PATRICIA BELT CONRADES

SUMMER SCHOLARSHIP & RESEARCH PROGRAM

September 24, 2026

Ohio Wesleyan University

SOPHIA ROHR

OWU ’27 | GENETICS MAJOR AT OHIO WESLEYAN UNIVERSITY
SSRP 2025 RESEARCH MENTOR | ANDREA SURIA, DEPARTMENT OF BIOLOGICAL SCIENCES

“Having this level of trust and collaboration was really satisfying to me since it made this experience feel more personal and helped affirm that research is something I want to do in the future. In addition, while sometimes frustrating, having unexpected results really drove home how important and novel research is.”

THE PATRICIA BELT CONRADES SUMMER SCHOLARSHIP AND RESEARCH PROGRAM

The challenges reshaping our world—from climate change and conflicts threatening global stability to the ethical dilemmas of artificial intelligence—remind us of our deep reliance on scholarly research across all fields. We turn to researchers, thinkers, and creators in every discipline to help us understand and address these complex global challenges.

Now in its 34th year, Ohio Wesleyan's Summer Scholarship and Research Program equips students to address complex issues by working side-by-side with accomplished mentors at OWU and other universities nationwide. At the Symposium, part of OWU's Fall Connection Conference, students will showcase their work and share why it matters. Following the event, research will be available at **owu.edu/ssrp2026**.

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September 24, 2026 | 1-3 p.m.

The Patricia Belt Conrades Summer Scholarship and Research Program coincides with Ohio Wesleyan's Fall Connection Conference.

owu.edu/ssrp
owu.edu/ConnectionConference

SIDE BY SIDE

Every summer on this campus, some version of the same scene plays out. A student looks up from a result that makes no sense and asks a faculty mentor what it means. The mentor has a look, grins, and says, "I have no idea. Let's find out." Today we celebrate student scholars and their faculty mentors who spent ten weeks finding out together.

In the last few years, advances in large language models have introduced powerful new tools and concerning new realities to research and scholarship. Although these tools are remarkable and offer scientists and scholars the ability to take their work in directions and at speeds not previously possible, a summer of mentored research offers something no algorithm can. It is a steady hand to offer guidance and an experienced mind to offer insight. It's a person who has experienced the highs and lows of the craft, who knows how hard the work is and believes you can do it anyway.

Inquiry is messy. Experiments fail for reasons nobody can explain. A brilliant idea in June can lead to results in July that don't quite fit. Over ten weeks of SSRP, mentors help students shrug off a bad day, rethink the plan, and come back the next morning ready to try again. Persistence, in this sense, is less a characteristic than a skill that must be used and sharpened to be useful and available.

I learned this from my own students. In the summer of 2009, Lindsey Aurora (OWU '11) joined my lab in the SSRP. Her project was difficult, but she stuck with it, and the next year her poster earned a Best Poster Award at a regional RNA conference, where she was competing mostly against graduate students and postdocs. What I remember vividly from that experience was watching Lindsey figure out that she wasn't just helping me with my research. She was doing it, and owning it, herself.

At Ohio Wesleyan, our students arrive ready to pursue ambitious self-discovery, and I can think of no better description of a summer in SSRP. The ambition is easy to spot in the pages that follow, but the self-discovery is there too. It happens when a student learns that confusion is not failure, just a normal Tuesday in the life of a scholar. It happens when a mentor asks "What do you think we should try next?" and actually waits for the answer.

I encourage you to wander the symposium and ask our students what they did and what they found. Better yet, ask what went wrong along the way. That is often where the magic happens and where the best stories live. Thanks to our mentors and, especially, to our young scientists and scholars. Today's Symposium is the end of a rigorous, sometimes difficult, but meaningful experience for you. It is also the beginning of something even better.

Dave Markwardt, Ph.D.
Associate Dean of the OWU Connection
Herbert L. and Margaret Wright DuPont Associate Professor of the Biological Sciences
Ohio Wesleyan University

THE PATRICIA BELT CONRADES SUMMER SCIENCE RESEARCH SYMPOSIUM ENDOWMENT

In 2006, Dr. Nancy Reynolds Schneider ’64, established an endowment to name the Summer Science Research Symposium after her good friend and fellow OWU alumna, Patricia Belt Conrades ’63.

