Interpreters located in the five states with the statistically highest number of individuals with LEP within the population (Hawaii, New York, New Jersey, California, and Texas). The survey consisted of the questions about their work experience, demographic questions, and a space for subjects to share their experiences as an interpreter (free-response question). Responses to the free-response text were coded using qualitative thematic analysis. First, response text was reviewed by two researchers. A codebook of descriptive domains and themes were developed, and all text was then coded by theme. To increase rigor and reliability, all text was double-coded by two researchers and coding discrepancies were resolved through consensus.

**Results:** Of the 981 interpreters invited to take the survey, 199 participated (20.3% response rate). Four domains were identified from the free-response question: *Professionalism and Role, Approaches to Mitigate Vicarious Trauma, The Rewarding Nature of the Job,* and *Work-Related Challenges* Respondents emphasized the challenges they face in their roles as interpreters, including compassion fatigue, a need to distance themselves from clients, and loneliness while working. Respondents identified a need for support in workplaces, both in ensuring their profession is taken seriously, but also to ensure their safety when working with patients.

**Conclusions:** Medical interpreters play an important in the U.S. healthcare system, yet they are faced with occupational challenges. Results from this study emphasize the need for employers and healthcare institutions to support medical interpreters.

**Poster # 141**

# Inducible CRISPR/Cas9 Gene Editing Offers Avenue for the Investigation of Cone Cell Proteostasis


## **Presented by:** Owen Canterbury

**Mentor:** Michael Varnum **Campus:** Pullman

**Major:** Biochemistry

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Michael Varnum, Peter Meighan, Tshering Sherpa, and Lin Fang



Cyclic nucleotide-gated (CNG) ion channels in cone photoreceptors convert light stimuli into electrical signals that are ultimately interpreted as vision. Heritable defects in *CNGA3* and *CNGB3* genes have been linked to the development of degenerative retinal diseases such as achromatopsia, progressive cone dystrophy, and macular degeneration. In order to investigate mechanisms underlying cone photoreceptor dysfunction, we have generated zebrafish models using CRISPR/Cas9 genome-editing technology to target zebrafish *CNGA3* orthologs: *cnga3a* and *cnga3b*. We recently employed an inducible editing system, via heat shock promoter-driven expression of Cas9 and constitutive expression of single guide RNAs (sgRNAs), to temporally restrict gene disruption. This allows for normal development of healthy zebrafish retinas and working vision (at 5 days post fertilization) prior to mutation of *cnga3a* and *cnga3b*. Successful editing was confirmed by mismatch cleavage using T7 endonuclease I and DNA sequencing. Using optomotor response visual performance assays and electroretinogram recordings, we found that without induced Cas9 expression, visual responses of sgRNA-expressing larvae were indistinguishable from wild-type controls. After induction of Cas9 expression, visual performance was drastically diminished within three days. The unexpectedly rapid timeframe for loss of vision suggested that turnover of cnga3a and cnga3b proteins cannot be explained entirely by canonical pathways involving photoreceptor phagocytosis. We hypothesize that uncharacterized ubiquitin-system pathways may contribute to rapid channel turnover in photoreceptors. We are currently using western blots to quantitatively track the loss of channel protein after Cas9 expression in our inducible model, and to determine the contribution of proteasomal versus lysosomal degradation to CNG channel turnover and the potential role of candidate E3 ubiquitin ligases that may target the channel for degradation. Future work will include use of a parkin knockout model to analyze its role in CNG protein degradation.

**Poster # 142**

# Use of a Digital Memory Notebook to Improve Independence for Older Adults with Mild Cognitive Impairment


## **Presented by:** Annika Willy

**Mentors:** Maureen Schmitter-Edgecombe and Reanne Cunningham **Campus:** Pullman

**Majors:** Neuroscience, Political Science

**Category:** Social Sciences



Over 16 million people in the US are living with cognitive impairment, which can affect one's ability to organize daily activities such as managing medications and scheduling appointments. The Digital Memory Notebook (DMN) is an iOS application iteratively designed with feedback from older adults with mild cognitive impairment (MCI) to be an external memory aid providing: a scheduler, daily activity to-do list, notes feature, and journaling feature. This study evaluated factors contributing to the uptake of the main features of the DMN by participants with MCI at 3 months post-intervention. Qualitative coding of interviews with participants was used to form recommendations for future interventions. Of the 22 participants who completed the interview (*M* age = 72; *M* education= 16; 46% female), 14 (64%) indicated they still used the DMN and 8 (36%) indicated they used at least one feature of the DMN on a daily basis. No group differences emerged between users and non-users in estimated pre-morbid intelligence, nor in self-reported prospective and retrospective memory abilities. The scheduling feature was the most likely feature to be used at follow up with 100% of continued users reporting use of this feature. The to-do list was used by 57.1% of users and the notes feature by 35.7% of users. The journal was the least likely to be in continued use, with 14.3% endorsing use. The scheduler and to-do list features are on the same page of the app and are both taught early in the intervention. The journal and notes features are also both on the same page and taught later in the intervention. It is possible that scheduling and to-do lists are more applicable to people's daily lives and are simpler to use than the journal and notes section. Alternately, it is possible that adjusting the intervention such that journaling and notes are taught earlier, separate from each other, or more time is spent on the purpose of these features might increase long-term use. Future directions include evaluating participant characteristics related to overall DMN use and specific feature use and applying feedback to future intervention design.

**Poster # 143**

# Computational Model of Actomyosin Kinetics


## **Presented by:** Sofiya Chayka

**Mentors:** David Lin and Bertrand Tanner **Campus:** Pullman

**Major:** Bioengineering

**Category:** Molecular, Cellular, and Chemical Biology

**Co-author:** Krista Brutman



Computational models allow researchers to scale up complex molecular and cellular phenomena and elucidate the importance of specific morphological features or dynamic properties for function of a physiological system. Historically, a mass action model was the conventional model that was used to study the kinetics of contractile proteins, myosin and actin. In these models, the proteins within a cell were assumed to act independently because the filaments on which the proteins were arranged were modeled as inextensible. However, recent spatially explicit actomyosin models, where each actomyosin interaction is accounted for, were used to address the realignment of binding sites and myosin attachment sites. Such realignment is due to filament and cross-bridge compliance and is related to the relative movement of the sites when force is produced by the binding of myosin to actin. Our computational model builds upon these previous models which linked actin-myosin kinetics with the spatial unidimensional arrangement of myosin attachment and actin sites relating to their compliance and resulting realignment. The model is based on previously defined contractile protein kinetics equations and Gibbs Free energy equations that have been matched to experimental data. With a four-state model of the cross-bridge cycle, the algorithm uses Monte Carlo Simulation to view and analyze the kinetics involved with the four different states. This study will focus on understanding the effect of actin-myosin realignment, binding site availability, and kinetics of cross-bridges on filament force generation.

**Poster # 144**

# Characterizing Fruit Development Across Blueberry Cultivars to Optimize Harvest for the Fresh Market.


## **Presented by:** Brenda Madrid

**Mentor:** Lisa DeVetter **Campus:** North Puget Sound at Everett
**Major:** Organic Agriculture Systems
**Category:** Applied Sciences
**Co-authors:** Yixin Cai and Lisa DeVetter



Northern highbush blueberry *(Vaccinium corymbosum)* does not have well-defined indicators for timing the best harvest period for the fresh market. Timing for harvesting is currently dependent on visual cues, such as the percent of observed blue fruit. These visual cues are subjective and may not adequately represent when fruit across different cultivars has reached its optimum quality. Fruit firmness and chemistry changes over time, which can inform optimal harvest timing and intervals. This study was initiated to optimize harvest timing of four commercially viable cultivars grown in western Washington by evaluating physical and chemical changes during fruit development. Samples of 'Draper', 'Duke', 'Aurora' and 'Liberty' were collected weekly from the S3 to S7 phenological stages. Changes in fruit firmness, soluble solids, acidity, and the sugar to acid ratio were analyzed. The results illustrate the variation in the chemical composition of blueberry fruit between each developmental stage and among cultivars. Results from this study can be utilized to support the development of harvest recommendations that correlate to when the fruit of each cultivar is at its optimal quality thereby improving postharvest longevity of fresh market blueberries.

**Poster # 145**

## Discussing Climate Change on Social Media

**Presented by:** Abby Marley, Catherine Schisler, Elliott Wong, and Veronica Powell

**Mentor:** Mina Park **Campus:** Pullman

**Majors:** Communication and Society, Strategic Communication

**Category:** Social Sciences

**Co-authors:** Anh Nguyen, Hanqian Xu, Jaycee Johanneck, and Torin Scott Filkins

While social media can be an effective place for users to discuss and learn about controversial topics, such as climate change, these platforms have also been used as a resource for hollow or hateful conversations. Due to anonymity, users' stance on climate change is more salient than personal characteristics, thus, discussions can become extreme, which hinders the conversation. The correlation between consumer's participation and post regarding climate change is measured in this study. We believe both, the amount of comments and its valence, will reflect the posts' stance. We are also looking into the possibility that the type of social platform can affect post reactions. Facebook, Twitter, and Instagram were chosen for this study based on their high daily traffic and popularity. In order to study the correlation, we coded six different posts and their corresponding twenty comments per social platform. From this data, we coded valence, stance, support and emotion. Of the 120 comments, we were able to see a correlation between post valence and comments valence, meaning if a post is negative the comments will also have a negative tone. Another correlation from the data is if a post has a stance of advocate, there will be more positive than negative posts.

**Poster # 146**

# Insulin Mediated Immunity During West Nile Virus and Zika Virus Infection


## **Presented by:** Sophie Mackinnon

**Mentor:** Alan Goodman **Campus:** Pullman

**Majors:** Genetics and Cell Biology, Microbiology

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Chasity E. Trammell, Laura R.H Ahlers, and Alan G. Goodman



West Nile virus is a disease that appeared in the United States in 1999 and has since spread through the country. Acute infection of West Nile virus presents as flu-like symptoms, and two-thirds of cases lead to neurological damage ranging from encephalitis to paralysis. Zika virus, a flavivirus similar to West Nile virus, can also present itself with symptoms such as a fever or headache but, in pregnant women, it can lead to neurological damage and microcephaly in fetuses. Currently, there is no vaccine to prevent infection nor any medical treatments for those infected. Stopping transmission from mosquito to human host would be the most effective mode of preventing this disease. In order to accomplish this, understanding the immune mechanisms used by the mosquito during infection is needed. Previously, our lab discovered that the insulin response pathway is important the immune response during West Nile virus infection. After investigating the mechanisms by which the insulin response pathway contributes to immunity against West Nile virus, our results support a model in which insulin-mediated antiviral protection was achieved by a mechanism other than the established FoxO-mediated RNAi pathway. To further these studies our lab has begun to examine if insulin-mediated immunity similarly controls Zika virus infection. Our research will delineate how insect vectors control and mediate their infection response. Furthermore, these results can be used in creating therapeutic solutions that would reduce the effects of infection as well as block transmission from infecting humans.

