The 2023

SUMMER UNDERGRADUATE RESEARCH SYMPOSIUM

at Washington State University

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Summer Undergraduate Research Symposium 2023

Friday, August 4, 2023
8:00 a.m. – 1:00 p.m.
CUE Atrium and CUE 203

Symposium Schedule

8:00 a.m. – 9:00 a.m. CUE Atrium
Check-in and poster set-up

9:00 a.m. – 10:00 a.m. CUE 203
Welcome and keynote speaker
Keynote: Kristen Delevich, *Back to the future: from summer undergraduate researcher to neuroscience professor*

10:00 a.m. – 1:00 p.m. CUE Atrium
Students are at their posters, available to discuss their research and to answer questions

1:00 p.m. CUE Atrium
End of the Symposium - put posters away and say farewell

WASHINGTON STATE UNIVERSITY
Office of
Undergraduate Research

Summer Research Symposium 2023

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Organized by Research Program

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Poster Number: 1

Student Name (Home Institution): Tyler Medina (University of Redlands)

Project Title: Automatic Input Creator for the Quick Environmental Simulation (QES) System

Co-Authors: Behnam Bozorgmehr, Heping Liu

Summer Research Program: Environmental Engineering: Measurements and Modeling in the Pacific Northwest

Abstract: This research project aimed to enhance the Quick Environmental Simulation (QES) modeling platform by developing an external link to the ArcGIS Pro software package. The link automates the process of reading Digital Elevation Models (DEM) and other GIS data and trims them to fit the QES modeling platform. The Python code accepts the user inputs of the computational domain coordinates and a parent DEM file. Leveraging ESRI's ArcPy package, it creates a polygon vector layer of the target area; and generates a new DEM raster layer that has been clipped from the Parent DEM for the specified area. The resulting information can then be exported to a custom or default location determined by the user. By using this Automatic Input Creator, the efficiency of QES has been significantly improved through streamlining the process of trimming DEM's, and other GIS data. Additionally, the code also ensures better data consistency and accuracy. Users benefit from reduced interaction time with the ArcGIS or other GIS-based packages, enhancing their experience while working with QES. Moreover, the code marks the initial step toward developing a unified graphical user interface (GUI) for the QES system, promising further user-friendly enhancement in the future.

Poster Number: 2

Student Name (Home Institution): Khairul Islam (Washington State University)

Project Title: Enhancing Network Reception through Directional Antenna Synchronization

Co-Authors: Subhanshu Gupta, Sreeni Poolakkal

Summer Research Program: Phenomics Big Data Management

Abstract: In our research project, we focus on enhancing the strength and quality of a network or its signal reception through the implementation of a novel directional antenna synchronization technique. Our main objective is to achieve a more robust and reliable network connection by concentrating the capturing capabilities of multiple antennas in a specific direction. To accomplish this, we propose a distributed antenna system with antennas dedicated to capturing signals from particular directions simultaneously, giving faster transmission rates. It's all about getting that strength and more robust network connection, which means smoother communication and faster data transfers. This advancement in network reception promises better communication and data transmission capabilities, offering substantial benefits in various application scenarios. By optimizing the utilization of multiple antennas in specific directions, we are paving the way for improved network connectivity and enhanced user experience.

Poster Number: 3

Student Name (Home Institution): Briana Craig (Chapman University)

Project Title: Capturing COVID-19: Using Photography in Public Health Curriculum to Support Visual Literacy and Systems Thinking

Co-Authors: Molly L. Kelton, Braelyn Young, Elizabeth Grace, Kristin Saba Fisher, Robert W. Danielson, Alison J. White

Summer Research Program: Research in Interdisciplinary STEM Education (RISE)

Abstract: Out-of-school educational programs are essential to supporting young learners in their STEM knowledge, especially when empowered by the incorporation of art. Washington State University's Health Equity through Arts-Based Learning (HEAL) team implemented a curriculum titled Care and COVID at a community center in central Washington. This curriculum is a program for 3rd-5th grade youth designed to explore socio-scientific issues related to contagious disease prevention through photography, personal narratives, and hands-on STEM activities. The curriculum contains five two-hour sessions focusing on an introduction to photography, protecting oneself from contagious disease, protecting one's community from contagious disease, protecting the global community from contagious disease, and an art showcase (Grace et al., 2023). Our team serves rural, agricultural communities throughout Washington state that are predominantly Latinx

The HEAL team administered a series of pre/post assessments asking students to answer questions about photo composition, the science of pathogens, and describe their interests and emotions concerning art and science. They also conducted think-aloud interviews where students were asked to circle photos they connected to COVID-19 and explain their reasoning to a facilitator in small groups. By incorporating art into STEM curriculum, HEAL wanted students to make connections with their everyday lives and society through a practice called systems thinking.

We conducted quantitative analysis on the pre/post assessments data to understand students' major takeaways from participating in the program. We also conducted a qualitative analysis of the conversations from the image selection interviews and looked for common themes across the multiple recordings that demonstrated the different ways the students used systems thinking to connect the photographs to the COVID-19 pandemic. To do this we used a framework called "structure, behavior, function" to categorize the different components of the COVID-19 pandemic that the students were able to identify.

Poster Number: 4

Student Name (Home Institution): Penelope Hunter (Macalester College)

Project Title: A Theoretical Case Study of Dam Management Using Dynamic Linear Programming

Co-Authors: Michael Brady

Summer Research Program: Stakeholder Informed Modeling of Innovations in the FEW

Abstract: Historically, the US Army Corps of Engineers has managed dams focusing on rules curves with only hydroelectric power generation and flood control. As time has passed, many more purposes have been added including navigation, fish passage, environmental protection, and recreational water access. Optimizing dam water releases is difficult when some priorities constrain others or are conflicting. This has led to a greater deviation from rule curves. This research provides a first step by developing alternative optimization models that consider hydropower and flood control and will provide a foundation for building more complex models. I use dynamic linear programming to determine the optimal amount of water to release from a dam over time. I develop four separate models built to maximize the revenue from the hydropower generation of a theoretical dam based on the Priest Rapids Dam on the Columbia River. With these, I explore how dam operators struggle to determine how much water to release when due to the tension between electricity prices and how much water is left to release.

Poster Number: 5

Student Name (Home Institution): Rachel Hale (Northeastern Illinois University)

Project Title: “Why’d you stop me?”: The social space and environmental determinants of citations, warnings, and searches during traffic stops

Co-Authors: Joey Famularo, Destiny Leonard

Summer Research Program: Studying Race and Policing in the Complex Social interactions Lab

Abstract: Traffic stops are the most common type of contact between the police and the community. As such, the consequences of street-level officers’ decisions can be severe. Police Officers are empowered with the legal discretion to perpetuate practices that can result not only in discriminatory outcomes but can also end a human life. For instance, other studies have found that among stopped drivers’ people of color were, on average, searched more often than White drivers, White drivers are targeted more often for citations where the White-to-Black income ratio is higher, and people of color are more likely to have investigatory interactions with police officers. This study seeks to build upon these connections by contributing observational data at the level of a police-citizen encounter. Using unedited body-worn camera footage, this research applies systematic social event modeling (SSEM) to a random sample of 120 traffic stops in the pacific northwest region of the United States. Furthermore, this project explores the social space between officers and person(s) of interest as well as any environmental or material predictors of whether a traffic stop results in a citation, warning, or search. Results indicate variability based on individual scenarios or circumstances.

Poster Number: 6

Student Name (Home Institution): Abby Chriss (Bowdoin College)

Project Title: An Updated Age Calibration for Open Clusters using Red Clump Stars with Gaia DR3

Co-Authors: Guy Worthey

Summer Research Program: Waves in the Universe and Technology

Abstract: An updated age calibration for twenty-five young to intermediate-age open clusters in the Milky Way galaxy is presented. Gaia DR3 astrometry and photometry are used to estimate star membership probabilities and calibrate cluster ages. Membership probabilities for the stars surveyed in each cluster are estimated using Gaia DR3 right ascension, declination, parallax, and proper motion. The age indicator relies on the difference in median colors of the red clump and the red giant branch at the luminosity of the red clump, as introduced by D. Hatzidimitriou in 1991. This difference is independent of reddening and systematic errors in photometry and is relatively insensitive to metallicity. Finally, the results are compared to theoretical age predictions including isochrones and previous observational age calibrations.

Poster Number: 7

Student Name (Home Institution): Grace Tiegs (Lewis-Clark State College)

Project Title: Comparison of Summer Air Pollution in the Northwestern and Northeastern United States

Co-Authors: KC Wahl, Leah Johnston, Nancy A C Johnston

Summer Research Program: Environmental Engineering: Measurements and Modeling in the Pacific Northwest

Abstract: Air pollutants known as volatile organic compounds (VOCs) can be hazardous to human health. Sources of VOCs include industrial plants such as paper mills and oil refineries. To compare levels of VOCs in both rural and urban areas in the northeastern and northwestern United States, Tenax sorbent tubes were placed in multiple sites near industrial areas: Philadelphia, PA (South District), Lewiston, ID (Lewis-Clark State College), Pullman, WA (Washington State University). Samples were analyzed using Thermal-Desorption-Gas-Chromatography-Mass-Spectrometry (TD-GC-MS) to measure levels of Benzene, Toluene, Ethylbenzene, Xylenes (BTEX), and other VOCs. BTEX concentrations will be compared between sites and proximity to local pollution sources.

Poster Number: 8

Student Name (Home Institution): Sofia Aronovsky (Washington State University)

Project Title: The Relationship Between Microslips and Error Awareness: A Preliminary Study

Co-Authors: Nicole Whiteley, Maureen Schmitter-Edgecombe

Summer Research Program: Gerontechnology

Abstract: Objective: Self-monitoring of errors is necessary for accurate completion of everyday activities. Microslips are non-deliberate actions corrected before an error is fully committed. A measure of sustained attention modified to capture error-awareness (Sustained Attention to Response Task; SART) was used to measure microslips and error-monitoring. I hypothesized that a higher number of microslips would be related to better error-monitoring. The relationship with demographics (i.e., age, sex, and years of education) was also examined.

Methods: Thirty community-dwelling older adults were included from a larger parent study (M age = 70; SD = 8). Microslips were observed when participants physically caught themselves before committing an error on the SART. Error-monitoring was examined by dividing accurately recognized errors by total errors. Pearson correlations were run for microslips, error-monitoring, overall performance, and demographics.

Results: More microslips were significantly related to higher total correct responses on the SART ($r(28) = .39$, $p = .03$), specifically, fewer incorrect responses to target items ($r(28) = -.49$, $p = .006$) and more accurate self-corrections to errors ($r(28) = -.42$, $p = .02$). More microslips were also associated with fewer years of education ($r(28) = -.47$, $p = .01$) but not error-awareness, age, or sex. Error awareness was not significantly related to any demographic variables, but was related to fewer total errors ($r(28) = -.40$, $p = .03$), more correct responses to non-target items ($r(28) = .53$, $p = .003$), and fewer incorrect omissions to non-target items ($r(28) = -.65$, $p < .001$).

Conclusions: Microslips and error awareness were both related to better overall performance. This suggests that error correction, both before and after they are completed, are important to efficient performance. There were few relations with demographics. The lack of relationship between microslips and error-awareness suggests that researchers may consider conceptualizing and measuring the two separately.

Poster Number: 9

Student Name (Home Institution): Jonathan Daniel (Otterbein University)

Project Title: Exploring Take-Home Materials and Arts Integration in Quality STEM Learning

Co-Authors: Alison White, Molly Kelton

Summer Research Program: Research in Interdisciplinary STEM Education (RISE)

Abstract: Out-of-school learning is an important component of STEM learning and development. Access to different forms of STEM learning environments supports the development of STEM knowledge and interest across the lifespan. Washington State University's Health Equity through Arts-Based Learning
(HEAL) project combines art and science to provide out-of-school STEM learning that aims to develop systems thinking about sciences, present art as a tool for learning, and support interest in STEM-based fields.

One project under HEAL is the creation of take-home kits that use arts-based STEM learning to teach health science. This kit focuses on cell membranes and viruses. Learners use kit materials and household objects to create found-object sculptures that represent cell membranes and viruses. Learners explore that cell membranes are unsmooth, diverse structures with many components, and that viruses come in many shapes and sizes and use this diversity to 'stick' to cell membranes. This leads into one of HEAL's goals: the development of systems thinking, which involves understanding pieces of a concept and how they combine into a whole picture. We conjecture that the informal nature of the kits might aid in presenting STEM as a pervasive aspect of everyday life.

To research how families engage with kits, the team will host events where kits will be used. We will then conduct informal focus-group interviews to determine effectiveness of format and what needs improvement. Kits are currently in development. By the end of summer of 2023, we are anticipating completion of data collection with further data collection and analysis taking place in the fall. While take-home STEM learning kits are becoming more pervasive, there is little research on them. Findings from this study stand to strengthen the research base informing best practices for STEM kits and contribute more broadly to research on out-of-school and intergenerational STEM learning.

Poster Number: 10

Student Name (Home Institution): Destiny Leonard (University of South Florida)

Project Title: Dressed to Impress: How Identity Contingencies Influence Police and Community Interactions

Co-Authors: Joey Famularo, Rachel Hale

Summer Research Program: Studying Race and Policing in the Complex Social interactions Lab

Abstract: The sociology of police work has documented a wealth of factors influencing the frequency and nature of contacts between the police and community. A hallmark of this body of research is the influence of individual factors (i.e., race, ethnicity, accent, gender) on the nature of these interactions. An influential concept emerging from this body of research is the "symbolic assailant," a concept indicating that distinct variations among individual factors influence police officers. Recently, researchers, focusing on traffic stops, documented variability in how officers communicate, finding linguistic variations based on the race of the driver. Building from this research, this research examines how driver demographics and contextually relevant factors influence how the contact unfolds. This project also measures other variables such as empathy statements, respect levels, and antagonism levels to rate the overall tone and respect of a traffic stop. Using a random sample of 120 traffic stops from a police department in the Pacific Northwest between June 2022 through August 2022, this research applies systematic social event modeling and qualitative coding to body-worn camera (BWC) footage. Results depict variability based on individual circumstances and will be further explained below.