Mrs. Conrades is a volunteer registered nurse and homemaker, and a member of Ohio Wesleyan’s Board of Trustees. She regularly assists in the operating room of Boston’s Mount Auburn Hospital and is also a nurse with Volunteers in Medicine, assisting the poor in Stuart, Florida. Dr. Schneider is a highly regarded Professor of Pathology and Director of the Cytogenetics Laboratory on the faculty of the University of Texas Southwestern Medical Center in Dallas. She also has served on the Ohio Wesleyan Board of Trustees.

Mrs. Conrades and Dr. Schneider share a commitment to the sciences, and are both examples of individuals who have enjoyed successful careers in science. The support of Mrs. Conrades and her husband, George Conrades ’61, a member of the OWU Board of Trustees, and Dr. Schneider and her husband, John Schneider, continues to strengthen the science and mathematics programs at OWU.

THE C. PATRICIA FERRY SUMMER SCIENCE RESEARCH PROGRAM ENDOWMENT

In 2008, Carolyn "Pat" Ferry '53 established the C. Patricia Ferry Summer Science Research Endowment in recognition of the program's value as an integral part of the liberal arts experience.

Pat, who passed in December 2021, was a long-time and generous supporter of Ohio Wesleyan's Summer Science Research Program. She visited campus several times during the summer months to meet with students and faculty conducting research.

Pat earned her B.A. in psychology from Ohio Wesleyan University in 1953. She worked for the Case Western Reserve University School of Medicine and the Cleveland Hearing and Speech center before spending more than 25 years as the administrator of the Case Western Reserve University School of Law retiring in 1992.

Pat had vivid memories from childhood of her father helping those less fortunate. "He always made sure that if someone was in trouble and he could help, he would do it," said Pat. "My father was a straight arrow, and he was very generous. He was just that kind of person." Pat and her parents created the Ferry Family Endowment with the hope of contributing some of their wealth to education. When the time came to begin distributing funds, Ohio Wesleyan was at the top of Pat's list. She was a member of Tower Society after committing to include OWU in her estate plans.

"I am pleased to have graduated from Ohio Wesleyan and to have been a part of doing something that might help the school in some way," Pat said. "It's just part of the giving back. I believe in this."

Board 1

CAROLINE O'MALLEY
HAILEY HARRIS

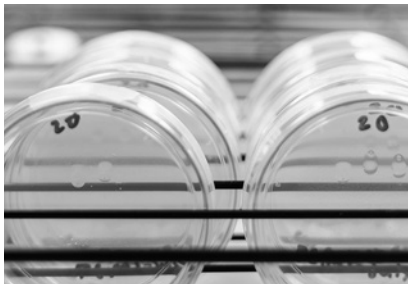
Research Mentor: Franchesca Nestor
Department of Politics & Government, Ohio Wesleyan University

Project Summary: We explore the ways in which public perceptions might impact the ability of individuals with disabilities—specifically, those with food allergies and chronic illnesses—to run for and hold elected office. Individuals with disabilities continue to be underrepresented in politics; further, while millions of Americans live with food allergy and chronic illness, there is little evidence of individuals with these conditions serving in public office, nor is the subject covered in the literature on disability and representation. This summer, we conducted a content analysis of our existing open-ended public opinion survey data to learn how the public feels about people with food allergy and chronic illness serving in elected office. We also created a new conjoint design survey that asks respondents to choose between pretend candidates with different chronic health considerations.

UNDERSTANDING DISABILITY REPRESENTATION: PUBLIC PERCEPTIONS OF POLITICAL ELITES WITH FOOD ALLERGIES OR CHRONIC ILLNESSES

Abstract: Previous literature suggests that there are unique challenges associated with winning and holding political office for people with disabilities. These include a lack of accessibility and resources, stigma, and privacy concerns. Despite millions of Americans living with food allergy and chronic illness, there is little representation of these conditions in elected office, nor has the underrepresentation of these disabilities in government been studied in the literature. Our work and findings to date are based on two surveys of the public. The first was released in fall 2025, and in summer 2026, we conducted a content analysis of open-ended responses to identify themes the data provide regarding people's comfort with elected officials serving in office while also living with food allergies or chronic illnesses. The second public opinion survey was designed in summer 2026 and will be in the field in fall 2026. This survey is a conjoint design survey which pits fictional candidates with different qualities, including different chronic health considerations, against one another for respondents to choose between. The second survey will enable us to understand the impact of chronic health conditions on electability, compared to the impact of other candidate qualities such as gender, experience, and age. From these projects, we will gain a better understanding of the impact of disability, specifically food allergy and chronic illness, on political candidacy and electability.