**Poster # 147**

# Rosalia Fire Station


## **Presented by:** John Gonzalez and Sarah Rosenthal

**Mentor:** Minyoung Cerruti **Campus:** Pullman

**Major:** Interior Design

**Category:** Arts and Design


Many rural areas in central Eastern Washington exclusively rely on the Rosalia Fire Station as their fire suppression, emergency medical service, and natural disaster protection. The fire station, staffed by 35 dedicated volunteer firefighters and two full-time staff members, is also the center of the rural, 500-person Rosalia community both geographically and metaphorically. The fire station, originally built in 1973 and expanded twice, has spatial and technical challenges that require architecture and interior design studies: lack of apparatus bays, ineffective office spaces, no dorms for staff growth over time, and no dedicated community areas. Our design team took on the challenge of fitting all of the complex program requirements into a tight, existing site. We took an evidence-based design approach to understand issues and innovations of fire station design through an in-depth literature review; to identify the needs of the end users (firefighters, community members) through interviews and a survey; and to evaluate building systems and materials through several design review meetings with design professionals.

Our design goals included (1) creating an environment that promotes health and wellness of firefighters and staff, (2) enhancing a greater sense of community, and (3) providing adaptability and flexibility for current and future users. For health and wellness, we used nature to create healing spaces throughout the station (nature view through window, nature-inspired patterns, natural color palette found in plants and old historic buildings of Rosalia). The community spirit was also enhanced through communal spaces dedicated to the community including a fitness room, a dining hall/classroom, and a museum showcasing the history of Rosalia. We also provided ample lockable storage for fire and medical equipment as well as spaces dedicated to the health and wellness of the firefighters like a private kitchen/dining room and individual sleeping rooms with private restrooms/showers. These spaces give the firefighters a sense of autonomy over their environment and the community a sense of belonging and engagement. Our design proposal, encouraging an integration of social, cultural, and safe environments within Rosalia, is relevant and applicable to other rural communities in the nation.

**Poster # 148**

# Assessment of Morphological Reproductive Parameters During the Non-Breeding Season in Rams


## **Presented by:** Arielle Gomez

**Mentor:** Martin Maquivar **Campus:** Pullman
**Major:** Animal Sciences
**Category:** Organismal, Population, Ecological, and Evolutionary Biology
**Co-authors:** Martin Maquivar and Jan Busboom



The main purpose of this study was to evaluate the morphological characteristics of spermatozoids in rams (Ovis aries) to determine the effects of the non-breeding season (Summer) compared to the breeding season (Fall). The study included 11 Suffolk-Hampshire crossbred sheep ranging from 1-3 years of age that were subjected to a breeding soundness evaluation and a semen sample was collected beginning in June until December. Semen was evaluated for progressive sperm motility, number of spermatozoids per field of microscope vision, percentage of live and percentage of abnormal spermatozoa. Based on the results of this study, best semen quality was observed during the early to mid-fall months (Sept-Oct). This was characterized by significant increases in live spermatozoa during the fall months, which suggest the optimal time to use males for breeding purposes. An increase in the total number of spermatozoa ($P < 0.001$) with September and October with the highest counts compared to summer months. Similarly, there were significant increases in the number of live spermatozoa count during fall months. Finally, the data showed decreases in the number of live spermatozoa and spermatozoa with progressive forward motility, as well as increases in abnormal spermatozoa. This suggests that semen quality drastically diminishes during the late fall months (Nov-Dec), despite the breeding season for these rams being September – December. This could be indication that the best time to use rams for breeding purposes would be in the early fall months.

**Poster # 149**

# Love, Sex, and Violence: How Parents and Teens Communicate About Intimate Partner Violence


## **Presented by:** Cassandra Semeling

**Mentors:** Kathleen Rodgers and Konul Karimova **Campus:** Pullman
**Major:** Human Development
**Category:** Social Sciences
**Co-authors:** Madison Benjamin, Kathleen Rodgers, and Konul Karimova



One in four teens who are romantically involved with someone have experienced violence within the relationship (Exner-Cortens, 2014). According to social learning theory, the media has influence over teens through modeling of unhealthy romantic relationships (Bandura, 2002). In this study, we analyze 20 transcripts from a larger study that examined how parents and teens talk about intimate partner violence (IPV) in media. Fifty parent-teen dyads were recruited from within a 40-mile radius of Pullman/Moscow and Spokane, Washington. The sample included 8 mother-daughter pairs, 6 mother-son pairs, 3 father-daughter pairs, and 3 father-son pairs. Parents and teens first watched three music videos separately, and then watched together and discussed each video for 10 to 12-minutes. Discussions were audio/visually taped. The conversations were held in a laboratory designed to be comfortable and home-like, with couches, decorations, and a television to view the music video. For this poster presentation, we focus on conversations from one of the music videos: *Love The Way You Lie* by Eminem ft. Rihanna. This video depicted relationship violence, sexual content, and alcohol use. Parent-teen discussions included guiding questions such as "What did you like and dislike about this video?" and "Do you think videos like this would worry parents/teens?" as well as questions and topics generated from the parents and teens. We use open and axial coding to identify themes found during parent-teen conversations, which are then qualitatively analyzed using grounded theory. Results will identify how communication between parents and teens occurs when media is used as a prompt for discussing dating violence. Questions of interest are: Do parents use the opportunity to discuss IPV with their teens? If so, how do they do so in relation to the music video? This information may be useful in preventing teen dating violence and improving communication about IPV in families.


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**Poster # 150**

# Probing Dirigent Protein Function in Red Alder (*Alnus rubra*)


## **Presented by:** Rebecca Hsieh

**Mentor:** Norman Lewis **Campus:** Pullman

**Major:** Bioengineering

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Aliya Quintal, Mi Kwon, Laurence B. Davin, and Norman G. Lewis


Red alder (*Alnus rubra*) tree species is commercially the most common and most important hardwood (angiosperm) in the Pacific Northwest region. It is extensively used for veneer, furniture, paneling and it is a potential biomass/biofuel forestry crop on marginal lands. It is a great source of important secondary metabolites that are used for traditional medicines by Native Americans (e.g. salicin, and oregonin, etc.). Through extensive screening, superior red alder clones were discovered in terms of having faster growth and development, more desirable wood properties, and improved commercial value.

In order to investigate the underlying molecular basis of their desirable traits and the potential for further enhancement, a genome sequencing project was carried out. Continuing our annotation of genes involved in defense and cell wall structural functions, the dirigent protein (DIR) gene family has 32 members in red alder. The majority of DIRs currently have no established biochemical function *in planta*, although those with known physiological functions include DIRs controlling the outcome of inter-molecular phenoxy radical coupling leading to lignans, lignins, aromatic di-terpenoids, and intra-molecular cyclization to give entry to pterocarpans.

Thus, in order to identify and understand the biochemical functions of red alder DIRs, full-length cDNAs of ArDIR4, ArDIR6, ArDIR11, ArDIR12, ArDIR13, ArDIR15, ArDIR16, and ArDIR17 were cloned into bacterial expression vectors, such as pET100 or pET200 for the production of N-terminal his-tag fused recombinant protein. Cloned genes were transformed into *E. coli* BL21star cells and induced by isopropyl β-D-1-thiogalactopyranoside (IPTG). Recombinant DIRs will be used for the protein assay to determine their biochemical function related to the secondary metabolite biosynthesis in red alder.

**Poster # 151**

# Bison in Compliance: An Analysis of Two Regulatory Designations Placed upon Reintroduced Bison in the Northern Great Plains, Montana.


## **Presented by:** Dan Curtis

**Mentors:** Samantha Noll and Micheal Goldsby **Campus:** Pullman

**Major:** Philosophy


**Category:** Organismal, Population, Ecological, and Evolutionary Biology


In the northern great plains, Montana, there are efforts underway to reintroduce the American Buffalo on both public and private lands. Some reintroduced bison are designated for conservation, but the majority of bison are designated as livestock. Each designation carries a distinct set of rules and regulations. Regulatory compliance plays a large role in reintroduction strategy as much of the work is being done on government land by Non-Government Organizations (NGO). One such NGO is the American Prairie Reserve (APR) which deals in both types of reintroduction for the stated goal of ecologically improving the grassland prairie region. The purpose of this study is to gain better insight as to why an organization might choose to invest in one type of bison recovery or the other, and whether the public might choose to support either on public and private lands in the northern great plains, Montana. I first briefly outline the stated goals of bison reintroduction in the grassland prairie of the northern great plains, Montana by the APR and some history behind the concept. Then I discuss important regulatory distinctions between conservation bison and livestock bison from the viewpoint of an NGO working to recover the animals for the stated goal. For this study I will be citing several monographs by experts on bison and bison recovery as well as podcast interviews with APR personnel. I will also review regulatory information such as land use permits on Department of Natural Resources (DNR) property, grazing permit criteria, and requirements for non-profits like the APR to purchase property. Finally, I'll touch on common real estate tactics involving the interface of public and private land such as "land locking" for the purpose of controlling large animal populations. This information will add to the literature regarding reintroduction and ecological improvement efforts at the interface of public and private lands by providing a thorough understanding of the relevant regulatory compliance strategies and how they affect the target species/habitat.

**Poster # 152**

# Head and Neck Postures on the Potential of Neck Pain


## **Presented by:** William Frantz

**Mentor:** Anita Vasavada **Campus:** Pullman

**Major:** Bioengineering

**Category:** Engineering and Physical Sciences

**Co-author:** Anita Vasavada


Neck pain is the fourth leading cause of disability in the world, affecting 27-48% of the population at some point in their life [1,2]. A major contributor to neck pain is awkward postures held for an extended period in workplace settings, causing fatigue of the neck muscles and compressive loads on the discs. This study aims to quantify the biomechanics of the neck in common postures in the workplace and daily life.

Nine subjects (5M, 4F) were recruited for the study which took place at Cougar Health Services. Lead beads and reflective markers were placed on various landmarks of their head and neck. Once markers were placed, the subjects were given instructions to assume a neutral sitting posture while they were simultaneously photographed and x-rayed. The neutral posture was followed by four additional postures, in a random order. The four postures consisted of forward-head posture, tallest sitting height, neck extension, and phone-in-hands while texting.

Using the data collected from the photograph's and x-rays, postural variables will be measured and compared for each of the five postures. These measurements include the head and neck angles, neck length, the positions of the neck vertebrae, spinal curvature, and the spacing between the discs. The differences between each of the postures from neutral will be compared. In addition, gravitational moment of the head about the neck joints will be calculated to further estimate loads on the neck and the potential for neck pain. In the future, the data will be used to create computational neck models. It is hoped that the models and results of this study will be taken into consideration when improving workplace conditions.

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[1] Cote, P., *et al.*, *Spine*, 2008, 33(4S):S60-74.

[2] Hoy, D., *et al.*, *Ann Rheum Dis*, 2014, 73(7):1309-15.