Poster Number: 11

Student Name (Home Institution): Alexa Nguyen (University of California, Los Angeles)

Project Title: Assessing Terrestrial Water Storage Variability in the Columbia River Basin: Insights from GRACE Satellite Mission and FEW System Analysis

Co-Authors: Sasha McLarty

Summer Research Program: Stakeholder Informed Modeling of Innovations in the FEW

Abstract: NASA's Gravity Recovery and Climate Experiment (GRACE) satellite mission provides an exceptional tool for monitoring global variations in terrestrial water storage based on Earth's gravity field. In this study, we evaluated the key components contributing to total water storage changes in the Columbia River Basin (CRB), including soil moisture, surface water, snow water equivalent (SWE), and groundwater. We categorized the total water storage changes observed by GRACE into two categories: those driven by the food, energy, and water (FEW) nexus and those arising from the food, energy, and water systems in isolation (non-FEW). To achieve this, we utilized the GRACE Tellus Monthly Mass Grids dataset from January 2003 to December 2022, provided by CSR RL06 Mascon Solutions (version 02), along with monthly soil moisture and snow water equivalent values simulated from land surface models. SWE changes were classified as non-FEW, while soil moisture changes were considered FEW exclusively in irrigated areas. Additionally, surface water storage changes in the CRB's five largest reservoirs were carefully examined and categorized as either FEW system changes or non-FEW system changes based on their purpose. The observations of surface water storage change in these reservoirs were processed and assigned to the respective categories. Groundwater storage changes were calculated by subtracting the soil moisture, SWE, and surface water changes from GRACE data. Based on the usage of groundwater rights for either irrigation or other purposes, the monthly values of groundwater storage were attributed to either the FEW system or non-FEW system. We then analyzed the fraction of terrestrial water storage changes related to FEW or non-FEW interactions, yielding valuable insights into potential mitigation and management strategies. Ultimately, this comprehensive analysis aids in identifying the system that merits greater focus to effectively address water resource challenges in the CRB.

Poster Number: 12

Student Name (Home Institution): Cameron Longwith (Washington State University)

Project Title: Development of mobile sensor technology to monitor air quality

Co-Authors: Clara Ehinger, Von P. Walden

Summer Research Program: Environmental Engineering: Measurements and Modeling in the Pacific Northwest

Abstract: Poor outdoor air quality significantly impacts human health. Low-cost sensors are increasingly being used to provide real-time data of air quality. Data from these sensors are important for monitoring acutely poor air quality that might be caused by smoke from wildfires and/or wood burning stoves. We have developed a low-cost air quality sensor that could be deployed via a mobile platform. The sensor uses a Raspberry Pi 3 Model B computer that is connected to an Adafruit BMP280 Temperature/Pressure Sensor and an Adafruit PM2.5 Air Quality Sensor. The sensor provides real-time location data from an Adafruit Ultimate GPS Breakout v3. A key component is a Sixfab Raspberry Pi 4G/LTE Cellular Modem Kit that allows a user to connect to the sensor in real-time, which allows remote control of the sensor as well as status of its data acquisition. The sensor was tested in Pullman, Washington in July 2023. During the tests, the air quality was very good with low particulate matter (PM2.5) concentrations. However, the tests indicate that this sensor maintains accurate positioning while in use and obtains valuable environmental data. Future versions of this sensor could be used with public transportation vehicles such as city buses.

Poster Number: 13

Student Name (Home Institution): Carolyn Blum (Lasell University)

Project Title: Growing Pains: Effects of Metacognitive Journaling on Students' Grade Outcomes

Co-Authors: Gretchen Rollwagen-Bollens, Travis Kibota

Summer Research Program: Research in Interdisciplinary STEM Education (RISE)

Abstract: The way in which students think about how they learn, if they are even thinking about it at all, can hold great value in understanding a student's grade outcome as well as giving instructors insight on what kind of advice to give or resources to provide. Instructors are not always able to be cognizant of outside factors students face and are therefore unaware of how they might be affecting a student's performance and their learning.

In order to help instructors gain these insights, I investigated how metacognitive journaling interventions affected student grade outcomes. To do this, I analyzed students' journals whose grades improved over the course of the term. These students' first exam grades weren't "passing" which means they earned a grade that was below a 74% and would not be able to move on to the next level science course if their grades remained low. However, by the end of the term, they ended with an average exam grade between exam one, exam two, and exam three that was "passing" meaning their grade was a 74% and above. I wanted to look at these because it means that a change occurred during the semester where they altered their study habits, mindset, strategies, or outlook on the course that caused a shift in their grades.

I used qualitative analysis methods on three sets of journal entries from various weeks that I believed best reflected students' thought processes as they worked to integrate the strategies they were learning about into their routines. I will discuss the approach I took to analyzing the students journal entries and if there is any kind of correlation between a students overall grade outcome and what they wrote about in their metacognitive journals as well as what themes and similarities I was able to pick out.

Poster Number: 14

Student Name (Home Institution): Michael Burnes (Central Connecticut State University)

Project Title: Characterizing Runaway Crystallinity Due to Processing Additives in Organic Solar Cells

Co-Authors: Brian Collins, Tanner Melody

Summer Research Program: Waves in the Universe and Technology

Abstract: Organic solar cells (OSCs) are a prevalent research area in solar technology for their potential to revolutionize the field, mostly due to their flexibility and printability. The main reason OSCs are not yet out on the market is that they still lag behind commercial silicon solar cells in efficiency. However, it has been demonstrated that processing additives can increase the efficiency of OSCs by controlling the nanocrystallinity. There is much research still to be done to find the best types of additives and their optimal amount. This project measured the effect on crystallinity that popular additives have based on their concentration using the methods of microscopy, spectroscopy, and X-ray diffraction. It was observed that past the optimal concentration these additives can lead to runaway crystallinity, which hinders the device performance. Moving forward, researchers and developers will have to be cognizant of the crystallinity threshold concentration of these additives to achieve optimal device performance.

Poster Number: 15

Student Name (Home Institution): Casey Smith (Lewis University)

Project Title: Evaluating the Ability of the Boise River System's Operational Rules to Meet Water Storage Targets in Response to Climate Change Using System Dynamics Modeling

Co-Authors: Kirti Rajagopalan, Matthew Yourek

Summer Research Program: Stakeholder Informed Modeling of Innovations in the FEW

Abstract: Climate change has far-reaching impacts on water storage systems that supply water, power, and other resources to communities. The Boise River System is a three-reservoir water storage system in the Columbia River Basin that supplies water for irrigation in the Treasure Valley region of Idaho, an important agricultural area for seed production. These agricultural seeds are internationally distributed, and due to this global dependence, a clear understanding of the Treasure Valley's resilience to climate change is needed. The representation of this system in existing reservoir modeling frameworks for the Columbia River Basin has been overly simplistic, limiting our ability to simulate the implications of climate change on this system. The objective was to build a model that simulated the operations of this system and to apply the model to quantify the impacts of climate change on the ability of the system to meet its refill target date at the end of July. The model developed is a System Dynamics model created in STELLA incorporating inflows into the system, losses from the reservoir system (e.g. evaporation), and the storage and release rules under which the system is operated by the United States Bureau of Reclamation and the United States Army Corps of Engineers to manage flood control and irrigation demands. Our simulations indicate that the ability of the system to meet irrigation storage needs is different under future climate simulations as compared to current simulations. As a next step, an exploration can be conducted of potential changes to operational rules that can allow for optimal operation of the system.

Poster Number: 16

Student Name (Home Institution): Molly Jobson (Washington State University)

Project Title: Improving Soil Health with Vermicompost Tea

Co-Authors: Gillian Falcon, Courtney Gardner

Summer Research Program: Environmental Engineering: Measurements and Modeling in the Pacific Northwest

Abstract: Traditionally, dairies use lagoon aeration to manage waste water. Because of environmental concerns, some dairies have started inoculating manure into worm composting beds, vermifilters, as an alternative solution. Replacing these lagoons with vermicompost beds has the potential to reduce the emissions of methane, leaching of excess nutrients into the surrounding soil and contaminants into the water, and the fertilizer made can provide an additional source of revenue. Vermicompost tea is an extract of this compost and can be used to treat soil to replace nutrients stripped from the soil after harvesting. Additionally, vermifiltration has been shown to increase biodiversity of microbial communities, an important indicator of healthy soil, at a low cost. In this project, onions grown in potting soil were treated with different concentrations of vermicompost tea, and DNA was extracted from the soil samples. The quality of the DNA was analyzed using gel electrophoresis and the 16s gene was amplified to indicate microbial presence in the soil using PCR. Results show higher DNA content in soil treated with vermicompost tea than traditional fertilizer or no fertilizer. Further research will be done to identify the impacts the vermicomposting method has on surrounding systems by identifying nitrogen cycling genes in the vermicompost. Based on preliminary research, vermifiltration has been shown to be an effective wastewater treatment system, and my research indicates that vermicompost tea as a fertilizer increases microbial communities, which can improve soil health.

Poster Number: 17

Student Name (Home Institution): Katherine Rysdon (North Carolina State University)

Project Title: If You Give a Mosquito a Map, It Will Probably Find You: Using Arts Integration to Support Systems Thinking in Stem Education

Co-Authors: Molly L. Kelton, Jeb P. Owen, Kellen Pautzke, Kristin Saba Fisher, Elizabeth Grace

Summer Research Program: Research in Interdisciplinary STEM Education (RISE)

Abstract: Systems thinking is looking at parts of a system and their connectedness to each other and the system as a whole. With complex systems making up the world around us, and ever prevalent in STEM subjects, systems-thinking is an important skill to have. Developing curriculum that helps support kids' systems-thinking is the goal of Washington State University's Health Equity through Arts-based Learning (HEAL) team. HEAL is an interdisciplinary team of educators, scientists, and artists who collaborate to design, implement, and evaluate arts-based science curriculum for children in grades 3-5. HEAL partners with predominantly Latinx communities in rural-agricultural areas of Washington.

HEAL uses a design-based research approach that involves iterative cycles of design, research, and improvement (Brown, 1992). This presentation focuses on a design phase of one of HEAL's curricula, Buzzing for Blood (B4B). B4B is a 10-hour curriculum that is currently in its second iteration of design
(Danielson et al., 2022; Pautske et al., 2022). The program aims to support systems thinking about mosquito-borne illnesses like West Nile Virus. It does this by blending information about mosquito morphology/ecology and public health practices with the cartographic arts. The curriculum design is informed by research in the learning sciences on supporting systems thinking in young children (Danish et al., 2014), as well as studies of spatial literacy using mapping as a tool for learning (Rubel et al., 2017; Taylor & Hall, 2013). HEAL plans to implement and evaluate B4B in the fall.

Poster Number: 18

Student Name (Home Institution): Kavina Peters (University of California Berkeley)

Project Title: Evaluating the Long-term Effects of Drought Relief Wells on the Surface Water-Groundwater System in the Yakima River Basin (YRB)

Co-Authors: Jennifer Adam

Summer Research Program: Stakeholder Informed Modeling of Innovations in the FEW

Abstract: More frequent seasonal drought due to climate change is an urgent issue facing the Yakima River Basin (YRB). In order to understand the long-term effects of a drought year like 2015, We created an integrated model of groundwater and surface water relationships, including the effects of human levers such as drought relief wells and aquifer recharge policies. This integrated model was created using a Systems Dynamics framework in STELLA, which implemented USGS and NOAA streamflow data, instream flow rules, Drought Relief Well entitlements, and irrigation demand in the YRB. We examined the sensitivity of three uncertain variables: initial aquifer storage, initial reservoir storage, and reservoir outflow in order to characterize how these parameters affect the groundwater-surface water system. Our findings show that as stream levels decline due to drought, and drought-relief pumping is used to fulfill the irrigation deficit, the level of the aquifer will fall below the level of the stream. This then results in a loss of water from the stream to the aquifer, further depleting the stream and triggering heightened groundwater pumping: a reinforcing feedback loop. Finally, We conclude that this reinforcing feedback loop may be balanced with the timely implementation of aquifer recharge policies such as Managed Aquifer Recharge (MAR) or In-lieu Recharge, in order to aid drought resilience in the YRB.

Poster Number: 19

Student Name (Home Institution): Aliza Hwang (Washington State University)

Project Title: Exploring the Relationship Between Race and Police Behavior

Summer Research Program: Studying Race and Policing in the Complex Social interactions Lab

Abstract: Improving the relationship between community members and police remains a key area for reform efforts. In cases when police show a lack of professionalism it deteriorates the trust that the community needs to have in the police, as well as contributes to lower levels of perceived legitimacy for the police. For the police to execute their jobs efficiently and safely, the community needs to believe that the police are trustworthy and credible. Research documents variability in the experiences of Black, Latine, and AAPI individuals, while other research has demonstrated limited variability suggesting the majority of officers display high professionalism across interactions. This research examines to what extent race and ethnicity are associated with police officer professionalism. Using a random sample of X traffic stops from a medium sized police department in the Pacific Northwest, this research applied systematic social event modeling (SSEM) to quantitatively and qualitatively examine if, and to what extent, officer professionalism varies. Additionally, this research applies a case study framework to interactions identified as unprofessional. Results show that the majority of officers maintained professional behavior. However, there was a pattern found amongst those who have displayed some level of unprofessionalism and bad behavior or misconduct. These results will be discussed further in the poster.