**Poster # 153**

# An *in vivo* Optical Imaging Approach to Understand Cannabis-Induced Feeding Behavior


## **Presented by:** Emma Wheeler

**Mentor:** Jon Davis **Campus:** Pullman

**Major:** Neuroscience

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Julianna Brutman, Sumeen Gill, and Jon F. Davis



Cannabis is the most widely used illicit drug worldwide. Presently, cannabis is legal for medical use in 33/50 US states, yet it is still illegal at the federal level. Medical cannabis is often used by cancer patients as an appetite stimulant, as roughly half of all cancer patients experience life threatening disease-based anorexia. However, the physiologic and molecular mechanisms governing cannabis-induced appetite are not known, and thus, patients receive little guidance when purchasing cannabis for appetite stimulation. Feeding behavior is regulated by the hypothalamus, a central nervous system (CNS) region that integrates peripheral signals with internal need to feed. Specifically, the arcuate nucleus (ARC) of the hypothalamus contains both hunger neurons and cannabinoid receptors, making this region of great interest for understanding cannabis-induced feeding. Data from our lab indicates that vapor cannabis exposure increases both homeostatic and hedonic feeding responses in rodents. Based off this observation, we hypothesized that cannabis vapor activates neurons in the ARC to stimulate appetite. Here we used a *in vivo* calcium imaging approach to visualize neuronal activity in freely behaving mice before exposed to cannabis vapor. Results indicate that anticipation and consumption of food lead to distinct patterns of neuronal activation in the ARC which were further modified by cannabis exposure. These data suggest that cannabis vapor regulates *in vivo* activity of ARC neurons to direct appetite.

**Poster # 154**

# Mmp-dependent Potentiation of Cng Ion Channel Activity: Divergent Effects on Channel Gating Based on Availability of Intracellular Disulfide Linkages


## **Presented by:** Julie Kealy

**Mentor:** Peter Meighan **Campus:** Pullman

**Majors:** Neuroscience, Psychology

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Michael D. Varnum and Peter C. Meighan


Cyclic nucleotide-gated (CNG) ion channels are nonselective cation channels that are comprised of CNGA and CNGB subunits and are activated by the binding of intracellular cyclic nucleotides (e.g., cAMP and cGMP). CNG channels are classically associated with sensory transduction in retinal photoreceptors and olfactory sensory neurons but have also been implicated in a variety of other physiological processes, such as endothelial cell control of vasomotor activity, pulsatile release of gonadotropin-releasing hormone (GnRH), hippocampal plasticity, and neurogenesis. Therefore, altered function of these channels could participate in a wide variety of normal regulatory and pathological processes.

Matrix metalloproteinases (MMPs) are a family of over 20 secreted and cell-surface endopeptidases. We previously described that exposure of CNG channels to MMPs results in extracellular proteolysis of the CNGA1 and CNGA3 subunits—the core channel subunits for rod and cone photoreceptors respectively—producing a dramatic increase in the ligand sensitivity of CNG channels. The mechanism by which extracellular channel proteolysis increases the ligand sensitivity of CNG channels has not been completely characterized. We report that the MMP-dependent increase in ligand sensitivity of CNGA1 and CNGA3 channels requires intracellular disulfide bond formation subsequent to channel proteolysis. Channels comprised of a CNGA3 splice variant lacking a conserved cysteine residue are relatively insensitive to MMP-dependent changes in channel gating. We observed that exposure of MMPs to CNG channels comprised of CNGA2 subunits—the core channel subunits for the olfactory CNG channels—produces persistent channel opening that is independent of cyclic-nucleotide availability. Interestingly, CNGA2 subunits lack the conserved cysteine necessary for MMP-dependent potentiation in CNGA1 and CNGA3 channels. Taken together, this suggests that MMP-dependent potentiation of CNG channels occurs by divergent mechanisms, likely influenced by intracellular disulfide bond availability.

**Poster # 155**

# Mechanisms of Plant Cell Division: Construction of a Partition During Cytokinesis


## **Presented by:** Phillip Romig

**Mentor:** Andrei Smertenko **Campus:** Pullman
**Major:** Biochemistry
**Category:** Molecular, Cellular, and Chemical Biology
**Co-authors:** Andrei Smertenko and Tania Smertenko



The cellulose-rich wall of a plant cell is an integral part of the structure and function of the plant as an organism. To generate a cell wall during cytokinesis, cells first use microtubules to build a preliminary partition known as the "cell plate" out of callose. Both callose ((1→3)-β-D-Glucan) and cellulose ((1→4)-β-D-Glucan) are made of glucose monomers, but callose is mechanically weaker, and can be produced much faster. Previous studies have found that two proteins, IMK-2 and IMK-3, localize to the cell plate, and that mutants of these proteins exhibit irregular cell division patterns and abnormal cell wall orientation. What is not known is how these proteins contribute to the regular formation of a cell plate and eventual cell wall. My project seeks to better our understanding of the functions of IMK-2 and IMK-3 in cell plate synthesis by using two herbicides: Propyzamide, an inhibitor of microtubule polymerization, and Endosin-7, an inhibitor of callose synthesis. To achieve this, wild-type and mutant seeds of *Arabidopsis thaliana* will be sterilized with ethanol, then grown vertically for two days on a regular medium. Subsequently, the seedlings will be transferred to a medium containing non-lethal doses of either Propyzamide or Endosin-7, and then be given a week to grow vertically, with the length of their roots being measured daily. Afterwards, the roots will be stained and analyzed under a microscope. Since Propyzamide and Endosin-7 inhibit known functions of the plant cell, a comparison of the impact each herbicide has on plant cell wall synthesis in mutant versus wild-type *Arabidopsis* will be used to determine which stages of cell plate formation are directed by IMK-2 and IMK-3. In the process of doing this, the experiment will also seek to identify at least 3 new alleles for mutant *imk-2 imk-3* using the CRISPR/Cas9 approach. A hypersensitivity of the mutant to Propyzamide or Endosin-7 would indicate that IMK-2 and IMK-3 aid microtubule polymerization or callose synthesis; resistance to Propyzamide or Endosin-7 would indicate IMK-2 and IMK-3 act as the inhibitors of these processes; neither hypersensitivity nor resistance would indicate that IMK-2 and IMK-3 contribute to other processes.

**Poster # 156**

# Single Reactor DME Synthesis for Applications in the Upstream Oil and Gas Service Industry


## **Presented by:** Greyson Bettencourt

**Mentor:** Su Ha **Campus:** Pullman

**Major:** Chemical Engineering

**Category:** Engineering and Physical Sciences

**Co-authors:** Su Ha, Oscar Marin Flores, Grant Norton, and Rabindra Nanda



Nearly 470 billion cubic feet of natural gas was vented or flared during upstream oil and gas operations in the United States in 2018. Based on average natural gas pricing, that equates to approximately $2 billion dollars of usable energy wasted per year in the U.S. alone. Not only is this practice detrimental to operational energy efficiency in the upstream sector, it is also contributing to increased emissions of greenhouse gases. The goal of this research is to develop a single portable reactor that can convert methane, the major constituent of natural gas, into dimethyl ether (DME). Dimethyl ether is a clean burning alternative to diesel fuel that produces significantly less particulate matter compared to traditional diesel as it does not contain C-C bonds in its structure. With this reactor, stranded gas at drilling and production sites can be converted to DME for power generation on-site. The unique approach to this research is accomplishing conversion in a single step reactor using low temperature catalytic partial oxidation (LT-CPOX) with a novel catalyst developed in house. The current industrial process for producing DME requires mass infrastructure and is a three-step process that produces syngas via steam reforming, syngas conversion to methanol and methanol dehydration to DME. Our process will convert methane directly into syngas using LT-CPOX and then directly synthesize DME from syngas. This research project can help reduce diesel fuel usage on-site by substituting a cleaner fuel, mitigate health and environmental impacts associated with flaring and significantly reduce operating costs of upstream operations in the oil and gas service industry.

**Poster # 157**

# Early Stage Sepsis Detection Via Anti-body Sandwiching


## **Presented by:** Derek Burnett and Nathaniel Tillman

**Mentor:** Howard Davis **Campus:** Pullman

**Major:** Bioengineering

**Category:** Engineering and Physical Sciences

**Co-authors:** Anthony Stenson, John Hinson, and Paul Whitney



Sepsis is a regularly life threatening condition that kills about 1 in 5 people in the world. Sepsis occurs when the human body's immune response acts excessively in reaction to an infection, causing harm to important organs. This condition is especially dangerous for infants, the elderly, and those with compromised immune systems. Additionally, Sepsis conditions deteriorate rapidly with each passing hour, increasing the mortality chance significantly

Our goal is to design a compact, relatively cheap, quick, and highly specific detection device that would allow for the early detection of sepsis causing bacteria and thus allow the appropriate antibiotic treatments to be used right away. Our device would use an antibody sandwiching assay strip to test a blood sample for a specific bacterial type by holding and marking bacteria with tagged mobile antibodies as well as un-tagged stationary antibodies. The tested strip would then be placed inside our detection device that would measure emission data from the tagged antibodies and would send this data to a doctors computer. The doctor could analyse the data to check for concerning concentrations of bacteria types and initiate appropriate, specific antibiotic treatments quickly and before the patients condition spirals out of control.

**Poster # 158**

# The New Generation of Smokers: WSU Students' Perceptions and Usage of Electronic Cigarettes


## **Presented by:** Kendall Hoy

**Mentor:** Cara Hawkins-Jedlicka **Campus:** Pullman

**Majors:** Marketing, Strategic Communication

**Category:** Social Sciences



**Goal:** The goal of this research is to understand WSU students' usage and perception of e-cigarettes in order to create an effective communication strategy to combat increased e-cigarette usage on campus. This study investigates the following question; how do the perceptions of young adults about e-cigarettes differ from traditional cigarettes and how do their beliefs and usage of e-cigarettes influence big tobacco's current marketing tactics?

**Methods:** This project is a combination of a literature review and a survey. The literature review examined current events, trends, and marketing tactics involving e-cigarettes, more specifically evaluating the e-cigarette brand—JUUL Inc. In addition, a survey was created to better understand WSU students' usage and perceptions about e-cigarettes. The survey was comprised of various interval, ratio, and nominal questions. Respondents were segmented and answered separate questions if they had used an e-cigarette in the past versus never using one. The survey evaluated social media usage, frequency of alcohol consumption, and how influencers and friends affect decisions in social settings.

**Findings:** Overall, social pressures and outside influences strongly contribute to WSU students' e-cigarette usage. Respondents who do not currently own an e-cigarette have a stronger belief that e-cigarettes are safer than traditional cigarettes when compared to current e-cigarette owners. Next, females are more likely than males to vape at a party and additionally more likely to vape if one of their friends is. It was also apparent that WSU juniors were the most frequent e-cigarette users. Lastly, many respondents have used an e-cigarette, but very few actually own one themselves.

**Conclusion:** Ultimately**,** social pressures lead to "social smoking" which is more common than normal everyday e-cigarette use. In addition, it was found that females especially are susceptible to these pressures. E-cigarettes also defined an entire graduating class as juniors use e-cigarettes significantly more than other age/class groups. Therefore, when developing campaign messaging, it should appeal to social females and college juniors. Lastly, further exploration into those who quit and how current events in the media or social pressure influenced their decision, to quit could further maximize campaign effectiveness.