Poster Number: 20

Student Name (Home Institution): Jess Hollenbaugh (Portland State University)

Project Title: Determining Accretion Disk Size from Photometric Band Lags in AGN

Co-Authors: Vivienne Baldassare

Summer Research Program: Waves in the Universe and Technology

Abstract: We present the estimated accretion disk sizes of eleven active galactic nuclei (AGN) interpolated from GRIZ photometric data taken by the Young Supernova Experiment (YSE). Most galaxies have a supermassive black hole (SMBH) at their centers, some of which are actively accreting matter at high rates. This accretion emits energy as photons near the SMBH, which follows a pattern of variability consistent with a damped random walk (DRW). Some of these photons are reprocessed through the disk, resulting in the propagation of the DRW variability in longer and longer wavelengths. We used the Butler QSOfit Python package to determine the significance that the variability in each band is consistent with what we expect from AGN. We then ran the Bayesian cross-correlation Python package JAVELIN to use Markov Chain Monte Carlo (MCMC) analysis to model the light curves as smoothed, scaled versions of each other and estimate time lags between them. The objects that JAVELIN was able to model were found to have g-r, g-i, and g-z delays of several days, which translates to disk sizes for each wavelength on the order of light-days. These calculated disk sizes are consistent with the current understanding of typical accretion disk size in AGN. Data for many of the objects recorded by the YSE were too sparse and irregular for JAVELIN to report accurate time lags, but some were successful and yielded significant results. Several were found to have inter-band lags indicative of disk radii greater than the self-gravity limit of 12 light-days, supporting the conclusion that the observed variability lags have a significant contribution from the broad line region based on the thin disk model.

Poster Number: 21

Student Name (Home Institution): Ruby Pascual (Cornell University)

Project Title: Mitigating Wildfire Impact on Water Resources

Co-Authors: Indranil Chowdhury, Mrittika Rodela

Summer Research Program: Environmental Engineering: Measurements and Modeling in the Pacific Northwest

Abstract: Annual wildfire occurrences have intensified, leading to adverse impacts on the environment and downstream water resources. These wildfires release ash particles into the water greatly disturbing its turbidity and overall quality. Soil and litter samples were collected from the University of Idaho Experimental Forest (UIEF) and burned in a muffle furnace at 250℃, 450℃, and 650℃ for two hours. Lower temperatures were associated with lower pH levels (7-8), whereas higher temperatures resulted in higher pH levels (9-10). Lab ash samples were mixed with unburned soils in the ratio 50:50 to evaluate the effects of soil and ash potential mixing. Solid samples were added to synthetic water at a concentration of 5g/L. To evaluate treatment efficiency, different amounts of coagulants (alum and ACH) were added to ash-water mixtures. Raw and treated waters were tested for turbidity, pH, electrical conductivity, zeta potential, and ultraviolet absorbance. Higher amounts of coagulants led to decreased turbidity, indicating a higher efficacy in the treatment process.

Poster Number: 22

Student Name (Home Institution): Mattea Gines (St. Olaf College)

Project Title: Investigating Performance Differences Across Demographic Sub-Groups Within Large Lecture Introductory Biology

Co-Authors: Jessie Arneson, Erika Offerdahl, Jacob Woodbury

Summer Research Program: Research in Interdisciplinary STEM Education (RISE)

Abstract: Previous studies have extensively documented achievement gaps among females, underrepresented minorities, and first-generation students, while recognizing the effectiveness of argumentation-based activities in enhancing student understanding. Nevertheless, undergraduate science instruction often neglects to prioritize argumentation, leading to a lack of knowledge regarding its potential impact on addressing these achievement gaps for the aforementioned student groups. This study aims to investigate these gaps further among the mentioned student groups in Biology 107 by examining the relationships between demographic variables (i.e. sex, underrepresented minority status, and first-generation status), preparation proxies, and exam performance. If achievement gaps are found, subsequent analyses will explore the impact of argumentation-based activities on these gaps. To accomplish this, data was collected from a diverse group of 988 students who enrolled in Biology 107 across two semesters (Fall 2019 and Spring 2020). The dataset included demographic information and performance data from pre-quiz assessments, exams, and in-class argumentation sessions. To analyze the relationships between demographic variables and exam performance, correlation tests, including point-biserial correlation coefficients, were utilized to inform subsequent linear regression analyses. Additionally, non-parametric t-tests were conducted on exam performance. Initial analysis indicated comparable exam score distributions between semesters, with statistically significant differences in demographics observed between the student groups. These findings highlight the importance of promoting equitable education and identifying areas requiring additional support. As the study progresses, further insights into the role of demographic variables in shaping academic outcomes will be gained, which will inform future improvements in large lecture introductory biology courses and similar educational settings.

Poster Number: 23

Student Name (Home Institution): Emily Rinn (Scripps College)

Project Title: Identifying electricity sources to power MSW-GFT technologies in the production of sustainable aviation fuel: A system dynamics approach

Co-Authors: Lina Pilar Martinez, Manuel Garcia-Perez

Summer Research Program: Stakeholder Informed Modeling of Innovations in the FEW

Abstract: Decarbonizing the aviation sector remains one of the most prevalent obstacles to reducing global greenhouse gas emissions. Sustainable aviation fuel production remains paramount in diminishing the aviation sector's emissions of noxious gases and heavy metals. The Sustainable Aviation Fuel Grand Challenge aims to supply enough aviation fuel to meet 100% of demand by 2050 by reducing production costs and enhancing sustainable practices. Gasification Fisher-Trophe using Municipal Solid Waste as feedstock has been examined as a promising technique for sustainable aviation fuel production. Within this process, a net electricity demand poses a significant economic barrier to the number of production facilities that can be established. This study identifies renewable and non-renewable energy sources, costs, and capacities using system dynamics modeling software. Levelized Cost of Electricity and capacity data of various energy sources are inputs, while the number of facilities that can be established based on the variable energy cost is the output. The model also accounts for the impact of policy on the number of potential facilities, as well as configuring different percentages of the varying energy sources for the lowest cost output. Results show photovoltaic solar and onshore wind as promising low-cost and high-availability energy sources. It also shows that the number of potential facilities is reliant on policy within the first years of operation. Future research into region-specific energy cost, capacity, and policy analysis is required to increase the accuracy of this model.

Poster Number: 24

Student Name (Home Institution): Megan Piontkowsky (Albion College)

Project Title: Enhancing Magnetic Field Stability in Spin Exchange Optical Pumping Experiments Through a Current Stabilizing Circuit

Co-Authors: Brian Saam, Chelsea Weaver

Summer Research Program: Waves in the Universe and Technology

Abstract: Spin exchange optical pumping (SEOP) is an experimental technique that offers promising advancements in the field of atomic physics. However, due to the nature of these experiments, it is crucial to maintain a stable magnetic field. With fluctuating temperatures and external forces, controlling and maintaining the current that produces the magnetic field can be extremely difficult. We provide a solution by creating a circuit whose purpose is to stabilize current.

The goal of this project is to improve upon the design of the existing circuit which had been previously used in this experiment. We compare the performance of the two circuits in order to demonstrate the enhancement of our current stability.

Our newly built circuit utilizes an IT 60-S ULTRASTAB transducer which boasts a low temperature coefficient. This transducer produces a current exactly proportional but 600 times smaller than the main current driving the coils; this allows the control circuitry to run free of excessive heating and/or large temperature variations. The circuit also uses an N-Channel MOSFET and two op-amps which work together to rapidly check and correct the current in the coils. We expect that this will greatly improve the performance of the circuit.

Poster Number: 25

Student Name (Home Institution): Julian Chavez (California State University of Long Beach)

Project Title: Language Barriers Between Police & the Public

Co-Authors: AJ Smith, Aliza Hwang

Summer Research Program: Studying Race and Policing in the Complex Social interactions Lab

Abstract: In 2020, Executive Order 13166, required Federal agencies to assess needs and provide services to those with limited English proficiency (LEP). While not directly applicable to all state agencies, what would follow were legislative efforts starting with needs assessments. Among those agencies challenged with conducting a needs assessment were police departments, who interact in a myriad of ways with the community, and do not routinely document perceived language barriers. This research project examines the presence of perceived language barriers and if, and how, those interactions vary based on objective measures of professionalism, subjective assessments of the quality of an interaction, and objective measures of contact efficiency. Using unedited body worn camera (BWC) footage from a medium sized agency in the Pacific Northwest, this research applies systematic social event modeling
(SSEM) to a random sample of 147 number of traffic stops. Findings suggest interactions associated with limited English proficiency are qualitatively and quantitatively different from those interactions involving those with proficiency.

Keywords: police, language, professionalism, body worn camera, traffic stops

Poster Number: 26

Student Name (Home Institution): Avery Gray (Mississippi State University)

Project Title: Potato Growth and Development Simulation under Distinct Water Regimes

Co-Authors: Fabio V. Scarpare, Joaquin Casanova

Summer Research Program: Environmental Engineering: Measurements and Modeling in the Pacific Northwest

Abstract: Potatoes (*Solanum tuberosum L.*) are a highly versatile and nutritious crop that provides significant economic benefits and food security. The Pacific Northwest is a major potato producer in the United States. Potatoes are a water-sensitive crop, and both excess water and water deficits cause adverse effects on tuber growth, quality, and yield. The aim of this project was to calibrate the biomass accumulation (above and below ground) and crop development in the CropSyst model. The Yukon Blush variety potato underwent one growth season in a monitored greenhouse environment. Each plant, grown in a pot (14' diameter) received water to keep the pot media close to the field capacity until flowering period. After that, i.e., during tuber formation two water stress level treatments (5 and 10 mm daily) coupled with fertilization applications were applied. Four samples (replicates) in each assessment (performed in DAP = 45, 87, 115) were taken of tubers and above ground biomass at flowering, onset of senescence, and harvest; two radar measurements of plants were taken with biomass samples; and canopy cover percentages were recorded roughly weekly. This data, along with meteorological variables and soil moisture information, were used to calibrate crop growth and development simulations. The post processing analysis was performed using R programming software. Simulation results and radar imagery assessment will be used for the next submission round of USDA NIFA SBIR proposals, in concert with Oceanit, Inc. Additionally, these results will be used to optimize potato production and crop management practices in the Pacific Northwest by reducing water usage while maintaining high tuber yield and quality.

Poster Number: 27

Student Name (Home Institution): Amelia Haller (Washington State University)

Project Title: Impacts of a Multi-year Drought on Groundwater Levels and Accessibility in the Columbia Plateau Regional Aquifer System Within Eastern Washington

Co-Authors: Sasha McLarty

Summer Research Program: Stakeholder Informed Modeling of Innovations in the FEW

Abstract: The central focus of our research is to understand the impacts of a multi-year drought on groundwater levels and accessibility in the Columbia Plateau Regional Aquifer System within Eastern Washington. Eastern Washington uses a combination of surface water and groundwater to maintain its Food, Energy and Water system. However, in the face of droughts, we have seen a limit on available water. This has drawn our focal point to understanding how groundwater availability changes in the face of these prevailing drought conditions. We used a System Dynamics approach to understand how the changes in drought length and groundwater percent used compared to surface water influence available groundwater. Snowpack, precipitation, crop cover, well depth, and water rights were included as factors influencing groundwater availability under differing drought conditions. We anticipate a nonlinear decline in available groundwater in response to the increase of duration of multi year droughts. As the drought length increases, the available groundwater volume and groundwater percent used will be driven down. Understanding the effects that drought has on groundwater is increasingly significant as we see the trends that are caused by climate change, such as declining winter snowpack decreasing summer water availability. As Eastern Washington is reliant on groundwater for irrigation and municipal water supply in much of the study area, knowledge of future pumping and recharge dynamics will be crucial in planning for a sustainable water future.

Poster Number: 28

Student Name (Home Institution): Conor Bartol (Whitman College)

Project Title: Extracting Angular Velocity Data for Rotation Law Fitting in Simulations of Binary Neutron Stars Post-Mergers

Co-Authors: Matthew Duez, Pavan Chawhan, Marlo Morales, Nishad Muhammed

Summer Research Program: Waves in the Universe and Technology

Abstract: Understanding the evolution of binary neutron stars (BNS) after they merge is relevant to electromagnetic observations of these objects, and computer simulations of BNS post-mergers can assist with that understanding. To accomplish this our group made a simulation of BNS mergers using relativistic fluid dynamics with the goal of simulating a post-merger to 5 milliseconds. In our efforts to simulate a BNS merger we adapted data from 3 dimensional simulations into 2 dimensions. This was due to the computational cost and time of 3D simulations. These simulations use an entropy profile and a rotation law (from previous BNS post-merger simulations) for stars at equilibrium. We began by filtering and fitting our data to see how it aligned with said rotation law. A major problem we encountered was that the motion of the post-merger star was not purely rotational, creating difficulty in defining or extracting the location of the axis of rotation, resulting in a poor fit. With our initial axis of rotation there was a quadrupole structure in the angular velocity data near the center of the star. An attempt to correct the position of the axis of rotation did not eliminate this quadrupole. We then devised a new technique using our velocity data to find shear and vorticity data for the star. We derived a relationship between shear, vorticity, and angular velocity, and used it to generate new data for angular velocity that did not require us to know the exact position of the rotation axis, thus allowing us to eliminate the quadrupole with velocity data alone. We anticipate that this can be used in conjunction with filtering of shear and vorticity data to produce data that will be a better fit for our rotation law in future simulations, and we are beginning that process.