**Poster # 159**

# Interactions between Stress Hormone Signaling and Cannabis on Vagal Afferent Neurons


## **Presented by:** Kajal Sabhaya

**Mentor:** James Peters **Campus:** Pullman

**Majors:** Bioengineering, Neuroscience

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Forrest Shaffer and James Peters



Medical and recreational marijuana use in the United States is rapidly increasing and is commonly used to treat disorders like anxiety and depression resulting from chronic stress. Similar to marijuana, the body produces two endogenous cannabinoids, 2AG and anandamide. These control neural signaling including the release of the neurotransmitter glutamate. Endocannabinoids bind to cannabinoid 1 receptors (CB1r) in the brain to inhibit neural activity in stress-associated brain areas. Yet, stress hormones, including glucocorticoids, also target these receptors. We have shown previously that the glucocorticoid, corticosterone, reduces activation of neurons in the solitary tract nucleus (NTS) of the brainstem. The NTS relays sensory information from visceral organs to the brain via the vagus nerve. The vagus innervates nearly every organ system in the body and is critical for regulating homeostatic reflexes like heart rate and blood pressure, breathing, and feeding. In addition to expanding on our previous findings in the brainstem, this research aims to better understand the effects and interactions of cannabinoids and stress hormones on the vagal afferent neurons. We hypothesize endocannabinoids act directly on vagal afferent neurons to inhibit neural excitability. To test our hypothesis, we performed functional single-cell calcium imaging and electrophysiological studies to investigate the cell bodies of the vagus (contained in the nodose ganglia) of rats. Roughly a third of the cells showed a decrease in intracellular calcium in response to 2AG. These findings help to further understand how exogenous cannabinoids act on CB1r to impact stress on vagal afferent function.

**Poster # 160**

# Reorientation of Donor Molecules in Organic Solar Cells


## **Presented by:** Kyle Norbert

**Mentor:** Brian Collins **Campus:** Pullman

**Major:** Physics and Astronomy

**Category:** Engineering and Physical Sciences



As concerns over climate change have grown, so too has cultural interest in solar cell technology. Organic solar cells (OSCs) offer an exciting alternative to the depleting and polluting fossil fuels upon which we heavily rely today. The favorable characteristics OSCs possess encourage and motivate the necessity for greater study. They are forged from organic material—primarily carbon—making them cheaper to produce at scale than traditional solar panels. OSCs are flexible and translucent, giving them the ability to be printed from inks onto films of flexible substrate and applied to domains—like building facades and aircraft windows—which are inaccessible for their rigid, bulky counterparts. Recent improvements in the understanding of these devices have driven higher performance, though they still lag behind silicon-based systems. A concrete understanding of the nanoscale mechanisms and interactions that occur is needed to manipulate and further improve their power generation. This study focuses on the influence of a purified catalyst on the active layer of OSC devices. Multiple methods of observation were implemented to show the myriad mechanisms behind the improved performance of these cells.

**Poster # 161**

## Thermally Stabilized Small-scale Portable Hydrogen Liquefier


**Presented by:** Marcelo Ruiz

**Mentor:** Jacob Leachman **Campus:** Pullman

**Major:** Mechanical Engineering

**Category:** Engineering and Physical Sciences

**Co-authors:** Marcelo Ruiz, Jacob Leachman, Jordan Raymond, and Zoe Xavier



Creating and engineering a possible way to design, build, and test a small-scale portable hydrogen liquefaction system. Hydrogen liquefaction plants are mostly on large-scale, creating a small-scale portable will impact the hydrogen economy. Large-scale hydrogen liquefaction (LHL) plants have grown from 20% up to 50% in efficiency. The small-scale portable hydrogen liquefaction system requires extensive research on the following fields: thermodynamics followed up by heat transfer, extensive knowledge of cryogenics, and the functionalities of liquid hydrogen. The goal is to construct and test a small-scale portable hydrogen liquefaction system. Building a thermal model for maintaining the total heat for all the equipment and maintaining the ambient temperature constant. The final product should be the liquefaction system finished and running inside a small portable container. Creating a portable container will significantly increase the access to transport liquid hydrogen therefore increase possibilities of potential applications such as incorporating it with renewable energy sources. This project will accomplish the storing of liquid hydrogen while being able to transport it anywhere and locating it in any climate.

**Poster # 162**

# Inspiring Transportation Careers with K-12 Curriculum Activities


## **Presented by:** Olivia Willis

**Mentor:** Cheryl Reed **Campus:** Pullman

**Majors:** Neuroscience, Psychology

**Category:** Social Sciences

**Co-authors:** Michelle Akin, Xianming Shi, and Cheryl Reed



Shortages in the transportation industry have resulted in an increasing need for employees with diverse backgrounds in multimodal and sustainable transportation. Two methods of outreach that have been successful at increasing awareness and interest in transportation careers in local youth have been working directly with students and training the teachers. This project worked directly with students by conducting outreach events that either involved hosting a table at a large science event where students would stop at tables for short periods of time to complete the activities, or by working with a group of students for a designated block of time for consecutive days. Hands on activities such as toothpick and gumdrop bridges, clothespin cars, and wind up cars were explored as well as demonstrations involving gears, a gyroscope, or a pull-back rubber band car. The activities present at each event were chosen based on the duration of time researchers would have with each student and the number of students expected to be present. Engaging the age range of K-12 (kindergarten through high school seniors) proved difficult with a single activity as younger students took more interest in activities with continuous guidance from the researchers while older students were more invested if they were completing the activity with minimal, or no, guidance. Both preferred hands on activities over demonstrations. A downfall to the outreach events was that few middle or high school aged students were present as the majority of the attendees were elementary aged students. Moving forward, current research is analyzing the effects of gender, screen time, self-efficacy, sense of belonging, and ideas about stereotypes on learning in middle and high school aged students.

**Poster # 163**

# How Pedagogical Materials Motivate Students of Spanish as a Foreign Language


## **Presented by:** Victoria Narbone

**Mentor:** Anne Marie Guerrettaz **Campus:** Pullman

**Majors:** Humanities: General Studies, Psychology

**Category:** Social Sciences

**Co-author:** Anne Marie Guerrettaz


Pedagogical materials — such as textbooks, handouts, PowerPoints, and more — are a key component in teaching and learning Spanish as a second language (L2) (see Larsen-Freeman, 2014; Tarone, 2014). Although pedagogical materials are seen as crucial to Spanish language teaching/learning, few studies have investigated how pedagogical materials affect foreign language classrooms, including students and teachers (Guerrettaz & Johnson, 2013). The *goal* of this study was to uncover how pedagogical materials afford opportunities for students to acquire Spanish as a second language. A critical component of this is understanding which of those classroom materials best motivate students to speak the target language.

Participants were university students and teachers of Spanish as a foreign language in the US. For the current poster, we draw from our larger national study of Spanish as a foreign language in the US that involved 16 focus groups and 94 participants; results focus on a subset of that data which includes:

1. Written focus groups artefacts (5) collaboratively produced by 26 student participants working in groups of 5-8. Participants were tasked to rate the materials they used in class using a 1-10 Likert scale (1 being “not engaging at all” and 10 being “very engaging”); and,
2. Traditional interview-style data produced during some of these same focus groups. For this second type of data, we centered on 5 particular focus groups comprised of students taught by 2 highly experienced instructors.

These data were triangulated with classroom observations and recordings.

Results from this study revealed that the following pedagogical materials have reportedly motivated them to use Spanish more frequently in their language studies: 1) worksheets, 2) journaling guides, and 3) games (e.g., Taboo, Bingo, Charades). Interestingly, 4) many students from a particular class rated their Spanish instructor as the learning material that most positively impacted their Spanish learning. This speaks current debates in language pedagogy research regarding extended definitions of pedagogical materials, some of which point to language instructors and their non-verbal, gestural communications as a form of pedagogical materials (Matsumoto, 2019). Findings in this study have implications for foreign language classroom practice and materials use and development.

**Poster # 164**

# Irony in Online Discourse: Confusion in the YouTube Comments


## **Presented by:** Alicia Henson

**Mentor:** Michael Thomas **Campus:** Pullman
**Major:** Psychology
**Category:** Social Sciences
**Co-author:** Michael Thomas



There have been many studies on online communication in the field of linguistics, but not many that focus on communication in the comments section. The comments section can facilitate discussion on important topics, or it can be used to spread misinformation or general incivility. Sarcasm is common in online comments and may lead to confusion or hostility. To better understand the effect of sarcasm and how its meaning is negotiated, this project will qualitatively analyze sarcasm in 45 YouTube comment chains. This project defines sarcasm as a statement whose literal evaluation implicitly contradicts its intended evaluation for a humorous, negative, or mocking effect. Only comment chains with two or more participants will be considered and variables of interest are the targets of the sarcastic comment, whether it's a positive or negative evaluation, and different types of responses to the sarcastic comment. Expected results are that confusion and hostility will be common responses to sarcastic comments, but some sarcastic comments may also lead to constructive discussion. Most young people use social media to get involved with important issues, and sarcasm is a commonly used communication style among young people on social media, which makes it important to understand sarcasm's role in online communication.

**Poster # 165**

# Nickel Tolerance Adaptation of Mesorhizobium


## **Presented by:** Chris Dexheimer

**Mentor:** Stephanie Porter **Campus:** Vancouver

**Major:** Biology

**Category:** Organismal, Population, Ecological, and Evolutionary Biology

**Co-authors:** Miles Roberts, Stephanie Porter, Angeliqua Montoya, and Camille Wendlandt



*Rhizobium* soil bacteria can fix nitrogen for its host plants, typically legumes species. The amount of nitrogen a strain can fix and provide to its host varies based on factors such as host preference, abiotic and biotic conditions. Bacteria that are locally adapted to their soil environment may confer a higher host fitness. An interesting adaptation the rhizobium genus *Mesorhizobium* can have is tolerance to heavy metals such as nickel. Nickel can have a similar effect as antibiotics, where higher levels can limit or prevent growth and replication of bacteria. Some legumes, such as the *Acmispon* genus, thrive in nickel rich serpentine soil where other plants cannot survive. The Porter lab has a collection of diverse *Mesorhizobium* strains gathered from two native *Acmispon* hosts in Oregon and California with analyzed soil data and includes 300 strains with whole draft genomes. One host plant, *A. brachycarpus* appears to tolerate harsher serpentine environments than *A. wrangelianus*. While both hosts associate with *Mesorhizobium*, different levels of fitness are conferred. If host survival is enhanced by their symbiont, then do strains in heavy metal rich environments have higher tolerance to nickel than those found elsewhere? To address this question, I will test the Ni tolerance of 1400 strains from the *Mesorhizobium* collection using a minimum inhibitory concentration (MIC) assays. The MIC is the lowest concentration of nickel, which prevents growth of the bacteria. Each assay consists of transferring small volumes of strain inoculum from a 96-well microplate, using a microplate replicator tool, on to daughter plates containing nickel enriched nutrient agar. The concentration of nickel ranged stepwise from 0 mM to 5 mM by 1 mM increments. This ensures that the most nickel tolerant strains will grow at the upper range and moderate tolerance would be witnessed mid-range. Each strain's tolerance was measured at 2 set intervals. Soil chemistry data of collection sites were used to determine if there is a correlation between soil nickel concentration and strain MIC. This data will be used in a larger experiment to help identify the mechanism for high nickel tolerance in *Mesorhizobium* and sequence the genes responsible.

**Poster # 166**

# Pepck Enzyme Increases Photosynthetic Rate in an Alternating Light Intensity Environment in Maize


## **Presented by:** Hannah Back

**Mentors:** Patrick Ellsworth and Asaph Cousins **Campus:** Pullman
**Major:** Zoology
**Category:** Molecular, Cellular, and Chemical Biology
**Co-authors:** Asaph Cousins and Patrick Ellsworth



C4 photosynthesis evolved a $CO_2$ concentrating mechanism to increase photosynthesis under low $CO_2$ environments. In the $CO_2$ concentrating mechanism, initially $CO_2$ is converted into a C4 compound in the mesophyll cells by phosphoenolpyruvate carboxylase (PEPC) and then transported to the bundle sheath cells where $CO_2$ is released by a decarboxylating enzyme, one of which is phosphoenolpyruvate carboxykinase (PEPCK). As a result, $CO_2$ concentration in the bundle sheath near Rubisco is about 10-fold higher than ambient $CO_2$ concentration. C4 species can be divided into three biochemical subtypes based on the decarboxylating enzyme used. However, maize principally uses NADP-ME but also uses PEPCK in a minor secondary decarboxylating pathway. The role that PEPCK plays in maize is not well understood, but it has been hypothesized to be important in maintaining higher photosynthesis under variable light conditions. To test the importance of PEPCK in photosynthesis under variable light conditions, we compared various photosynthetic parameters between wildtype and mutants lacking functional PEPCK in maize. Gas exchange measurements to measure photosynthetic rate were made under varying light intensities using the LICOR 6800. Photosynthetic response to intercellular $CO_2$ concentration was not affected by PEPCK nor was maximum photosynthetic rate. Photosynthetic carbon isotope discrimination also did not change between wildtype and mutant plants under multiple light intensity levels. In contrast, in an experiment to test the effect of photosynthetic rate under alternating high and low light intensities, wildtype maintained higher photosynthetic rates at high light intensities but not at low light intensities. Light intensity in the lower leaves in the plant canopy alternates between shade and full sun. During periods of high light exposure, PEPCK pathway increases photosynthetic rates, so that overall photosynthetic output of these leaves is greater.

**Poster # 167**

# High Value Vanillin Production from Waste Lignin for Commercial Bioproducts


## **Presented by:** Jasmine Che

**Mentor:** Bin Yang **Campus:** Tri-Cities
**Major:** Biology
**Category:** Molecular, Cellular, and Chemical Biology
**Co-author:** Xiaolu Li



The 2nd generation biorefinery process is focused on using lignocelluslose as feedstock by extracting sugars from two of its main components, cellulose and hemicellulose, for biofuel production. However, lignin, its third main components, is usually underutilized and generates a large quantity of waste because it is extremely difficult to break down into useful products.The bacteria R*hodococcus jostii* RHA1 is a promising candidate for lignin valorization which possesses essential lignin-degrading enzymes and vanillin catabolic systems. Valorization of lignin will increase the carbon efficiency of the whole process. Production of valuable chemicals from lignin is one of the approaches to upgrading lignin. One of these valuable products derived from lignin is vanillin considering its similar aromatic structure to that of lignin. The natural vanillin price is comparatively higher than the synthetic product. The natural vanillin price is sensitive to natural, economic, and political issue; therefore, its price is very unstable. Development of new chemical routes have been introduced to overcome those problems. Vanillin is used in various fields including food, cosmetics, and pharmaceutical industries.The efforts of this study are to increase the value of lignin by successfully breaking it down through the use of the enzymes possessed by R. *jostii* RHA1 and taking the valuable bioproducts that are useful in other industries.

**Poster # 168**

# Infectiousness and Susceptibility in the Ranavirus-Wood Frog System


## **Presented by:** Madelyn Kirsch

**Mentor:** Jesse Brunner **Campus:** Pullman

**Major:** Zoology

**Category:** Organismal, Population, Ecological, and Evolutionary Biology

**Co-authors:** Jesse Brunner and Erin Keller



Epidemics of emerging amphibian diseases have become more prevalent in the last thirty years, potentially due to an increase in human-induced stressors causing chronic stress. A key question for understanding the impact of stressors on epidemics is whether immunocompromised animals are more or less infectious. This study tests whether infectiousness correlates with susceptibility in chronically stressed individuals, using the wood frog-ranavirus system. Ranaviruses infect cold-blooded invertebrates and cause amphibian die-offs around the world. Wood frogs (*Lithobates sylvaticus*) are widely distributed and well-studied amphibians in North American that are frequently infected with and may be particularly susceptible to ranaviruses. Their susceptibility may be impacted by many factors; in this study, we focused on three potential stressors: elevated temperature, elevated salinity, and increased density. Wood frog tadpoles were housed in different populations corresponding to manipulations of these three stressors. At five different time points over the course of the summer, one tadpole per population was exposed to the virus. The infectiousness of each tadpole was assessed twice after inoculation by swabbing the skin, filtering shed viral DNA from the water, and bringing a different (naïve) tadpole into contact with it for approximately one second. This naïve tadpole was then observed for 20 days post-contact for symptoms of the virus. DNA will be extracted from the swabs, filters, and tissue samples from the focal and naïve tadpoles, and the amount of viral DNA in each sample will be measured. We hope to regress one or several measures of infectiousness in each population type and trial against susceptibility data from a simultaneous experiment. While our results will be most relevant to amphibian conservation, this system can also help in understanding vertebrate diseases and how environmental effects can interact with them in complex ways.

**Poster # 169**

# Functions of Social Media Platforms

**Presented by:** Fabian Rangel, Jared Bradley, Olivia Severino, and Rachel Attwood

**Mentor:** Mina Park **Campus:** Pullman

**Majors:** Strategic Communication, Communication and Society

**Category:** Social Sciences

**Co-author:** Mina Park

Social media is used by a vast variety of people on a daily basis to promote, share, and even apologize whether it be a video or a message. With this research, we sought to find factors within social network sites that caused a visible effect on social norms for that site. This is significant because our data can show that the factors on a site do create a culture that users are a part of. To collect data, we identified thirteen influencers who (influencer selection process). We then identified two identical posts on different platforms such as an apology on YouTube and the same apology on Twitter. We then coded the top ten comments for each across Youtube, Twitter, and Instagram. Thus, a total of twenty-six posts and 260 comments are included for the content analysis. Four coders coded the affective tones (positive, negative, or neutral tones), the characteristics of the commenters (i.e. influencer or non-influencer), the interaction to a comment (number of replies and likes it received), relevance (to the content of the post), and whether it was a joke or a meme. Our results showed that, as expected, the same content in different platforms led to different responses. For example, Twitter saw a split between negative and positive comments. The other two SNS received more positive comments, which is likely due to Instagram artificially sending influencer's comments to the top, regardless of their like count. Youtube also has a dislike button, something the other two sites do not, so its responses were more representative of how the general audience received the video. An excerpt from a video (posted to Instagram) seemed to get more of a positive response than the whole video (posted to Youtube). There was a significant correlation between influencers and the affective tone of a comment. To conclude, the different functions on social media platforms have affected the reactions that the content received.

**Poster # 170**

# Usage of Unmanned Aerial Vehicles to Score Damage from Beyond Chemical in Wheat (*Triticum aestivum* L.)


## **Presented by:** Kayla Beechinor

**Mentor:** Michael Pumphrey **Campus:** Pullman

**Majors:** Agricultural Biotechnology, Field Crop Management

**Category:** Applied Sciences

**Co-authors:** Zhou Tang and Michael Pumphrey



Unmanned aerial vehicles (UAVs) are becoming increasingly popular in agriculture due to their ability to collect a large amount of data on a crop in a short amount of time. The major dilemma of using UAVs is that pulling data from the images and finding how to correctly utilize the data can be difficult. This research was conducted to find when to fly a UAV to collect images that would be beneficial to the Spring Wheat Breeding Program at Washington State University. Currently, a lot of time is spent on scoring damage done to wheat plots from the use of the herbicide, Beyond. This research focused on finding how many days after application of the Beyond chemical is ideal for the collection of data on damage in the plot through using a UAV. Through using wheat trials located in two different locations and a DJI Phantom 4 Pro drone with a Double 4K Multi-Spectral Ag camera, images from the trials were collected for this project. From this, different programs including QGIS, Python, GRID and R-studio were used to pull data from the images and analyze it. Knowing the ideal time frame to fly the UAV to collect data after application of Beyond chemical will allow for a more precise score to be taken of the plots. In the future, scores of damage in wheat plots from other chemicals can be collected through also using this method. The application of the UAV will contribute to saving time, labor, and money in the breeding program.

**Poster # 171**

# Tissue Specific RNAi Pathways Affecting Lipid Droplet Size Measurements


## **Presented by:** Courtney Sheldon

**Mentor:** Jennifer Watts **Campus:** Pullman
**Major:** Biochemistry
**Category:** Molecular, Cellular, and Chemical Biology
**Co-author:** Jennifer Watts



Lipid droplets are cellular organelles that store fats. In humans, obesity is associated with enlarged lipid droplets. The goal of this project is to use the model organism *C. elegans* to study whether lipid metabolism genes expressed in tissues, such as skin, can affect lipid droplet size in the intestine. For this project we used RNAi to knock down the *fat-7, daf-22, sbp-1,* and *sams-1* genes in specific tissues to see the consequences on intestinal lipid droplet size. In whole body knockdowns, we previously showed that *fat-7* depletion lead to small lipid droplets, *daf-22* depleted worms often have one large lipid droplet, *sbp-*1 knockdowns have smaller lipid droplets, and that *sams-1* knockdowns are associated with large intestinal droplets. We are currently examining whether intestinal lipid droplets are affected by knockdown of these genes in other tissues, such as skin or muscle. These studies will provide insight into tissue-specific regulation of lipid homeostasis genes and lipid droplet formation.

**Poster # 172**

## Material Science Engineering


### **Presented by:** Abdulljwad Almutawah

**Mentors:** Yiran Guo and Juejing Liu **Campus:** Pullman

**Major:** Bioengineering

**Category:** Engineering and Physical Sciences



Electrospinning is a protein fiber production method which uses electric force to draw charged threads of protein solution creating fibers in different sizes. The existing method of electrospinning the protein-based solution results in having normal distribution of fiber diameters, where most of the fibers are in medium size . This distribution of fibers effect the pressure difference and the fiber efficiency. In previous work, the focused was to build a green gradient air filter by electrospinning Zein protein with normal distribution. In this work, the fibers mythology is the main focus to improve air filtering and other uses of zein protein fiber. However, to avoid having normal distribution, Anionic, Cationic, and Nonionic surfactant has been added to the Zein protein solution. Those surfactants change the morphology of the protein fibers which show a bimodal distribution where there are at least one order of magnitude difference between the two diameter peaks. Producing Air filter is one of the applications for spinning Zein protein and adding surfactant increases the filtration efficiency and decrease the pressure difference.