Poster Number: 29

Student Name (Home Institution): Vaughn Brown (Pomona College)

Project Title: Sustaining Science: Identifying Barriers and Resources to BASIL Implementation

Co-Authors: Diane Ugwu, Erika Offerdahl

Summer Research Program: Research in Interdisciplinary STEM Education (RISE)

Abstract: BASIL, or Biochemistry Authentic Scientific Inquiry Laboratory, is a course-based undergraduate research experience (CURE) curriculum that engages students in authentic research to identify proteins with unknown functions using wet lab and computational modules. While CUREs have broadly been shown to be advantageous to student learning and equity, the development of applicable technical skills, and improving student confidence, the challenges to sustaining these types of courses have not been closely studied. Often, a CURE may be implemented but lose elements that make the research authentic or phase out entirely after a few years of implementation. Additionally, many findings about CUREs are reported in aggregate without differentiating between the various Carnegie institutional types or acknowledging that institutions do not always have the same or comparable resources. Thus, our research question is what are the common motivators and barriers to CURE implementation, specifically regarding BASIL, amongst diverse institution types? We will discuss these findings based on survey data and faculty-generated implementation plans that were collected from recruitment workshops. We will also discuss the design and validation of an implementation survey designed to capture factors critical to long-term sustainability of CUREs in various institutional contexts. These findings will allow CURE developers to better understand the needs of their colleagues and advocate on behalf of various institutions to funding agencies and policymakers. With improved sustainability, we hope to expand undergraduate research opportunities beyond self-selecting REUs and jobs and strengthen the diverse workforce in sciences, technology, and medicine.

Poster Number: 30

Student Name (Home Institution): Chance Baggett (Syracuse University)

Project Title: Viscosity and Drag Force in Superfluid Hydrodynamics

Co-Authors: Michael Forbes

Summer Research Program: Waves in the Universe and Technology

Abstract: The Gross-Pitaevskii equation (GPE) is a mean-field approximation that accurately describes the dynamics of superfluids, a state of matter experimentally realized in Bose-Einstein condensates. Here we simulate the GPE alongside a hydrodynamic model which inherits the same form as the governing equations of classical viscous flow. Existing theory and experiment inform us that density fluctuations due to vortex shedding and soliton wave turbulence create an effective viscosity in superfluids. Our work investigates this emergent viscosity by considering the drag force on a weak potential due to a superfluid flowing at a uniform velocity. We numerically model this force from the reference frame of both the fluid and the potential, fit the behavior to hydrodynamic equations including a dissipation term, and express this force as a function of hydrodynamic viscosity. By coarse-graining the hydrodynamic model, we seek to establish an effective theory that will allow us to qualitatively compare wave turbulence and vortex turbulence.

Poster Number: 31

Student Name (Home Institution): Sarah Sanzebin (Columbia University)

Project Title: Increased Yield in High Biomass Wheat Backgrounds Due to Scarlet Region on a 4A QTL

Co-Authors: Peter Schmuker, Mike Pumphrey

Summer Research Program: Phenomics Big Data Management

Abstract: On a wheat's 4A chromosome, it is found that a specific region may be connected to plant growth. This region, or the quantitative trait locus (QTL), identifies if the spring wheat contains the QTL of interest that was crossed in from its desired parent, the wheat variety Scarlet, which is presumed to be beneficial for overall yield. The Scarlet 4A QTL was crossed into high biomass backgrounds so that the potential impact of the genes could be most visible. In each background, there consisted of a "twin" pair– almost identical except that one plant had the Scarlet region intentionally crossed in, and the other did not. In this study, we focused on the trait impacts that the Scarlet parent had on these different backgrounds using agronomic and field data. A holistic approach to see the effect of this Scarlet region requires investigating the impact over time. With the help of the DJI Inspire 2 drone, calculation of indices using bands such as normalized difference vegetation index (NDVI) were used to assess the high biomass pairs' health and vegetative state over several weeks over two locations. Certain high biomass backgrounds (HB) such as HB01, HB02, HB07, HB11, and HB12 display a visible difference with the Scarlet presence. Backgrounds HB01, HB02, and HB07 had a greater yield average of 75.32 bu/a, compared to that of HB11 and HB12 which yield an average of 67.81 bu/a. However, backgrounds HB01, HB02, and HB07 had a slightly lower gene impact, of a 5.26% increase, compared to HB11 and HB12's 6.47%. As shown here, the presence of the intentionally crossed Scarlet region has positive yield effects in these backgrounds. Future data collection over more locations of these pairs in these backgrounds can substantiate the effects in these backgrounds of interest.

Poster Number: 32

Student Name (Home Institution): Skyler Allison (Washington State University)

Project Title: The Rhizosphere Microbiome Involved in Resilience to Soil Acidity in Dryland PNW Spring Wheat Breeding and Production

Co-Authors: Tarah Sullivan, Mike Pumphrey, Aaron Esser, Augusta Finzel

Summer Research Program: Improving Crop Resiliency: Agriculture in Changing Climate

Abstract: Soil acidification is a significant and growing problem in the Palouse and worldwide. The Palouse soil is composed primarily of aluminum-silicate clays. Ammonia-based nitrogen fertilizers are contributors to this soil acidification. As H+ ions accumulate within the soil, they react with soil colloids to displace soluble aluminum (Al +3) from the clay lattice structure. This causes aluminum toxicity which negatively affects soil structure, nutrient cycling, soil biology, and subsequently plant vigor and crop yields. Calcium carbonate (CaCO3) or lime is an effective way to raise pH over time by buffering H+ ions in the soil. Some species of bacteria within the genera *Gemmatimonas* and *Nocardiodes* are known to naturally produce CaCO3 in the right environmental conditions.

To understand how soil acidity and liming affect the bacteria that support vigorous spring wheat grown under acidic conditions, we studied the the rhizosphere microbiome of twenty different varieties of wheat, on limed and unlimed plots in a spilt plot design. Wheat varieties developed by Dr. Pumphrey are paired from parental lines with a single allele mutation (ALMT1), splitting into either “susceptible” or
“resistant” to Al toxicity. The V4 region of the 16s rRNA gene was amplified and sequenced on an Illumina MiSeq and QIIME2 was used to analyze the sequencing data. Rhizosphere microbial diversity of the limed vs unlimed plots can give insights as to overall soil biological recovery from acidity after liming.

Additional cultivation approaches involve B4 medium, and have been successful in isolating organisms capable of CaCO3 precipitation from the acidic soils. Bacterial amplicon data reveal a significant presence of *Nocardioides* and *Gemmatimonas* bacteria in the unlimed plots. This work provides preliminary data for the laboratory's goal of creating long-term solutions for soil acidity in the Palouse. Future research aims to develop endophytic wheat varieties that host CaCO3 precipitating bacteria.

Poster Number: 33

Student Name (Home Institution): Ashleigh Carlton (Washington State University)

Project Title: Plant Wound Defense: Jasmonic Acid and Its Receptor; Jasmonic Acid Induces a Response in the Semi-functional Mutant Receptor Coi1-30, but Not in Coi1-1

Co-Authors: Ashleigh S. Carlton, Jeremy B. Jewell, Laura E. Bartley

Summer Research Program: NSF Plant Genome

Abstract: When plants are wounded, they employ defensive measures to protect themselves. Jasmonic acid (JA) is a chemical plant hormone that triggers the transcription of genes that allow plants to produce medium and long-term wound response, which often leads to reduced growth. COI1 is the only known receptor of JA. Extracellular ATP (eATP) is a signaling molecule that, when in high concentrations on the outside of the cell, as happens with wounding, causes a calcium burst. Plants treated with JA that contain functional COI1 receptors have an exaggerated calcium burst in response to eATP compared to plants not pretreated with JA. A mutant allele of COI1, known as *coi1-30*, has been considered a null or nonfunctional allele. Unexpectedly, experiments using *coi1-30* resulted in an increased calcium response when treated with JA. This led us to wonder if the *coi1-30* mutant is still functional, or if there could be another JA receptor. To distinguish these, we sought to determine the functional output of a second mutant allele of COI1, known as *coi1-1*. Seeds with a *coi1-1* mutant receptor and the aequorin calcium reporter gene were selected on methyl jasmonate and kanamycin selective media plates, respectively. Plants with long roots after JA treatment were evidence of *coi1-1* homozygous mutants. Unlike *coi1-30*, the *coi1-1* calcium burst was not exaggerated in response to JA. From these experiments, we propose that *coi1-30* is a partially functional receptor and *coi1-1* is a nonfunctional receptor of jasmonic acid. These experiments will help to better understand the plant wound response signaling pathway to improve agriculture under pest pressure.

Poster Number: 34

Student Name (Home Institution): Riley Evergreen (Washington State University)

Project Title: Supporting carbon sequestration in switchgrass: Isolating Root Specific Promotors from Switchgrass

Co-Authors: Demeke Bayable, Jeremy Jewell, Laura Bartley

Summer Research Program: NSF Plant Genome

Abstract: Switchgrass (*Panicum virgatum*) is a bioenergy crop. We are exploring a switchgrass variety with more lignin in the roots. This may store carbon in the soil and further improve sustainable bioenergy production relative to carbon releasing fossil fuels. Here, we have isolated root-specific promoters with the goal of directing the expression of the genes in the below-ground organs of the plant, while minimizing alterations to above ground organ gene expression. To find candidate root-specific promoters we developed genes with high expression in roots and low expression in shoots based on public data. To test those promotors, we cloned their sequences into a dual luciferase reporter plasmid. We transfected cells from the model grass, rice (*Oryza sativa*), with plasmids containing our selected promoters. This allows us to compare the amount of transcription in cells derived from both tissues. Thus far, all three promoters tested gave consistently higher expression in root cells compared to shoot cells. In the future, our investigation will expand to include “stem-specific” promotors and combine the tissue-specific promotors with desired genes. Once the desired genetic constructs are created, we can integrate them in switchgrass in the hope of generating an improved plant for carbon sequestration that is still amenable to biofuel conversion.

Poster Number: 35

Student Name (Home Institution): Anna Carroll (Eastern Washington University)

Project Title: Investigating the Timing of Alpha-amylase Induction During Grain Germination in Wheat: A Sticky Problem.

Co-Authors: Sarah Peery, Scott Carle, Camille Steber

Summer Research Program: Improving Crop Resiliency: Agriculture in Changing Climate

Abstract: Wheat grains contain large starchy endosperms that are a major component of flour. The gelling capacity of long starch molecules helps make wheat flour a highly versatile ingredient in baked goods. During seed germination, starch digestion by the enzyme alpha-amylase provides polysaccharides as food for a growing seedling. But alpha-amylase digestion decreases starch gelling capacity, leading to quality issues like cakes that collapse, sticky bread, and sticky noodles. This is a serious problem when pre-harvest rainfall causes the initiation of germination. Farmers receive serious discounts for such grain. Germination is both an event and a process. The event of germination is the moment any part of the seedling emerges from the seed coat (most often the primary root). However, many germination-related processes occur before this event (i.e. cell repair), and after the primary root emerges. Normally alpha-amylase expression is considered to occur after the germination event, but previous work has suggested that the level of alpha-amylase in flour is not always tightly linked to visible germination. This study tested the hypothesis that alpha-amylase expression can occur prior to the germination event, and tested whether timing varied across genotypes. Alpha-amylase expression was analyzed during germination time course experiments in six genotypes of wheat selected for variable susceptibility to sprouting. The data will be used to refine existing methods for identifying wheat varieties and genes that are less prone to quality problems from elevated alpha-amylase.

Poster Number: 36

Student Name (Home Institution): Anna Buetow (Whitman College), Emi Eleccion (Washington State University), Heidi Vandyk (Western Washington University)

Project Title: Unraveling the Biochemical Enigma: Using Lipidomics to Investigate Pennycress' Potential as a Winter Cover Crop

Co-Authors: Zhaslan Akhmetov, Phil Bates, Bhabesh Borphukan, Matt Garneau, Karen Sanguinet

Summer Research Program: Improving Crop Resiliency: Agriculture in Changing Climate

Abstract: Thlaspi arvense, commonly known as field pennycress, is a weed species in the *Brassicaceae* family known for its prolific growth in diverse environments, and their high seed oil and protein content. Although pennycress promises to be an attractive winter annual cover crop, several limitations, such as the presence of anti-nutritional glucosinolates and erucic acid, has been linked to negative effects on health and limits its value as a crop. Several mutant lines have been generated to improve both pennycress seed oil quality and harvestability; however, the effect of these mutations on plant development remains unclear. Additionally, the adaptive response of pennycress to abiotic stressors is crucial to assess its viability as a cover crop. In the current study, pennycress lines with CRISPR-Cas9 knockout mutations of the lipid metabolism genes *fae1*, *rod1*, and the transcription factor tt8 were analyzed for changes in leaf lipids profile at 2, 3 and 5 weeks after germination. Further, tt8 mutant lines along with corresponding winter and spring reference lines MN106 and SP32-10 were subjected to growth hormones ABA, JA, GA3, and GA4+GA7 treatments to assess their impacts on primary root growth. The behavior of root hair elongation in response to cold stress at 10 degrees Celsius was observed in *Arabidopsis thaliana*, a closely related species to pennycress, and compared to other species. Additionally, a CRISPR-Cas9 knockout of pennycress *Sugar Dependent 1 (SDP1)* in the SP32-10 genotype, a gene that encodes a triacylglycerol lipase protein enhancing seed oil composition. Expected results include a change in lipid content among mutants, enhanced primary root growth in optimum growth hormone concentrations, and similar root hair elongation patterns in response to cold stress compared to other plant species. Taken together, these findings offer valuable insights into both lipid metabolism and overall plant development in the emerging oilseed pennycress.