**Poster # 173**

# Consequences of Different Tendon-Bone Attachment Designs


## **Presented by:** Nicholas Ozanich

**Mentor:** David Lin **Campus:** Pullman

**Major:** Bioengineering

**Category:** Engineering and Physical Sciences

**Co-author:** David Lin



The purpose of the research that I will be conducting under Dr. Lin is to examine and elucidate the possible mechanical advantages of the tendon organization in kangaroo rat tails. The specific characteristic of the kangaroo rat tail under examination is that they have a tendon attachment site at nearly every vertebra (n=26) for four separate 'tendon highways.' They have no muscles in their tail: thus, they rely on tendons stretching from the base of their tail to the tip for much of the fine motor control they need to survive in the wild. I am currently constructing two physical models: one with tendons attaching at the most distal vertebra, and one where tendons attach at every other vertebra. I am using dental floss (to mimic tendons) and six 3D printed tail vertebrae, obtained from my earlier work in Dr. Lin's lab, along with other supporting materials to construct each model. The goal of the design is to have two models that can be moved in any direction by pulling on a combination of the four tendon highways from the proximal end. The primary methodology used will be to pull the tendons (or a combination) a certain distance to see how much deviation from the straight tail is present. By contrasting results of the two models, we aim to establish a motive for different systems of tendon attachments that may potentially explain the evolution of tail mechanics.

**Poster # 174**

# Tailoring Brand Voice to Consumer Culture on Social Media

**Presented by:** Andrew Wood, Celeste Harms, Dean Richey, and Torin Sundburg

**Mentor:** Mina Park **Campus:** Pullman

**Majors:** Communication and Society, Journalism and Media Production, Marketing

**Category:** Social Sciences

**Co-authors:** Brittany Kesic, Cindy Choy, Clifford Berkman, Feyisola Olatunji, Martinus Dewa, and Su Ha

One of the most effective means today for brands to communicate with their consumers is through social media platforms like Twitter and Instagram. Learning how to adapt to different platforms is becoming more important for brands as each platform has a different culture. This study examines how brands can tailor their voice to each site and reach their target market directly, and how their consumers respond through likes, retweets, replies and comments. Focusing on popular fast food brands -- Wendy's, Burger King, and McDonald's—four coders analyzed the 20 most recent posts and top 10 comments on their official Twitter and Instagram accounts. The coding scheme includes types of promotion, affective tones, persuasive appeal (i.e. humor appeal), and use of social media functions (i.e. use of video). Our findings revealed that brands tend to use a more neutral tone on Twitter (i.e. "breakfast arrives on 3/2") and a more positive tone (i.e. "celebrate with this iconic shake!") on Instagram. We also found that on Twitter, tweets with a more positive tone correlated with less retweets and tweets with a negative tone correlated with more retweets. Use of a negative tone is also correlated with more replies, but did not show a significant relationship with number of likes. Use of a negative tone (i.e. Wendy's ridiculing McDonald's lack of reply to their tweet by posting, "Guess they're gonna make us pull forward and wait,") indicates that people are more likely to share the content but not "like" it. We were also surprised to find that there was no relationship between brand promotion and number of likes. Companies seemed to recognize this by keeping their brand promotion posts to a minimum. Even when tweeting brand promotion content, the tweets that were best received (as indicated by number of likes, retweets, and replies) were those that incorporated humor instead of strictly serving as an advertisement (i.e. a satirical vintage-style video). We believe this research has valuable practical implications by showing brands how they can tailor their content to best appeal to and capture their target market on both Twitter and Instagram.

**Poster # 175**

# Castor

**Presented by:** Emily Feuerstein, Kajal Sabhaya, Sofiya Chayka, Yatin Singla, and Zachary Larson

**Mentor:** Howard Davis **Campus:** Pullman

**Majors:** Bioengineering, Computer Science, Finance, Neuroscience, Strategic Communication

**Category:** Engineering and Physical Sciences

**Co-authors:** Alicia Hegie, Ray Combs, Yatin Singla, and Howard Davis

An estimated 5 percent of Americans—more than 13 million people—have post-traumatic stress disorder (PTSD) at any given time. People with this disorder experience stress-induced anxiety attacks and aggressive outbursts. These attacks are uncontrollable and can be experienced anywhere from multiple times a day to once a week by 70-80% of patients. These attacks cause strains on the patient's personal relationships; limiting their social and career opportunities. Currently, there is no way for people suffering from PTSD to realize they are going to have an anxiety-induced episode. To help mitigate this problem, we are developing a tool called Castor. This tool is a machine learning application compatible with IOS. Castor uses ECG data from the Apple watch to calculate heart rate variability and in turn, uses biometric reading to predict stress-induced attacks. Stress is directly linked to heart rate variability (HRV) due to the effects of the autonomic nervous system. A low HRV value decreases the body's defense mechanisms against stress, causing a cascade of nervous system events. The algorithm of the HRV is centered around a Root Mean Square of the Successive Differences (RMSSD) analysis with a single value output. Heartbeat data will be analyzed based on whether variability is low (unhealthy) or high (healthy). We will be calculating heart rate variability using ultra short-term analysis, which is a consistent calculation of data that is gathered in a <5-minute interval. By using this application, patients will be notified at least 1-minute prior to a stress-induced anxiety attack helping them take control of their social and professional lives.

**Poster # 176**

# Hood for Wind Ensemble


## **Presented by:** Lucas Blevins

**Mentor:** Gregory Yasinitsky **Campus:** Pullman

**Major:** Music Composition


**Category:** Arts and Design

Lucas Blevins, an ambitious music composition student at Washington State University, was commissioned in the Fall of 2019 to compose an original musical work for Director of Bands Tim Kilgore and his Corbett High Symphonic Band. At this writing, the piece, titled *Hood,* is still under development with preview drafts being read by the commissioning ensemble to great success. Blevins' writing represents the natural landscape and wildlife of Corbett, Oregon. Nestled between Mount Hood and the Columbia River Gorge, the area is known for its abundance of picturesque waterfalls and boundless forests. The memorable melodies of *Hood* paint these scenes in the listener's mind; its harmonic progression moving them like new buds of Spring. In February, drafts of the piece were also read by Dr. Dan Pham and his WSU Symphonic Wind Ensemble, receiving high praise from faculty and Blevins' peers in the School of Music. Following a world premiere performance by the Corbett High Symphonic Band later this Spring, *Hood* will go on to be recorded and published with its sheet music made available for sale to the general public.

**Poster # 177**

# Back to the Future: Methods to Recover Historic Rhizobial Strains from Herbarium Specimens


## **Presented by:** Amanda Antoch

**Mentor:** Renee Petipas **Campus:** Pullman
**Major:** Biochemistry
**Category:** Organismal, Population, Ecological, and Evolutionary Biology
**Co-authors:** Renee H. Petipas and Maren L. Friesen



Preserved plant specimens can provide a better understanding of coevolutionary patterns by acting as a snapshot of plant/microbe interactions throughout time, which may indicate the trajectory of coevolution in the Anthropocene. The revival of herbarium specimens could allow for manipulative experiments to study historic patterns, however it is unclear if these historic samples can be revived. This set of experiments examined whether the manipulation of components in bacterial growth media could result in the revival of historic rhizobia from herbaria. We selected nodules from *Medicago lupulina* specimens collected from five counties in Washington State from 1950-2015. We performed a culturing experiment using seven different types of media: Luria broth (LB), tryptone yeast (TY), yeast mannitol (YM), dilute YM, YM plus extra calcium, YM plus extra salt, and YM plus pyruvate. We were able to recover historic bacteria from three specimens, which were collected in 2015, 2004, and 1950. We inoculated plants with successfully revived historic and fresh strains to confirm nodulation and compare growth benefits. We confirmed the identity of isolated cultures with Sanger sequencing. Bacteria from fresh nodules grew equally well on all media except Luria broth ($\chi^2$=22.56, P=0.001). Bacteria from historic, preserved nodules grew significantly better on tryptone yeast ($\chi^2$=6.85, P=0.03). We determined that historic strains of bacteria can be recovered from herbarium specimens but the time frame may be limited to the recent past, and the most effective media for recovering bacteria from historic nodules was tryptone yeast extract (TY) media. Future steps include an additional culturing experiment using liquid media broth to encourage revival of historic rhizobia within the nodule prior to plating on solid media. The successful recovery of historic bacteria from herbaria indicated that preserved herbaria samples can be effective resources of material for experiments to better understand plant-microbe relationships and their coevolution.

**Poster # 178**

# The Influence and Perceptions of Online Celebrities and Influencers

**Presented by:** Colin Brown, Emily McCallum, Kyle Shurm, and Olivia Harnagy

**Mentor:** Mina Park **Campus:** Pullman

**Majors:** Communication and Society, Strategic Communication

**Category:** Social Sciences

Our research was designed to examine the relationship between influencers on Instagram and their audience. This was significant because of the large influence social media portray in our daily life. We really wanted to look further into what we are constantly consumed by and those who are influential within that. With this, we wanted to look at a large scale of influencer levels to see how they would correlate. In particular, we examined whether celebrities with millions of followers have more of a negative relationship with their followers than influencers with fewer followers because of the impersonal and unrealistic presence they portray. In addition, we investigated whether receivers are more likely to have a negative impression of the information if a social media profile has a large following and impersonal promotional posts. We chose to look at influencers that our team was interested in as well as influencers that are well known and that the similar age demographic would be aware of. This includes influencers ranging from 30,000 + followers into the many millions. Once established we analyzed their profiles and looked at their content, promotions, bios, followers, following, etc. We chose to analyze one photo from each influencer and look at the likes, comments, replies, favorability, and overall engagement rate. The analysis revealed that influencers, in fact, tend to interact positively with their followers, on both small and large scales, contrary to the expectations. The larger influencers tend to receive mostly positive comments, and smaller influence also receives positive comments while also interacting with their followers through replies and likes. We also learned that verified users (i.e. Kim Kardashian or Gigi Hadid) receive much more interaction on their posts. Verified users also experience large amounts of interaction if they comment on other users' posts. From these findings, we can conclude that the interaction on smaller influencers posts was very similar to that of larger influencers, just on a different scale. This implies that our findings showed an overall positive correlation between influencers and their audience, concluding that verified influencers have a more positive influence on their audience than expected.

**Poster # 179**

# Scary Coronavirus: How Social Media Affects People's Perception

**Presented by:** Anh Nguyen, Hanqian Xu, Jaycee Joganneck, and Torin Filkins

**Mentor:** Mina Park **Campus:** Pullman

**Majors:** Communication and Society, Journalism and Media Production, Strategic Communication

**Category:** Social Sciences

**Co-author:** Anita Vasavada

“Coronavirus” is the most searched keyword on the internet recently, when the spread and impact of this pandemic reached global levels. While correct information about this pandemic, such as causes, symptoms, and treatment can be found, fake news (i.e. the false alarm in France) and misinformation about Coronavirus have been widely shared mostly due to fear and uncertainty. This study aims to reveal how social media portrays the coronavirus and how those portrayals negatively affect people, by changing the way they view this pandemic and their safety. We focused on YouTube, the most popular video-sharing platform and media outlets for demonstrating Coronavirus. Using content analysis, four coders analyzed a total of 12 videos and 600 comments (50 comments for each video). In particular, we examined video features (i.e. likes, dislikes, replies, affective tone) as well as characteristics of comments (i.e. affective tone, emotions, etc). Our findings show a positive correlation between effective tones of the videos and comments. In other words, people's reactions to the video are consistent with the affective tone of the comments. We also observed more negative comments, which accounted for 60% of the total and the other 30% were positive. The findings support the argument that the content in Youtube videos affects the way people view the pandemic negatively. In addition, we found other results. The comments expressing sympathy receive most likes, but the following emotion is disgust, which made up 30% and 25% of the emotions, respectively. The results have important implications for the understanding of the influences of social media sites and people’s changes in perceiving an ongoing issue – Coronavirus and their safety for future research.

**Poster # 180**

# The Effects of *Coxiella burnetti* Against Hemocytes from *Drosophila*


## **Presented by:** Siobhan Choong

**Mentor:** Alan Goodman **Campus:** Pullman

**Major:** Bioengineering


**Category:** Molecular, Cellular, and Chemical Biology


Hemocytes are blood cells that circulate in the plasma of the hemocele of insects. That play an important role in the immune response when infected. The goal of this experiment is to observe the effects of pathogenic infection to hemocytes from the *Drosophila* fly line AG46. Using the *ex vivo* infection method from a previous study made in the lab, 200 *Drosophila* larvae were obtained from the line AG46. This number of larvae could produce up to $3x10^6$ live hemocytes for testing. The larvae were about 6-7 days old from the start date of when the adult flies were moved into the vial to the next week when the larvae were large enough to collect but had not yet started their cycle into the cocoon phase. Hemocytes are injected within 30 minutes of being collected. The hope of this experiment is to observe the hemocyte response and build another experiment based off of the found results.

**Poster # 181**

# Using the *Drosophila* Genetics Reference Panel to Identify Host Factors Associated with *Coxiella burnetii* Infection, with Emphasis on the Schnurri Gene


## **Presented by:** Benjamin Hollenberg

**Mentor:** Alan Goodman **Campus:** Pullman

**Major:** Microbiology

**Category:** Organismal, Population, Ecological, and Evolutionary Biology

**Co-authors:** R. Marena Guzman, Zachary P. Howard, Ziying Liu, Stephen N. White, and Alan G. Goodman



The pathogen *Coxiella burnetii* is an obligate intracellular, gram negative bacterium, and is a causative agent for the zoonotic Q fever. While it has been shown that there is a link between human/animal genotype and effectiveness of *Coxiella burnetii* infection, research has not yet narrowed down exactly which genes are responsible for variations in immunity to *Coxiella*. In this study, the *Drosophila* Genetics Reference Panel (DGRP) was utilized in order to identify the genetic-variants that could be significant in affecting susceptibility to *Coxiella burnetii* infection. Genome-wide association study (GWAS) was used to obtain more specific information about these genetic variations, and it was discovered that the gene *schnurri* contained 9 out of the 17 significant genetic variants found significant in female-only hazard ratios. The *schnurri* gene, which is orthologous to the *HIVEP2* gene found in humans, is responsible for encoding a zinc finger transcription factor that inhibits the Brk gene and has been implicated in bone morphogenetic protein (BPP) signaling. This BPP signaling has already been shown to regulate the *Drosophila* immune response when the organism is infected with *Salmonella*. The specific *schnurri* sub-types in this study are shn[KG01182], and shn [1]. According to preliminary data from mortality curves, shn[KG01182] flies had no significant immunity against *Coxiella burnetii*, but shn[1] flies showed a significant increase in effectiveness against *Coxiella burnetii* compared with a wild-type control. If shn[1] continues to show significant immunity, we'll examine the gene further to determine more specifically how it fits in the immune response pathway of *Drosophila*. By furthering our knowledge of this pathway, we'll be able to better predict the spread of disease, and eventually learn how to better intervene therapeutically for those already affected.

**Poster # 182**

# Environmental and Economic Perspectives from Local Intag Ecuadorian Population on Development Interventions


## **Presented by:** Hilary Zuniga

**Mentors:** Michael Goldsby and Caitlin Bletscher **Campus:** Pullman

**Majors:** Environmental and Ecosystem Sciences, Philosophy

**Category:** Organismal, Population, Ecological, and Evolutionary Biology

**Co-author:** Caitlin Bletscher, and Michael Goldsby



When addressing the idea of sustainable development and it's interventions towards poverty and deprivation-stricken countries, a practical analysis should examine the practice as a whole. This should be done by taking into consideration those in a power position- the 'outsiders' implementing the development practice, as well as the residents of underdeveloped rural communities. An issue arises with the possibilities of interveners constructing their own realities of these communities from a distance, possibly for their own convenience. In this study, the evolution and definition of "sustainable development" is addressed as well as its implications on the interventions implemented. "Intervention" is defined in this research as an attempt to aid in the environmental or economic sectors of the third-world country by implementing solutions with the goal of helping either the development of the country, or the welfare and livelihood of locals from the region. This study will draw from existing, yet limited literature and results from implemented solutions in third world-countries with a local narrative and analyze how they compare to the perspectives of Ecuadorians from the Intag Valley regarding non-governmental organizations (NGO) development agencies. The goal will be to identify possible inconsistencies between the proposed goals of NGOs and local priorities and views. The local perspectives of residents from the Intag Valley on their local environmental and economic wellbeing were analyzed and compared to the perceived priorities set forth by the development agencies. A series of individual interviews were conducted through a convenient sampling of adult Intag residents. Interview questions explore their perspectives on personal economic wellbeing and their natural environment before and after the presence of a developing agent while exploring other possible connections with other sectors that make a community- political, social, and cultural. The effectiveness of outside interventions when it comes to economic and environmental wellbeing of third world countries will be explored as well as the perceived ethical dilemmas and moral responsibilities that accompany economic and environmental development work. Identifying and further exploring the effectiveness and ethics behind development in third world countries is crucial in understanding whether 'good' is truly being done, rather than harm.

**Poster # 183**

# Manganese Separation and Particle Size Effect on Ammonia Production


## **Presented by:** Constance Kirby

**Mentor:** Peter Pfromm **Campus:** Pullman
**Major:** Chemical Engineering
**Category:** Engineering and Physical Sciences
**Co-author:** Wrya Mohammadi



The production of ammonia is essential to keeping up with the world's food production. 40% of the world's food would not exist without the ammonia production which is done through the Haber-Bosch process. This process revolutionized our capacity to feed the world and allow us to enrich fixed nitrogen depleted soils to grow more and larger produce. One of the primary issues with the Haber-Bosch process is that it is incredibly energy intensive. By some estimates, about 2% of the world's commercial energy is consumed via fossil fuels to produce ammonia through this very process. This presents us with using renewable energy to power the production of ammonia, however renewable energy often comes with fluctuations in power that can make a traditional Haber-Bosch reaction difficult to use effectively. This is where our intermittent process comes in.

One of the obstacles with our intermittent process is having a catalyst that works well at effectively activates ,or splits, the nitrogen gas while also being able to release from the catalyst after reacting with hydrogen to form ammonia. Manganese powder is able to form stable manganese nitrides (MnxNy) and is effective at splitting nitrogen at approximately 700 degrees Celsius. Since splitting requires activation sites, looking at how manganese particle sizes will impact the ammonia production will help optimize the usage of manganese as an effective catalyst. The hypothesis for this is that having smaller particles will result in an increase in the rate of ammonia production. Now to separate manganese powder on the micron scale, I utilized ethanol and settling methods to have an easy but controlled way of obtaining smaller particles for this research.

**Poster # 184**

# Towards an Understanding of Friesland's Village Organs


## **Presented by:** Thomas LeClair

**Mentor:** Jill Schneider **Campus:** Pullman

**Majors:** Biology, Music

**Category:** Humanities

**Co-authors:** Jill Schneider and Keri McCarthy



The province of Friesland in the Netherlands has an incredibly high density of churches and organs. Marked by a large number of small towns, the province has well over one hundred medieval churches, despite being considered relatively rural and of similar size to Whitman County. These churches and the pipe organs contained within them are critical parts of Friesland's history and have been landmarks on an otherwise-flat landscape for centuries. Over the course of the twentieth century, the Netherlands' experienced a dramatic shift in religious affiliations, with a sharp increase in the number of people with no religious affiliation. The resultant small congregations have had difficulty maintaining the historic buildings which they control, and funding to repair these registered monuments is finite. Several Dutch church buildings have been successfully converted into alternate uses, including libraries and apartments, maintaining the character of the village and preserving the church building. However, pipe organs are much more restricted in their use, and such renovations often result in the loss of these historic instruments. Despite the high cultural value and musicological value of these instruments, the English literature on the topic is nearly non-existent. This study investigated the historic and contemporary cultural value of village organs in Friesland through field and archival research. It specifically looked at the physical construction of instruments and their musical properties, comparing multiple villages throughout the province. It fills a gap in the modern English literature on the province and aims to raise awareness and conserve the history of these historic instruments.

**Poster # 185**

# To Germinate or not to Germinate: Using Increased ABA Hormone Sensitivity to Prevent Untimely Germination of Winter Wheat Before Harvest.


## **Presented by:** Drew Bowdish

**Mentor:** Camille Steber **Campus:** Pullman

**Major:** Agricultural Biotechnology

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Stephanie Sjoberg, Camille M. Steber, Tracy Harris, Kimberly Garland-Campbell, and Emily Klarquist



The purpose of this study is to improve preharvest sprouting tolerance by selecting for the ENHANCED RESPONSE to ABA (ERA8) gene in soft white winter wheat. Wheat grain can germinate on the mother plant if cool and rainy conditions occur before harvest, a problem called preharvest sprouting. Preharvest sprouting can cause major financial losses for farmers because it results in over-production of the enzyme alpha-amylase, leading to low falling numbers and problems with cakes that fall, bread that rises poorly, or sticky noodles. The plant hormone ABA increases seed/grain dormancy, leading to decreased germination capacity until dormancy is lost through a period of dry storage called after-ripening. Previous work increased wheat resistance to preharvest sprouting using a gene that increased sensitivity to ABA hormone. This gene, called ERA8, has been mapped to wheat chromosome 4A and is linked to single nucleotide polymorphisms (SNPs), 20, 17, and 29. ERA8 has been crossed to a number of varieties that have problems with preharvest sprouting susceptibility. This study will examine if selection for SNPs 20, 17, and 29 increase the ABA sensitivity of winter wheat. This is a first step towards using ERA8 to improve preharvest sprouting tolerance in wheat.

**Poster # 186**

# Reactive Oxygen Species Scavenging Mechanisms Combating Drought Stress in Wheat


## **Presented by:** Jessica Fisher

**Mentor:** Andrei Smertenko **Campus:** Pullman

**Major:** Genetics and Cell Biology

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Andrei Smertenko, Kathleen Hickey, Taras Nazarov, and Glenn Turner



Wheat is a global staple food crop; however, global wheat production is being threatened by drought. The frequency and intensity of drought events are predicted to intensify as a consequence of the climate change. Additionally, there is a decline in the availability of water for irrigation. Therefore, drought poses a major risk to food security and the best solution to address drought-induced food security risks is through breeding of drought tolerant wheat varieties. For breeding programs, a significant challenge remains the high genetic complexity of drought-tolerance trait. Drought severely affects yield due to the inhibition of photosynthesis.Under drought stress, plants synthesize abscisic acid hormone from roots where it travels to the shoots and causes stomata closure, limiting carbon dioxide gas exchange. Excess light energy cannot be used for photosynthesis and results in production of toxic reactive oxygen species (ROS), which deteriorates plant health. Plants deploy ROS scavenging system to detoxify ROS. Some scavengers can be found in a small organelle called the peroxisome. We can use peroxisome abundance as a proxy for internal ROS concentration since peroxisome abundance in cells increases under stress in response to ROS. We have found that, using enzymatic kinetics and Nitro BODIPY fluorescence, we can phenotype ROS scavenging on a population level. However, due to the genetic complexity of wheat, genetic markers of ROS scavenging are still unknown. We hypothesize that peroxisome proliferation is an adaptive stress response that protects cells from oxidative damages caused by accumulation of ROS under drought. In this research project, we have correlated catalase, an ROS scavenger, and nitro BODIPY fluorescence with peroxisome abundance in wheat. Next, we started measuring expression of peroxisome fission genes in wheat using real time qualitative PCR. Due to the genetic diversity of wheat, we use a less genetically complex plant Arabidopsis to identify novel genes that control peroxisome fission. Our work would facilitate breeding drought-tolerant crops to address global food security.