Poster Number: 37

Student Name (Home Institution): Jung Wang (Washington State University)

Project Title: Studying Movement of viral RNA segments of Potato Virus in plants

Co-Authors: Hira Kamal, Kiwamu Tanaka

Summer Research Program: NSF Plant Genome

Abstract: Potatoes are a popular and widely consumed food that provides sustenance to many individuals. However, the underground nature of potato plant's crucial edible part, the tuber, makes it susceptible to various soilborne pathogens, leading to significant diseases. One such important potato virus is the Potato mop-top virus (PMTV), which consists of three single stranded RNA segments: RNA-RdRp, RNA-CP, and RNA-TGB. These segments have distinct functions such as replication, encapsidation and movement with the plants. However, the exact mechanism by which these RNA segments spread in the plant body remains unknown. The focus in this study is to identify the specific RNA segment(s) for the movement within plants, ultimately leading to disease symptoms. To accomplish this, we chose *Nicotiana benthamiana* as a model host, as it is commonly used to study plant viruses. We inoculated leaves of *N. benthamiana* plants with artificial RNA clones of PMTV, creating eight different combination groups. We then employed quantitative-PCR to measure RNA levels in both the inoculated (local) leaves and non-inoculated (systemic) leaves of the same plant. The results demonstrated that all RNA segments were detected in both local and systemic leaves. Additionally, there was no interaction between all RNA segments, except for RNA-RdRp-enhanced movement of the RNA-CP segment. By uncovering the roles of specific RNA segments in PMTV movement, this research will contribute to our understanding of viral distribution functions. Additionally, it will enhance our knowledge about PMTV, potentially aiding in the development of strategies for blocking transmission of the virus in agricultural field.

Poster Number: 38

Student Name (Home Institution): Oscar Rodriguez (Washington State University), Nallely Leon (Lewis-Clark State College)

Project Title: Expression and Purification of Potential Protein Markers of Heat and Drought Stress: NBR1 and Catalase

Co-Authors: Alyssa Parish, Kathleen Hickey, Andrei Smertenko

Summer Research Program: Plant Cell Biology and Biochemistry

Abstract: Peroxisomes function in oxidative reactions such as the beta-oxidation of fatty acids, photorespiration, and the glyoxylate cycle. Some of these oxidative reactions produce hydrogen peroxide as a byproduct—known as a reactive oxygen species (ROS)—that is harmful to cells and proteins. Catalase is an enzyme found in peroxisomes at a high abundance and plays a role in the degradation of hydrogen peroxide. Catalase helps maintain low concentrations of hydrogen peroxide to prevent cell damage. Peroxisomes also undergo damage by ROS. Therefore, peroxisomes need a way to become degraded. Autophagy is a process that regulates the number of organelles, proteins, and lipids that are damaged by degrading them and recycling certain aspects that can be reused. Pexophagy is a type of selective autophagy where specific protein, protein complexes, organelles, and in this case, peroxisomes, are targeted for autophagy. Pexophagy receptors in plants are still unknown, however in mammals the cargo receptor NEIGHBOR OF BRCA1 (NBR1) is necessary for pexophagy. In plants, there is a homolog to human NBR1 which is a potential candidate as a pexophagy receptor. The goal of this experiment was to produce sufficient proteins of NBR1 and Catalase to be used to create a method for detecting and quantifying these proteins during normal growth in plants and during abiotic stress. We anticipate that the abundance of Catalase and NBR1 can be used to phenotype heat and drought stress responses.

Poster Number: 39

Student Name (Home Institution): Yizhen Zhao (Whitman College)

Project Title: Hydroxycinnamate Analysis of Wheat Whole Grain Flour for Antioxidant Profiling

Co-Authors: Niharika N. Chandrakanth, Aichatou Djibo Waziri, Kimberly Campbell, Laura Bartley

Summer Research Program: Improving Crop Resiliency: Agriculture in Changing Climate

Abstract: Hydroxycinnamate (HCA) abundance contributes to the health benefit of whole grain consumption including prevention of cardiovascular disease, cancer, and diabetes. Two of the most prevalent HCAs, *Para*-Coumaric acid (*p*CA) and ferulic acid (FA), are mainly bounded to cell wall polymers like lignin and arabinoxylan. Previous research has shown that both HCAs demonstrate antioxidant, anti-cancer, antimicrobial, antivirus, and anti-inflammatory properties. Therefore, *p*CA and FA concentrations are interesting to profile for the selection of grains for biofortification. We use high performance liquid chromatography coupled with UV detection to quantify HCAs in whole-grain wheat flour of different genotypes. All samples contain FA concentration 20-30 times higher than *p*CA. Among all genotypes, Purple 2 soft winter wheat yields the highest HCA concentrations (0.039 µg *p*CA/mg flour and 0.89 µg FA/mg flour). Additional genotypes are now being examined for HCA concentrations. Genotypes with higher HCA concentrations can be used to breed wheat varieties with higher health value.

Poster Number: 40

Student Name (Home Institution): Mya Mackowski (Washington State University)

Project Title: Investigating the Role of Root Hairs in Nitrate Uptake in the Grass Species Brachypodium Distachyon

Co-Authors: Miguel Rosas, Karen Sanguinet

Summer Research Program: NSF Plant Genome

Abstract: Root hairs are important for plants as they increase root surface area thereby expanding access to soil nutrients like nitrate. Nitrate rich fertilizers are essential for productive crop yield and in some plants nitrate can stimulate root hair initiation. In *Brachypodiumdistachyon*, a model for grass species, the wild type Bd21 has dense root hairs. However, the *Brachypodium buzz* mutant displays a root hairless phenotype. We hypothesize that the lack of root hairs in the buzz mutant would absorb less nitrate from its environment compared to the wild type Bd21. Furthermore, we hypothesize the decreased nitrate content would result in lower nitrate uptake by the *buzz* root. To test this hypothesis, we compared nitrate content and uptake between wild type and *buzz*, using a hydroponic system. *Brachypodium* plants were grown on 0mM NO_3 plates for 7 days and then moved to hydroponics in either low nitrate (0.1mM) or high nitrate (10mM) conditions. To test total shoot and root nitrate uptake content and root uptake, plants were grown in hydroponics for 7 days before harvesting tissue. To measure total nitrate content in root and shoot, we used a colorimetric assay of known nitrate concentrations to generate a standard curve and quantify the nitrate concentration in plant tissue. Our results show *buzz* has a higher nitrate content in shoots under low nitrate conditions and therefore reject of our null hypothesis. This suggests that under low nitrate conditions, the total nitrate content increases in the *buzz* shoot. This can be impactful depending on the environment or other factors like fertilizer used that the plants are grown in. Finally, this can be beneficial as the traits that *buzz* displays can encourage growth in soil conditions that lack proper nutrients alongside decreasing our dependency in chemical fertilizers.

Poster Number: 41

Student Name (Home Institution): Dana Passinhas-Bergman (Washington State University), Trinity Hanning (Washington State University)

Project Title: Analysis of heat and drought stress in wheat

Co-Authors: Taras Nazarov, Glenn Turner, Andrei Smertenko

Summer Research Program: Improving Crop Resiliency: Agriculture in Changing Climate

Abstract: In the Pacific northwest, several crop species undergo heat and drought stress during the summer months as the weather becomes hotter and heat waves become more prominent. The higher temperatures have a continuing negative impact on crop yields, which in turn impact crop productivity and profitability. The goal of our research is creating a pathway to breeding more resilient varieties of wheat. Our research is split into three parts. The first part is studying how heat and drought stress can alter the physical structure of Berkut during seed development and germination.The second part is measuring the biochemical response of heat stress through peroxisome abundance. The third part is a pilot study that focuses on the impact that Gamma-aminobutyric acid (GABA) has on the number of peroxisomes contained in several crop species and how different methods of application of GABA can influence peroxisome proliferation. The samples from the heat stress and GABA experiments are collected across different time points to see how time affects peroxisome proliferation.Although further research is needed to fully understand the role GABA has in crop species, understanding how heat and drought stress can affect the physical and biochemical response in crop plants as well as finding ways to mitigate those responses will lead to more resilient varieties, higher productivity in agriculture, and food availability for everyone.

Poster Number: 42

Student Name (Home Institution): Erica Stryker (Washington State University)

Project Title: Bioinformatic Analysis of CRISPR-mediated Acyltransferase Knockout Mutations in Panicum virgatum and Oryza sativa

Co-Authors: Niharika Chandrakanth, Stephen Ficklin, Laura Bartley

Summer Research Program: NSF Plant Genome

Abstract: The emergence of biofuels as an alternative to traditional fossil fuels presents many promising advantages including increased ecological sustainability as well as positive economic impact and stability. Acyltransferases modify the cell wall of plants through the addition of hydroxycinnamate components altering the ease of biomass access for processing into products like biofuels. This study seeks to investigate the effects of using CRISPR-mediated genome editing to knockout OsAT5 in rice (*Oryza sativa*) and both OsAT9 and OsAT10 in switchgrass (*Panicum virgatum*) to understand acyltransferase catalyzed cell wall modifications. *Panicum virgatum* was transformed using pRGEB32, a plasmid containing CRISPR-CAS9 and hygromycin phosphotransferase (HPT), a gene that confers hygromycin resistance. Transformation was evaluated through the PCR amplification of HPT. Gel electrophoresis confirmed the presence of HPT in *Panicum virgatum* acyltransferase knockout strains. Bioinformatic analysis was performed via various pipelines (AGEseq, GraphMap, CRISPRnano) to evaluate the presence of an insertion or deletion type mutation in *Oryza sativa* knockout strains. Genomic modifications were found in *Oryza sativa* that were consistent with CRISPR induced deletions. Further cell wall analysis is needed to determine the effectiveness of acyltransferase inactivation mutations on cell wall integrity and composition in both *Oryza sativa* and *Panicum virgatum* for use in microbe-based biofuel production.

Poster Number: 43

Student Name (Home Institution): Stephanie Denton (Central Washington University), Una Griffith
(California Polytechnic State University), Hunter Whitlock (Washington State University)

Project Title: Exploring the Effects of Plant Specific Proteins During Cytokinesis

Co-Authors: Alyssa Parish, Tetyana Smertenko, Andrei Smertenko

Summer Research Program: Plant Cell Biology and Biochemistry

Abstract: Embryophytes were the first members of the Plantae kingdom to colonize land due to the evolution of the phragmoplast, which forms during cytokinesis. Microtubules facilitate phragmoplast development in conjunction with various proteins and cell structures. An important family of proteins that coordinate this process through microtubular management are known as Microtubule Associated Proteins (MAPs). To better understand the phragmoplast and plant cell cytokinesis, this research focuses on the plant specific microtubule regulators, MACET and AUGMIN7 which are apart of the microtubule nucleating factor known as the AUGMIN complex. These proteins are unique to embryophytes and localize to the phragmoplast. MACET4, MACET5, and AUGMIN7 are observable and manipulatable for in vivo and in vitro experiments therefore the combination of these mutations are the focus of this research. The effects of MACET4, MACET5, and AUGMIN7 knockout are studied in Arabidopsis thaliana to determine the phenotypes that are associated with triple mutant lineages compared to wild type. Phenotypes of interest include microtubule nucleation effects, microtubule catastrophe and rescue occurrences, and microtubule polymerization and depolymerization rates. Mutants are genotyped using DNA extraction, PCR, and gel electrophoresis. Microtubule catastrophe/rescue frequency and on/off rates of tubulin are calculated using fluorescent microscopy and kymograph analysis to determine phenotypes. The macet4macet5 double mutants were generated by mutagenising MACET5 in MACET4 knockout background using CRISPR-Cas9. Triple mutant of macet4, macet5, and augmin7 were generated through crossing the macet4macet5 double mutants with augmin7-1 allele. To better understand the phragmoplast and the importance of MACET4 in its formation, future research will include the further study of mutant lineages. This research will also expand to include other plant specific proteins, their participation in phragmoplast development, and their coordination and interaction with the important protein–MACET4.

Poster Number: 44

Student Name (Home Institution): Nicolas Tanaka (Massachusetts Institute of Technology)

Project Title: Laser Injection Locking using Active Feedback Loop

Co-Authors: Colby Schimelfenig, Peter Engels

Summer Research Program: Waves in the Universe and Technology

Abstract: Laser light often needs to be amplified for ultracold atom experiments. Light from one laser diode (seed laser) can be amplified by passing it into another laser diode (injection laser). With this method, low-noise amplified laser light can be achieved. However, the injection laser diode current must be stabilized such that the injection cavity resonates with the frequency of the seed laser. We stabilize the current using an active Proportional-Integral (PI) feedback loop. A linear signal around the locking point is required for the feedback loop. We use a narrow laser-line filter for our 671 nm laser, which provides a linear signal around the lock point. The feedback loop circuit was designed on a printed circuit board, using operational amplifiers for the feedback components. A scanning Fabry-Pérot interferometer with 0.2 pm resolution was assembled to examine the spectral purity of the amplified laser light. A signal with linear regions was acquired, and the scanning Fabry-Pérot interferometer was used to find a lock point with clean spectral purity. A lock point in a linear region with a clean spectral purity was found. The grating spectrometer with 0.1 nm resolution was used to further verify the spectral purity of the lock point. The printed circuit board was assembled and the circuit components are being tuned to acquire locking. This amplified laser light will be used for a Lithium cooling experiment.

Poster Number: 45

Student Name (Home Institution): Anna Lichterman (Sonoma State University)

Project Title: Regenerative Agriculture: Can Cover Crops Be Integrated with Current Rotations Across Agro-Ecological Zones in the Palouse?

Co-Authors: Jan Boll, Fabio V. Scarpare

Summer Research Program: Stakeholder Informed Modeling of Innovations in the FEW

Abstract: Regenerative agriculture focuses on restoring soil health through methods such as no-till, precision fertilizer application and cover crops. Maintaining and restoring soil health is a key challenge in the Palouse region which is known for its intensive production of crops such as wheat and lentils. Implementing regenerative agricultural practices such as cover cropping has the potential to increase soil organic matter and decrease the need for fertilizer over time. However, much of the Palouse is dryland agriculture so the impact on soil moisture must be considered when cover crops are added to crop rotations. In this study, the viability of cover crops and their effect on the water balance was evaluated in order to determine how regenerative agriculture principles can be successfully applied to the Palouse region. Three locations, one in each dryland agro-ecological zone in the Palouse, were chosen to examine the addition of cover crops using rotations typical in that zone. Two of these locations currently have ongoing cover crop field trials taking place. CropSyst, a process-based model that generates daily time-step crop simulations, was used to create multiple scenarios to examine both “business as usual” and cover crop rotations. Cover crops were added to the “business as usual” rotations either by replacing fallow periods or by replacing a spring cash crop. Simulation results show the impact of the addition of cover crops on the water balance and cash crop yield and other agronomic variables such as organic matter. Future research could examine the effect of changing planting and termination dates for cover crops, the usage of cover crops as forage or feed for livestock and different cover crop mixes using both current climate conditions and future climate scenarios.

Poster Number: 46

Student Name (Home Institution): Shelby Chandar (California State University, Sacramento)

Project Title: A heavy LIFT: Qualitative Analysis of Faculty Intervention Modalities

Co-Authors: Lillian Sean

Summer Research Program: Research in Interdisciplinary STEM Education (RISE)

Abstract: Perception is how we engage with our world and determines the path we take in life. The ways in which students perceive common classroom experiences shapes their subsequent engagement. If they fail an exam, they may see it as an area of growth, or a door slammed. “WISE” interventions make use of this fact by providing opportunities for shifts in mindsets (Walton & Wilson, 2018). The LIFT program equips faculty with this knowledge of WISE interventions (e.g., growth mindset and resilience, mindfulness and self-compassion, and/or values and values-based decision making). Historical LIFT data has shown the effectiveness of such interventions, but there is little research, on how faculty choose to implement these kinds of interventions into their classrooms. Using a priori and emergent coding of LIFT program artifacts (e.g., application materials, final program reports), we describe the ways in which faculty infused their courses with wise interventions as well as the problems faculty faced during the implementation process. Two coders coded independently using the emergent codebook which was done iteratively with discussions to reach consensus. We found that there were differences to the degree to which interventions were embedded in the course (e.g., single activities vs changes to assessment structures). Additionally, faculty voiced concerns around time and student push-back. Our findings have implications for instructors and faculty professional developers regarding key considerations for navigating the implementation process of WISE interventions.

Poster Number: 47

Student Name (Home Institution): Galileo Defendi-Cho (Colorado College)

Project Title: Riverine Microbial Biodegradation of Pyrogenic Dissolved Organic Matter from Wildfire Ash

Co-Authors: Saraf Islam Promi

Summer Research Program: Environmental Engineering: Measurements and Modeling in the Pacific Northwest

Abstract: Wildfires leave partially burned organic matter behind as ash, which is readily dissolved by post-fire rainfall, inundating aquatic environments with pyrogenic dissolved organic matter (PyDOM), a bioavailable source of carbon and nitrogen. This increase in PyDOM concentration can lead to a host of environmental water quality issues. Presently, biogeochemical outcomes of PyDOM are not fully understood. Previous studies using lab-created ash have shown that riverine microbes can biodegrade PyDOM, ultimately returning it to the atmosphere as CO_2 and N_2. This study aims to extend this proof of concept to genuine wildfire ash, utilizing samples collected from the LNU Lightning Complex Fire, Lake County, CA in October 2020. Concentrations of total organic carbon and inorganic nitrogen compounds were measured over 20 days in dissolved wildfire ash samples inoculated with riverine microbes from the Palouse River, WA. Bacterial colony counts were conducted to track relative density of microbes to more accurately attribute PyDOM biodegradation. We found that dissolved organic carbon in ash samples treated with riverine microbes was degraded more rapidly and more completely compared to sterile samples, and the rise and fall of ammonia, nitrite, and nitrate concentrations in the same samples points towards a similar trend for dissolved organic nitrogen. These findings show that riverine microbes are able to biodegrade PyDOM from wildfire ash, extending the previous proof of concept. This study takes a step forward towards accurately modeling true conditions in post-wildfire environments, and confirms that riverine microbes are integral in the process of returning these environments to stable, baseline conditions.

Poster Number: 48

Student Name (Home Institution): Theresa Harbert (Washington State University), Stevee Judy (Ball State University), Molly Hamilton (San Francisco State University)

Project Title: The Association of Race and Communication Patterns Among Law Enforcement Interactions with Cognitively Impaired Civilians

Summer Research Program: Studying Race and Policing in the Complex Social interactions Lab

Abstract: The last two decades have witnessed an increase in awareness and urgency toward improving police interactions among persons with mental illnesses (PMIs). Embedded within this response are efforts to improve empathy, active listening, and responsive referrals to resources. Survey and interview-based research documents issues and challenges from the perspectives of the individual, officer, and family members, though absent from this research is research examining the nature of these interactions. This research uses 105 randomly sampled videos of police body-worn camera (BWC) footage to examine dimensions of interpersonal communication (i.e., tone, intensity, pace) within contacts involving a person exhibiting observational cues associated with cognitive impairment. These outcomes are examined to determine to what extent individual and situational factors influence the interaction. Results suggest variability in the frequency and nature of effective interpersonal communication within these contacts, variability in the presence of observational cues associated with cognitive impairment, and referral for services.

Poster Number: 49

Student Name (Home Institution): Aidan Sudler (University of Oklahoma)

Project Title: Quantum Synchronization in Interacting Collective Spin Systems

Co-Authors: Qingze Guan

Summer Research Program: Waves in the Universe and Technology

Abstract: Our understanding of classical synchronization—used as a measure to quantify the extent to which two or more coupled events occur at the same time and rate—allows us to accomplish several important tasks, i.e. running power grids and making effective pacemakers. Achieving synchronization in quantum systems will lead to advances in quantum information protocols, quantum networks, and quantum metrology (sensing) applications. Recent experiments demonstrate that achieving quantum synchronization of single spin-½ trapped ion is physically realizable. Our work investigates quantum synchronization of collective spin-½ bosons with all-to-all interactions which is mapped to the Lipkin-Meshkov-Glick (LMG) model subject to gain and loss terms. We aim to understand the interplay between the various interaction effects such as the self-trapping phenomena and the quantum synchronization in the collective spin system.

Poster Number: 50

Student Name (Home Institution): Ketna Kolakaluri (Washington University in St. Louis)

Project Title: Systems Dynamic Model of a Biodiesel Plant's Economic and Environmental Viability in the Palouse

Co-Authors: Kara Whitman

Summer Research Program: Stakeholder Informed Modeling of Innovations in the FEW

Abstract: At the start of 2023, plans for AgTech OS to build a biodiesel plant in Pullman were under way. The plant would operate in a circular fashion, buying canola from farmers in the Palouse and selling biodiesel back to them, providing the region with reliable and sustainable energy. Due to public discontent over the plant's location, the original plans were scrapped and AgTech OS secured a new location within the Palouse. The paper aims to determine if the proposed plant will be economically viable for both Ag Tech OS and farmers while generating carbon reductions. To best model the complexities of the plant's influence on public perception, farmers, and the environment, we take a systems dynamics approach. The model has 4 main components: farmers' profits, the plant's profits, carbon emissions, and public acceptance. Due to the circular nature of the plant's proposed business model, it is highly likely that policy interventions are necessary to make the plant financially viable for both farmers and AgTech OS. Subsidies, rebates to farmers for buying biodiesel, or a combination are tested on the system to determine the optimal method for generating an economically feasible system. In this model, carbon reductions generated from farmers using locally produced biodiesel instead of petrodiesel incentivizes government subsidies to maintain the economic feasibility of the plant. We predict the model will demonstrate the plant causing a reduction in carbon emissions and the requirement of a combination of rebates to farmers and subsidies to the plant to maintain the financial viability of the plant.

Poster Number: 51

Student Name (Home Institution): Joshua Barron (Kansas State University)

Project Title: Student Justification on the Color Spectrum in an Introductory Level Physics Course

Co-Authors: Anya Guy

Summer Research Program: Research in Interdisciplinary STEM Education (RISE)

Abstract: The Physics 150 class, Physics and your World, is an introductory physics class for those pursuing education degrees. We collected data from a worksheet about the color spectrum in the 2021-2022 school year and created a codebook to understand the frequency and correctness of students' justifications. The worksheet questions were then modified to foster better student responses. Data collected from the 2022-2023 school year utilized this new worksheet. From this, we analyzed trends and differences across the two years to understand if the revisions to the worksheet worked as intended. Understanding the framing of questions is a valuable process for any class. Because student knowledge is not always reflected in student responses, revising questions is critical to aligning what the educator thinks students know and what students know. We are interested in understanding when and how student responses utilize experimental observations when asked to justify their conclusions. In this context, we view justification as how students understand their responses to be true. Justification is often a tool for educators to gauge whether their students understand material on a conceptual level. When the material is a familiar concept, in this case lights and color, we investigate how effective the worksheet is at deepening knowledge and student reasoning through the use of their justifications.

Poster Number: 52

Student Name (Home Institution): Alex Castronovo (Saint Mary's College and University of Notre Dame)

Project Title: The Degradation of Free Chlorine in Premise Plumbing in a Young Building

Co-Authors: Tim Ginn, Aidan Griffin, Dave Bollinger

Summer Research Program: Environmental Engineering: Measurements and Modeling in the Pacific Northwest

Abstract: Disinfection is a very important step in cleaning potable water as it removes bacteria that are harmful to human health. Free chlorine is one of the most frequently used water disinfectants in drinking water treatment. With any disinfectant, it is important to put enough of the chemical in the water so that there will be residual, or remaining, chlorine throughout the drinking water distribution system (DWDS). However, disinfectants, and free chlorine in particular, are very prone to degradation in DWDSs, which can lead to a reduced defense against pathogenic bacteria. This decay can occur most rapidly in the premise, or building, plumbing part of the DWDS. Here I will report on the results of a sampling campaign designed to evaluate the residual free chlorine at different points within premise plumbing. The sampling campaign was done in the PACCAR building on Washington State University campus, which was constructed in 2015. Results suggested positive interference by manganese oxide or other particulate matter. In order to avoid this interference, a slower flow rate for sampling was used.

Poster Number: 53

Student Name (Home Institution): Josie Dieu (University of Arizona)

Project Title: Evaluation of Seed Treatments on Various Pea Cultivars Using Multispectral Unmanned Aerial Vehicle (UAV).

Co-Authors: Milton Valencia Ortiz, Diego Fernando Restrepo Holguin, Sindhuja Sankaran, Rebecca McGee

Summer Research Program: Phenomics Big Data Management

Abstract: Optimizing production and continually enhancing crop resilience is essential to increase yields and feed the rapidly growing world population. It is crucial to explore options that may lead to the discovery of plant varieties that exhibit superior performance in comparison to others. Seed treatments were applied to two cultivars of spring peas, Hampton and PS171000022, and two cultivars of winter peas, MiCa and Klondike. The seed treatments were Bigfoot (mycorrhizae - a symbiotic relationship between fungi and plants), X-seed (a nutritional slurry), *Rhizobium leguminosarum* (bacteria that forms a symbiotic relationship with the plant and fixes atmospheric Nitrogen), and an untreated control. The experiment was planted using a split-plot design with four replications at the WSU Spillman Agronomy Farm. Multispectral sensors mounted on an unmanned aerial vehicle (UAV) were used to capture images every 7-10 days until physiological maturity. Images were stitched and orthorectified using Pix4D, and MATLAB was used to extract the normalized difference vegetation index (NDVI), green normalized difference vegetation index (GNDVI), and the normalized difference red edge index (NDRE). Custom code scripts using Python were developed to create visual displays that assisted in recognizing trends and patterns in the data. It is anticipated that the data may indicate significant differences in vegetation index values between the various pea cultivar and seed treatment combinations. Results will determine if any of the seed treatments significantly affected the growth/productivity of the pea cultivars and may serve as the basis for further research.

Poster Number: 54

Student Name (Home Institution): Anselma Bautista (Yakima Valley College)

Project Title: Using Ecological Momentary Assessment to Capture Older Adults' Memory Strategy Use in Real-Time

Co-Authors: Brooke F. Beech, Catherine Luna, Maureen Schmitter-Edgecombe

Summer Research Program: Gerontechnology

Abstract: Objective: This study aimed to characterize how older adults use compensatory strategies in their typical environments. Compensatory strategies refer to tools and techniques individuals utilize to complete tasks. Effective utilization of these strategies in completing everyday tasks is known to promote older adults' functional independence.

Methods: To capture typical usage of compensatory strategies in daily life, participants (*n* = 63, age 50 and older) wore a smartwatch for two weeks and were prompted four times a day to report their real-time experiences. Participants were also given the opportunity to capture their experiences outside of the prompts by pressing a "strategy" button that was always accessible on the watch home screen. Questions on the smartwatch inquired about the most helpful strategy used in the past hour and what type of activity it was used to support.

Results: A total of 2024 compensatory responses were captured. About twice as many answers were received in response to prompts (n = 1410) as were manually entered (n = 614). The most popular responses entered during prompts included no strategy (28.6%), paper note (12.6%), part of routine
(12.4%), electronic note (9.1%), and item location (8.9%). Similar trends were observed in the manually entered data. Regarding the type of activity the strategy was used to support, participants most often endorsed "appointment" (17.4%) or "other" (42.3%).

By employing ecological momentary assessment (EMA), this allowed us to capture participants' experiences in-the-moment, which provides a more accurate depiction of their daily lives compared to artificial, time-limited laboratory settings. To the authors' knowledge, this was the first EMA study to examine real-time strategy usage. Future studies should consider adding more activity options to reduce endorsement of "other." By capturing real-time data, we can better understand patterns, advance understanding of cognition and behaviors and enhance assessment and intervention techniques.