**Poster # 187**

# Materials Informatics for Predicting Thermal Behavior of NiTi Shape Memory Alloys


## **Presented by:** Orion Conroy

**Mentors:** Scott Beckman and Irmak Sargin **Campus:** Pullman

**Major:** Materials Science and Engineering

**Category:** Engineering and Physical Sciences



There has yet to be a good means of predictively engineering the thermal-mechanical response of SMAs; although, developing such an understanding should be possible from the literature, which is rich in published data. The goal of this project was to create a data science classification model that can determine if a NiTi shape memory alloy (SMA) will go through a single, double, or multi-step phase transformation on heating. The classification model uses differential scanning calorimetry (DSC) and data harvested from literature as input. The Python-based software inputs data, organizes it, trains a classification model, and plots the results.

**Poster # 188**

# Demographic Impacts of Contemporary Climate Change on the Greenland Shark (*Somniosus microcephalus*)


## **Presented by:** Claire Stein

**Mentor:** Richard Gomulkiewicz **Campus:** Pullman
**Major:** Zoology
**Category:** Organismal, Population, Ecological, and Evolutionary Biology
**Co-author:** Richard Gomulkiewicz



Microevolution is well understood today, especially with regard to antibiotic resistance. Little is known about the adaptive capabilities of long-lived organisms. This study investigates these adaptive capabilities within the Greenland Shark, the longest-lived vertebrate. Greenland Sharks have lifespans that can range over 500 years. Their environment is rapidly changing under the pressures of global climate change. Climate change is developing over a time period that is significantly less than a single individual's lifespan. The rapid change paired with a slow reproductive rate and long lifespan leaves the adaptation capability of the Greenland Shark in question.

This study utilizes a Leslie-matrix projection model in order to predict the persistence of the Greenland Shark. An initial Leslie-matrix model was created based on the stable stage distribution for a constant environment to determine the demographics of the current Greenland Shark population. Four separate models manipulated the initial vital rates to reflect the effects of climate change on juvenile survivorship, adult survivorship, fecundity, and time to maturation.

**Poster # 189**

# Melon Variety Trial 2019


## **Presented by:** Michael Dolieslager

**Mentor:** Carol Miles **Campus:** Pullman

**Majors:** Fruit and Vegetable Management, Organic Agriculture Systems

**Category:** Organismal, Population, Ecological, and Evolutionary Biology

**Co-authors:** Patricia Kreider, Ed Scheenstra, and Carol Miles



Melon (cantaloupe and honeydew) is an annual diploid plant belonging to the Cucurbitaceae family that serves as an important dietary component worldwide (Erickson et al. 2005). The trail was intended to explore the possibility of melon production in Northwestern Washington where it can be challenging due to the cool, short-season climates of the Pacific Northwest. Optimal soil moisture, temperature and pollination are all significant factors which influence melon growth, especially during the flower blossoming and fruit bearing periods (Gong et al. 2014). The primary objective of the melon screening experiment was to determine the adaptation of various melon cultivars to Northwestern Washington. Using high tunnels has the potential to produce melons earlier while also increasing yield and quality. Ten varieties of melon were grown in a high tunnel (30'x96' Semi Gable 5' On Center, Oregon Valley Greenhouses. Aurora, OR) and the adjacent open field. The experimental design was a randomized complete block with 2 replications and 5 plants per plot. Days to first harvest are between 68-80 days according to seed company's data. In 2019, days to first harvest were 92-105 in the high tunnel and 90-96 in the open field. Fruit weight and number per plant were generally two times greater for all varieties in the high tunnel than in the open field (Figs. 2, 3 and 4). Pongo had the greatest cumulative fruit weight in both the high tunnel and open field. Weight per fruit ranged from 1.1-2.9 lb in the high tunnel and 0.8-2.2 lb in the open field (Table 2). Fruit tended to be slightly larger in the high tunnel and overall average was 2.1 lb per fruit compared to 1.7 lb per fruit in the open field. Fruit in the high tunnel tended to be sweeter with an average of 12.3 Brix compared to 10.5 in the open field. The findings of this experiment support the potential of melon production in Northwestern Washington and have identified varieties that may be more apt to the regions climate. The experiment also demonstrated how use of a high tunnel and increase the potential of the traditional growing season.

**Poster # 190**

# Biocontrol of *Botrytis cineria*: Interactions with Native Vineyard Yeasts


## **Presented by:** Sullivan Nevada

**Mentor:** Patricia Okubara **Campus:** Pullman
**Major:** Food Science
**Category:** Applied Sciences
**Co-author:** Patricia Okubara



Grape growers and winemakers in the state of Washington focus on the production of premium wines that are globally recognized for quality. One challenge faced by growers and winemakers is the reduction in berry and wine quality caused by grape berry and vine pathogens. The pathogen *Botrytis cinerea* causes Botrytis bunch rot, a major disease in wet, cool climates, such as the Puget Sound area of Washington State. This disease is managed with fungicides, but the pathogen has been known to develop fungicide resistance. The **objective** of this project was to explore the biocontrol potential of native (wild or indigenous) yeasts as an alternative to fungicides. In this study, isolates of *B. cinerea* and native yeasts were obtained from infected berries from vineyards in the Puget Sound, and cultured on selective media in the laboratory. Yeasts and *Botrytis* were characterized using molecular identification methods. Analysis of genetic relatedness among 26 *Botrytis* isolates indicated that all were of the species *cinerea*. Six isolates of *B. cinerea* and ten isolates representing five species of native yeasts were selected from a preliminary biocontrol screen and tested in one-on-one interactions for growth inhibition of the pathogen. Assays were conducted under controlled conditions and optimized for the growth pattern of each *B. cinerea* isolate. The inhibition assays indicated that one "super" yeast isolate controlled all six *Botrytis*; the remainder were inhibitory to one or two of the *Botrytis*. On the other hand, two *Botrytis* isolates were resistant to inhibition by all except the "super" yeast. Furthermore, yeast isolates of the same species varied in their ability to control each pathogen isolate. These findings suggest that the Puget Sound *Botrytis* have inherent variability in their responses to native yeasts, such that no single yeast (with the exception of the "super" yeast) is able to control all *Botrytis* in the vineyard. Research will continue with one-on-one interactions on whole grape berries, which will represent a more holistic biocontrol assay. Future applications of this study include the identification of inhibitory mechanisms and biocontrol compounds used by the yeasts, and application to disease management in vineyards.

**Poster # 191**

# *Campylobacter jejuni* Requires the Cellular Protein Talin-1 to Invade Host Intestinal Cells


## **Presented by:** Abigail Hicks

**Mentor:** Michael Konkel **Campus:** Pullman

**Major:** Genetics and Cell Biology

**Category:** Molecular, Cellular, and Chemical Biology

**Co-authors:** Nicholas M. Negretti, Courtney M. Klappenbach, and Michael E. Konkel



*Campylobacter jejuni*, a bacterium commonly found in chicken, infects about 1.5 million people in the United States every year, making *C. jejuni* the country's number one bacterial cause of diarrheal illness. One out of every 1,000 cases of *C. jejuni* infection leads to Guillain-Barré syndrome, an autoimmune disease that results in paralysis. *C. jejuni* causes disease in humans by invading epithelial cells, which line the intestines. *Campylobacter* researchers continue to debate the mechanistic basis for *C. jejuni* invasion of epithelial cells. The focal adhesion, which is a dynamic structure involved in linking the cell to the extracellular matrix, may be exploited by bacteria to facilitate cell invasion. Talin-1 protein is encoded by the *TLN1* gene and links the actin cytoskeleton to transmembrane proteins that sense the extracellular environment. We hypothesized that *C. jejuni* internalization by human INT 407 epithelial cells is dependent upon the focal adhesion component Talin-1. To test this hypothesis, we reduced *TLN1* expression in human INT 407 epithelial cells using a lentiviral delivered shRNA that targets the 3' untranslated region of the *TLN1* mRNA. An immunoblot showed that knockdown of Talin-1 was successful. We then used a binding and internalization assay, along with confocal microscopy, to determine if *C. jejuni* were internalized into the Talin-1 knockdown cells. A significant reduction was observed in the number of *C. jejuni* internalized by the Talin-1 knockdown cells when compared to the wild-type cells. Experiments are now in progress to complement the *TLN1* gene in the knockdown cells to test if the observed results are specific to the reduced expression of *TLN1* rather than the lentiviral transduction insertion itself. The data collected to date support our hypothesis that Talin-1 is essential for *C. jejuni* internalization by human epithelial cells. These data implicate a new cellular protein in *C. jejuni* invasion. Further research will investigate the mechanism by which *C. jejuni* interacts with Talin-1.

**Poster # 192**

# The Relationship Between Self-Schema Psychological Need Themes and PTSD Symptoms


## **Presented by:** Delaney Adams

**Mentor:** Walter Scott **Campus:** Pullman
**Major:** Psychology
**Category:** Social Sciences
**Co-author:** Walter Scott



The purpose of this study is to analyze and compare the content of self-schemata, which are beliefs about the self, in individuals experiencing post-traumatic stress disorder (PTSD) symptoms. In addition, I will compare self-schema content in individuals exposed to trauma who develop subclinical PTSD, individuals exposed to trauma who do not develop PTSD, and individuals who neither experienced trauma nor PTSD. The study will take place through Qualtrics survey software via the internet, where participants are directed through a series of self-report surveys. Participants will respond to a Relational Self-Schema Measure (RSSM), another self-schema measure (Dysfunctional Attitude Scale; DAS), an anxiety and depression measure (ADDI-27), a PTSD symptom measure (PCL-5), and a trauma event measure (Life Events Checklist; LEC). It is predicted that participants with a greater number of post-traumatic symptoms will present higher levels of self-schema need frustration, lower levels of self-schema need satisfaction, greater variability in self-schema psychological need themes across self-schemata targets, and a greater number of negative cognitions (i.e. dysfunctional attitudes) even after controlling for depressive and anxiety symptoms. It is also predicted that compared to participants who meet criteria for the no trauma and trauma-only groups, participants who meet criteria for the PTSD group will report higher levels of psychological need frustration, lower levels of psychological need satisfaction, and greater variability in psychological needs across self-schema targets.