Poster Number: 55

Student Name (Home Institution): Melanie Santiago (Haverford College)

Project Title: Self-Healing: The Role of Domains in Self-Healing of Dye-Doped PMMA

Co-Authors: Elliot Steissberg, Acacia Patterson, Brian Collins, Mark Kuzyk

Summer Research Program: Waves in the Universe and Technology

Abstract: Self-healing is a phenomenon capable of reversing photodegradation of materials used in lasing and nonlinear optical device applications, which extends material lifetime and durability. The materials of interest for this project were poly(methyl methacrylate) (PMMA) doped with disperse orange 11 dye (DO11) of varying concentrations. It was observed that at higher temperatures, the recovery rate of dye-doped PMMA decreased. This counter-intuitive result inspired the hypothesis that domains (clusters of varying sizes) of dye molecules were responsible. Our model of self-healing, which posits that the healing rate depends on domain size, accurately predicts domain size and DO11 self-healing. Resonant Soft X-ray Scattering (RSoXS) gives us direct confirmation of the existence of domains and can be used to infer the dye domain size as a function of dye concentration for samples fabricated using polymerization and spin-coating. Sample thickness was measured with UV-Vis spectroscopy and Variable Angle Spectroscopic Ellipsometry (VASE). The absorbance peak from UV-Vis can then be used to confirm dye concentration of polymerized samples. This work focuses on the reproducibility of RSoXS data so that this technique can be used to differentiate dye domains from roughness and other sources of noise.

Poster Number: 56

Student Name (Home Institution): Tanner Miller (Millersville University)

Project Title: Treatment of Wildfire Ash in Drinking Water

Co-Authors: Mrittika Rodela, Indranil Chowdhury

Summer Research Program: Environmental Engineering: Measurements and Modeling in the Pacific Northwest

Abstract: Wildfires continue to showcase greater intensity and frequency as a consequence of climate change. As a result, more communities are becoming vulnerable and impacted by wildfires, which pose a threat to their respective water supplies due to ash contamination. For the study, soil samples were collected from the University of Idaho Experimental Forest (UIEF) and burned in a muffle furnace for 2 hours at 250 ℃, 450 ℃ and 650 ℃. Aluminum Chlorohydrate, commonly known as ACH, was used to assess its effectiveness on various lab and wildfire ash types at the following dosages: 5 mg/L, 10 mg/L, 15 mg/L, and 20 mg/L. Post-treatment parameters that were examined include turbidity, pH, electrical conductivity (EC), zeta potential, specific ultraviolet absorbance, and dissolved organic matter (DOC). Lab ash characterization parameters included pH, EC, zeta potential, and bulk density measurements for ashes produced at temperatures of 250 ℃, 450 ℃, and 650 ℃. Ash samples were also characterized by color using the Munsell color chart. Findings suggest that ACH can reduce the magnitude of zeta potential and turbidity (< 5 NTU) post-coagulation. Further research will allow for water treatment plants to understand the physiochemical characteristics of ash-contaminated water and be able to effectively treat that water for the safety of affected communities.

Keywords: Climate Change, Wildfire Ash, Water Treatment, ACH

Poster Number: 57

Student Name (Home Institution): Josephine Famularo (Washington State University)

Project Title: Traffic Stops and Constitutional Policing: Racism, Colorism, and Language-based Disparities.

Co-Authors: Rachel Hale, Destiny Leonard

Summer Research Program: Studying Race and Policing in the Complex Social interactions Lab

Abstract: Traffic stops are the most common form of interaction between the police and public. Historical analysis of these contacts documents significant differential treatment, particularly as it concerns race and ethnicity. Explanations for this variability highlight explicit and implicit biases, compounded by situational and environmental factors. However, embedded within this research are calls for future research to improve upon the methodology by transitioning the lens to examine how the interaction unfolds. Body-Worn Camera (BWC) footage now allows researchers to focus on the nature of these interactions and evaluate if, or to what extent, there is differential treatment within these stops. This research applies Systematic Social Event Modeling (SSEM) to a random sample of traffic stops from a mid-sized police agency in Washington state in order to investigate and evaluate the relationship between the escalation of traffic stops and the race, color, and English proficiency of the driver being stopped. Results reveal variability in traffic stops depending on individual circumstances.

Poster Number: 58

Student Name (Home Institution): Ava Fetzner (University at Buffalo)

Project Title: Utilization of Systems Dynamics Modeling to Evaluate the Reduction in Gaseous Pollutants with Biochar Co-composting Integration in Washington State

Co-Authors: Brenden Campbell, Manuel Garcia-Perez

Summer Research Program: Stakeholder Informed Modeling of Innovations in the FEW

Abstract: Agricultural waste and forest fires are large contributors to greenhouse gas (GHG) emissions and other gaseous atmospheric pollutants that have negative environmental consequences. Due to rising global warming temperatures and logistical loss of landfill space, Washington state has implemented House Bill 1799 stating 75% of organic waste, approximately 2.16 million tons, must be diverted from landfills by 2030. Increased demand for alternatives has pushed for composting as a proposed end-of-life solution. Although composting emissions are generally lower compared to landfill numbers, aerobic composting still produces large amounts of ammonia, H_2S, and CH_4. In order to combat these pollutants, biochar, a byproduct of pyrolysis with carbon sequestration capabilities, can be made from woody biomass forest waste. Biochar can be added to compost to decrease odor and emissions, and increase the quality of end compost. Biochar also reduces the necessity for fertilizer with nutrient retention and soil deacidification benefits. Utilizing systems dynamics modeling, the global warming potential and gaseous emissions can be compared between different landfill and composting disposal methods. These quantifications can be used to propose policy and increased funding for co-composting integration. By implementing biochar co-composting overall GHG emissions from composting are decreased by 32.4% and emissions from landfilling are reduced by 66%. Ammonia emissions are decreased by 37% compared to regular compost. 285,000 tons of biochar can be implemented into current composting facilities to reduce these pollutants. These findings suggest that co-composting should be incentivized through additional government funding, as the total emissions show a large decline when biochar is initiated.

Poster Number: 59

Student Name (Home Institution): Brendan Sanders (Oklahoma Baptist University)

Project Title: Tilt and Bowing of Projectiles at a High Velocity

Co-Authors: James Hawreliak, Nate Arganbright, Kurt Zimmerman

Summer Research Program: Waves in the Universe and Technology

Abstract: Tilt and bowing of high velocity projectiles have a very important role in the physics of shockwave impacts. Because of this, finding the tilt and bowing of a projectile using different points and their times of impact on the projectile is very important. In this study we performed a high velocity shockwave impact experiment to get the data necessary to find the tilt and bowing of the impactor in the experiment. We used a gas gun to accelerate a copper impactor molded in TPX into a glass target with seven Photon Doppler Velocimetry (PDV) probes behind it connected to optic fibers that send a laser signal upstairs to oscilloscopes where the data is received. The 0.979mm copper impactor was lapped and polished to a 3 micron finish on the impact side. Impact on the target was probed at seven locations The data from the oscilloscopes along with the velocity of the projectile were then used to calculate the tilt of the plane of the projectile. We conducted two experiments, the first on the 2-stage and the second on the powder gun. In the first experiment the velocity was 5.289km/s and the calculated tilt was 3.808 millimeters. The second experiment has an expected velocity of 2.7 km/s and a similar tilt will be calculated from that data. We conclude that the data received from these experiments and future experiments can be used to find the tilt and bowing of projectiles with a high velocity.

Poster Number: 60

Student Name (Home Institution): Jhonny Guzman (Oregon State University)

Project Title: Comparative Analysis of Physics and Education Students: Understanding of Wave Behavior

Co-Authors: Anya Guy

Summer Research Program: Research in Interdisciplinary STEM Education (RISE)

Abstract: This study aimed to comprehend the depth of understanding of phenomena and physics concepts that comes along with wave propagation and interference among students perusing an undergraduate degree in Physics or Education. Two distinct data samples centered around a group-worked worksheet were used to assess the understanding of these students. We analyzed the depth of descriptions in the student responses comparing the responses of Physics students versus Education students hoping to see the effects of Physics Education backgrounds and motivations. A binary hybrid image-text analysis as well as traffic light hybrid image-text analysis was used to assess the understanding and misunderstanding presented by the student responses in their respective worksheets. The binary analysis consisted of whether students showed a minimal understanding of the desired physics phenomenon. There were three categories in which the students' responses could fall into: Correct if the response described most of the presented phenomenon. Incorrect if the response was not describing the presented phenomenon. Partial if the response presented some described phenomenon. With the newfound knowledge of this study, we hoped to better support the students and their comprehension of physics concepts by developing a better worksheet considering misconceptions and abstract ideas that students were found to struggle with.

Poster Number: 61

Student Name (Home Institution): Kaila Bush (Amherst College)

Project Title: Treatment Wetland Impact on Nutrient Removal and Water Temperature Under Future Climate and Agricultural Scenarios, Yakima Basin, USA

Co-Authors: Julie Padowski

Summer Research Program: Stakeholder Informed Modeling of Innovations in the FEW

Abstract: The Yakima River Basin is a highly productive agricultural basin in Washington, USA facing dual challenges from water pollution and warming waters. Like many farming areas across the US West, the Yakima experiences challenges from non-point agricultural runoff pollution but is also expected to experience significant increases in stream temperature as climate changes, which could be highly detrimental to endangered fish species. One method of addressing water pollution is the use of constructed treatment wetlands (CTWs). CTWs have been researched in the Yakima valley for their efficacy in nutrient removal, however, this research lacks systematic analysis of the interconnected systems at play within the wetland as well as the response of such wetlands to changes in the climate and farming practices. This study implements STELLA systems dynamic modeling of the nitrogen and phosphorus removal of a theoretical CTW in the lower Yakima basin in well as the effect that it may have on the water temperature. This model uses existing data on nutrient removal rates and assesses the efficacy of the wetland in lowering nutrient and temperature pollution under different temperature projections and fertilization practices. Results indicate that as temperatures warm, the nitrogen removal rate of the wetland will increase, resulting in higher removal efficiencies. Though the wetland efficiency in nutrient removal increases under these conditions, the rising air temperature reduces the wetland's cooling effects on the water. This could result in stream temperatures that may exceed thresholds that create additional challenges for endangered fish.

Poster Number: 62

Student Name (Home Institution): Aidan Smith (University of Alabama)

Project Title: Professionalism in Traffic Stops: How Driver Demographics and the Local Environment Influence Officer Behavior and Outcomes

Summer Research Program: Studying Race and Policing in the Complex Social interactions Lab

Abstract: A wealth of research demonstrates that establishing standards and holding employees to established standards has a positive impact on improving organizational performance. When it comes to the institution of policing in the United States, being more decentralized/scattered in authority and therefore more complex in regulating than other countries[1], unique challenges are presented in benchmarking police-citizen interactions and implicating them into effective policy. Using a random sample of traffic stops, from a medium-sized police department employing between 75-100 officers, this research applies systematic social event modeling (SSEM) to police body-worn camera (BWC) footage. The footage was coded by marking numerous variables related to professionalism and analyzed to determine whether the demographics of a driver and the stop's environment influence the behavior of the officer. Results and limitations are discussed, and future directions are provided.

[1] David H. Bayley, The Complexities of 21st Century Policing, *Policing: A Journal of Policy and Practice*, Volume 10, Issue 3, September 2016, Pages 163–170, https://doi.org/10.1093/police/paw019

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Buetow	Anna	Whitman College	36	Unraveling the Biochemical Enigma: Using Lipidomics to Investigate Pennycress' Potential as a Winter Cover Crop	Improving Crop Resiliency: Agriculture in Changing Climate
Burnes	Michael	Central Connecticut State University	14	Characterizing Runaway Crystallinity Due to Processing Additives in Organic Solar Cells	Waves in the Universe and Technology
Bush	Kaila	Amherst College	61	Treatment Wetland Impact on Nutrient Removal and Water Temperature Under Future Climate and Agricultural Scenarios, Yakima Basin, USA	Stakeholder Informed Modeling of Innovations in the FEW

Last Name	First Name	Home Institution	Poster Number	Project Title	Research Program
Carlton	Ashleigh	Washington State University	33	Plant Wound Defense: Jasmonic Acid and Its Receptor; Jasmonic Acid Induces a Response in the Semi-functional Mutant Receptor Coi1-30, but Not in Coi1-1	NSF Plant Genome
Carroll	Anna	Eastern Washington University	35	Investigating the Timing of Alpha-amylase Induction During Grain Germination in Wheat: A Sticky Problem.	Improving Crop Resiliency: Agriculture in Changing Climate
Castronovo	Alex	Saint Mary's College and University of Notre Dame	52	The Degradation of Free Chlorine in Premise Plumbing in a Young Building	Environmental Engineering: Measurements and Modeling in the Pacific Northwest
Chandar	Shelby	California State University, Sacramento	46	A heavy LIFT: Qualitative Analysis of Faculty Intervention Modalities	Research in Interdisciplinary STEM Education (RISE)
Chavez	Julian	California State University of Long Beach	25	Language Barriers Between Police & the Public	Studying Race and Policing in the Complex Social interactions Lab
Chriss	Abby	Bowdoin College	6	An Updated Age Calibration for Open Clusters using Red Clump Stars with Gaia DR3	Waves in the Universe and Technology
Craig	Briana	Chapman University	3	Capturing COVID-19: Using Photography in Public Health Curriculum to Support Visual Literacy and Systems Thinking	Research in Interdisciplinary STEM Education (RISE)
Daniel	Jonathan	Otterbein University	9	Exploring Take-Home Materials and Arts Integration in Quality STEM Learning	Research in Interdisciplinary STEM Education (RISE)
Defendi-Cho	Galileo	Colorado College	47	Riverine Microbial Biodegradation of Pyrogenic Dissolved Organic Matter from Wildfire Ash	Environmental Engineering: Measurements and Modeling in the Pacific Northwest
Denton	Stephanie	Central Washington University	43	Exploring the Effects of Plant Specific Proteins During Cytokinesis	Plant Cell Biology and Biochemistry
Dieu	Josie	University of Arizona	53	Evaluation of Seed Treatments on Various Pea Cultivars Using Multispectral Unmanned Aerial Vehicle (UAV).	Phenomics Big Data Management

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Eleccion	Emi	Washington State University	36	Unraveling the Biochemical Enigma: Using Lipidomics to Investigate Pennycress' Potential as a Winter Cover Crop	Improving Crop Resiliency: Agriculture in Changing Climate
Evergreen	Riley	Washington State University	34	Supporting carbon sequestration in switchgrass: Isolating Root Specific Promotors from Switchgrass	NSF Plant Genome
Famularo	Josephine	Washington State University	57	Traffic Stops and Constitutional Policing: Racism, Colorism, and Language-based Disparities.	Studying Race and Policing in the Complex Social interactions Lab
Fetzner	Ava	University at Buffalo	58	Utilization of Systems Dynamics Modeling to Evaluate the Reduction in Gaseous Pollutants with Biochar Co-composting Integration in Washington State	Stakeholder Informed Modeling of Innovations in the FEW
Gines	Mattea	St. Olaf College	22	Investigating Performance Differences Across Demographic Sub-Groups Within Large Lecture Introductory Biology	Research in Interdisciplinary STEM Education (RISE)
Gray	Avery	Mississippi State University	26	Potato Growth and Development Simulation under Distinct Water Regimes	Environmental Engineering: Measurements and Modeling in the Pacific Northwest
Griffith	Una	California Polytechnic State University	43	Exploring the Effects of Plant Specific Proteins During Cytokinesis	Plant Cell Biology and Biochemistry
Guzman	Johnny	Oregon State University	60	Comparative Analysis of Physics and Education Students: Understanding of Wave Behavior	Research in Interdisciplinary STEM Education (RISE)
Hale	Rachel	Northeastern Illinois University	5	“Why’d you stop me?”: The social space and environmental determinants of citations, warnings, and searches during traffic stops	Studying Race and Policing in the Complex Social interactions Lab
Haller	Amelia	Washington State University	27	Impacts of a Multi-year Drought on Groundwater Levels and Accessibility in the Columbia Plateau Regional Aquifer System Within Eastern Washington	Stakeholder Informed Modeling of Innovations in the FEW

Last Name	First Name	Home Institution	Poster Number	Project Title	Research Program
Hamilton	Molly	San Francisco State University	48	The Association of Race and Communication Patterns Among Law Enforcement Interactions with Cognitively Impaired Civilians	Studying Race and Policing in the Complex Social interactions Lab
Hanning	Trinity	Washington State University	41	Analysis of heat and drought stress in wheat	Improving Crop Resiliency: Agriculture in Changing Climate
Harbert	Theresa	Washington State University	48	The Association of Race and Communication Patterns Among Law Enforcement Interactions with Cognitively Impaired Civilians	Studying Race and Policing in the Complex Social interactions Lab
Hollenbaugh	Jess	Portland State University	20	Determining Accretion Disk Size from Photometric Band Lags in AGN	Waves in the Universe and Technology
Hunter	Penelope	Macalester College	4	A Theoretical Case Study of Dam Management Using Dynamic Linear Programming	Stakeholder Informed Modeling of Innovations in the FEW
Hwang	Aliza	Washington State University	19	Exploring the Relationship Between Race and Police Behavior	Studying Race and Policing in the Complex Social interactions Lab
Islam	Khairul	Washington State University	2	Enhancing Network Reception through Directional Antenna Synchronization	Phenomics Big Data Management
Jobson	Molly	Washington State University	16	Improving Soil Health with Vermicompost Tea	Environmental Engineering: Measurements and Modeling in the Pacific Northwest
Judy	Stevee	Ball State University	48	The Association of Race and Communication Patterns Among Law Enforcement Interactions with Cognitively Impaired Civilians	Studying Race and Policing in the Complex Social interactions Lab
Kolakaluri	Ketna	Washington University in St. Louis	50	Systems Dynamic Model of a Biodiesel Plant's Economic and Environmental Viability in the Palouse	Stakeholder Informed Modeling of Innovations in the FEW
Leon	Nallelly	Lewis-Clark State College	38	Expression and Purification of Potential Protein Markers of Heat and Drought Stress: NBR1 and Catalase	Plant Cell Biology and Biochemistry

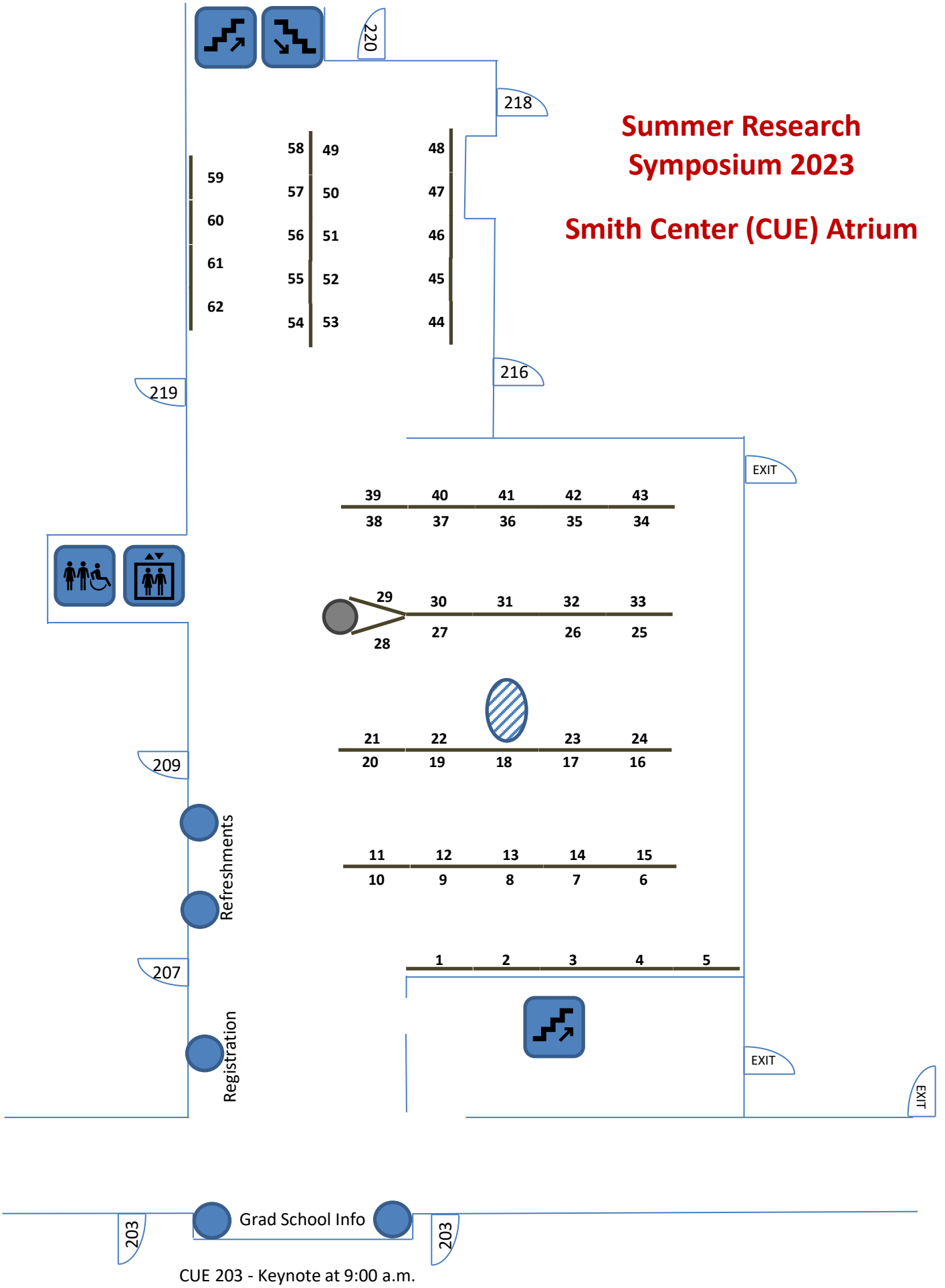
Last Name	First Name	Home Institution	Poster Number	Project Title	Research Program
Leonard	Destiny	University of South Florida	10	Dressed to Impress: How Identity Contingencies Influence Police and Community Interactions	Studying Race and Policing in the Complex Social interactions Lab
Lichterman	Anna	Sonoma State University	45	Regenerative Agriculture: Can Cover Crops Be Integrated with Current Rotations Across Agro-Ecological Zones in the Palouse?	Stakeholder Informed Modeling of Innovations in the FEW
Longwith	Cameron	Washington State University	12	Development of mobile sensor technology to monitor air quality	Environmental Engineering: Measurements and Modeling in the Pacific Northwest
Mackowski	Mya	Washington State University	40	Investigating the Role of Root Hairs in Nitrate Uptake in the Grass Species Brachypodium Distachyon	NSF Plant Genome
Medina	Tyler	University of Redlands	1	Automatic Input Creator for the Quick Environmental Simulation (QES) System	Environmental Engineering: Measurements and Modeling in the Pacific Northwest
Miller	Tanner	Millersville University	56	Treatment of Wildfire Ash in Drinking Water	Environmental Engineering: Measurements and Modeling in the Pacific Northwest
Nguyen	Alexa	University of California, Los Angeles	11	Assessing Terrestrial Water Storage Variability in the Columbia River Basin: Insights from GRACE Satellite Mission and FEW System Analysis	Stakeholder Informed Modeling of Innovations in the FEW
Pascual	Ruby	Cornell University	21	Mitigating Wildfire Impact on Water Resources	Environmental Engineering: Measurements and Modeling in the Pacific Northwest
Passinhas-Bergman	Dana	Washington State University	41	Analysis of heat and drought stress in wheat	Improving Crop Resiliency: Agriculture in Changing Climate

Last Name	First Name	Home Institution	Poster Number	Project Title	Research Program
Peters	Kavina	University of California Berkeley	18	Evaluating the Long-term Effects of Drought Relief Wells on the Surface Water- Groundwater System in the Yakima River Basin (YRB)	Stakeholder Informed Modeling of Innovations in the FEW
Piontkowsky	Megan	Albion College	24	Enhancing Magnetic Field Stability in Spin Exchange Optical Pumping Experiments Through a Current Stabilizing Circuit	Waves in the Universe and Technology
Rinn	Emily	Scripps College	23	Identifying electricity sources to power MSW-GFT technologies in the production of sustainable aviation fuel: A system dynamics approach	Stakeholder Informed Modeling of Innovations in the FEW
Rodriguez	Oscar	Washington State University	38	Expression and Purification of Potential Protein Markers of Heat and Drought Stress: NBR1 and Catalase	Plant Cell Biology and Biochemistry
Rysdon	Katherine	North Carolina State University	17	If You Give a Mosquito a Map, It Will Probably Find You: Using Arts Integration to Support Systems Thinking in Stem Education	Research in Interdisciplinary STEM Education (RISE)
Sanders	Brendan	Oklahoma Baptist University	59	Tilt and Bowing of Projectiles at a High Velocity	Waves in the Universe and Technology
Santiago	Melanie	Haverford College	55	Self-Healing: The Role of Domains in Self-Healing of Dye-Doped PMMA	Waves in the Universe and Technology
Sanzebin	Sarah	Columbia University	31	Increased Yield in High Biomass Wheat Backgrounds Due to Scarlet Region on a 4A QTL	Phenomics Big Data Management
Smith	Aidan	University of Alabama	62	Professionalism in Traffic Stops: How Driver Demographics and the Local Environment Influence Officer Behavior and Outcomes	Studying Race and Policing in the Complex Social interactions Lab
Smith	Casey	Lewis University	15	Evaluating the Ability of the Boise River System's Operational Rules to Meet Water Storage Targets in Response to Climate Change Using System Dynamics Modeling	Stakeholder Informed Modeling of Innovations in the FEW
Stryker	Erica	Washington State University	42	Bioinformatic Analysis of CRISPR-mediated Acyltransferase Knockout Mutations in Panicum virgatum and Oryza sativa	NSF Plant Genome
Sudler	Aidan	The University of Oklahoma	49	Quantum Synchronization in Interacting Collective Spin Systems	Waves in the Universe and Technology

Last Name	First Name	Home Institution	Poster Number	Project Title	Research Program
Tanaka	Nicolas	Massachusetts Institute of Technology	44	Laser Injection Locking using Active Feedback Loop	Waves in the Universe and Technology
Tiegs	Grace	Lewis-Clark State College	7	Comparison of Summer Air Pollution in the Northwestern and Northeastern United States	Environmental Engineering: Measurements and Modeling in the Pacific Northwest
Vandyk	Heidi	Western Washington University	36	Unraveling the Biochemical Enigma: Using Lipidomics to Investigate Pennycress' Potential as a Winter Cover Crop	Improving Crop Resiliency: Agriculture in Changing Climate
Wang	Jung	Washington State University	37	Studying Movement of viral RNA segments of Potato Virus in plants	NSF Plant Genome
Whitlock	Hunter	Washington State University	43	Exploring the Effects of Plant Specific Proteins During Cytokinesis	Plant Cell Biology and Biochemistry
Zhao	Yizhen	Whitman College	39	Hydroxycinnamate Analysis of Wheat Whole Grain Flour for Antioxidant Profiling	Improving Crop Resiliency: Agriculture in Changing Climate

Summer Research Symposium 2023

Smith Center (CUE) Atrium



CUE 203 - Keynote at 9:00 a.m.