Board 2

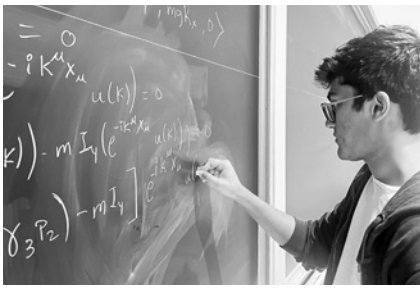
RANJAN SHARMA
MADDIE EBBERT
RYUKA OKADA
MANNAT SIKAND

Research Mentor: Kira Bailey
Department of Psychology and Neuroscience Program, Ohio Wesleyan University

Project Summary: We've designed a fun, immersive video game, "GLYPHMIND," that trains focus, memory, and decision making skills. Before players dive into the game, we use a brain stimulation technique called tDCS (transcranial direct current stimulation) to boost activity in the area that supports staying focused, setting goals, and making smart choices. By combining gameplay and brain stimulation, we're making cognitive training more engaging and effective. From this project, we want to see if the combination of electrical stimulation and an engaging video game will help improve cognitive functioning more effectively than other types of training.

IMPACT OF VIDEO GAMES AND BRAIN STIMULATION ON WORKING MEMORY

Abstract: Working memory refers to a brain system responsible for temporarily holding and processing information essential for tasks. It is an underlying executive function that supports everything else. This capacity tends to decline with age, and is regulated by the dorsolateral prefrontal cortex (DLPFC). Previous studies have shown that stimulating the DLPFC improves performance on working memory tasks (Barbey, 2013), however traditional cognitive training is often reported as boring, repetitive and non-transferrable. Our project addresses this issue by designing an immersive 3D Nback video game task and stimulating the left DLPFC using transcranial direct current stimulation (tDCS). The Nback task is used to measure working memory during which a participant is presented with a sequence of stimuli, such as letters or symbols, and they have to answer whether the current stimuli matches the one presented N trials earlier. tDCS is a safe, non-invasive brain stimulation technique that modulates cortical activity by delivering a low-intensity current (1–2 mA) (Nitsche & Paulus, 2000; Stagg & Nitsche, 2011), which can enhance brain function for up to an hour after stimulation. By stimulating the left DLPFC, a region central to executive function and goal-directed behavior (Miller & Cohen, 2001; Ramnani & Owen, 2004), during gameplay, we expect to find greater improvements in performance and motivation compared to sham stimulation or gameplay with no stimulation. Combining brain stimulation with engaging cognitive training games may lead to more accessible, user-friendly approaches to maintaining or enhancing working memory and cognitive function.positively predict BAS-2. We also hypothesize that there will be an indirect effect of FCP on body image through LGBTQ+ family socialization. This study aims to garner a greater understanding of body image development and how LGBTQ+ family socialization may foster resilience in marginalized families.



Board 3

ELLA NEUENSCHWANDER

Research Mentor: Laurel Anderson
Department of Biological Sciences,
Ohio Wesleyan University

Project Summary: As invasive species are harmful to the environment, studies of garlic mustard can provide insights on the impacts to native plant species and inform forest management decisions. We collected data over a 21-year period on the spread of invasive garlic mustard throughout the Ohio Wesleyan University Kraus Preserve and analyzed its effects on other plant species. We found that garlic mustard does not strongly affect the other plant species, that it is usually found in favorable locations that have higher plant species diversity, and that garlic mustard populations tend to decline in the years after it initially invades an area.

INVASIVE GARLIC MUSTARD (ALLIARIA PETIOLATA) POPULATIONS AND THEIR EFFECTS ON UNDERSTORY PLANT SPECIES COMPOSITION IN A TEMPERATE FOREST

Abstract: Garlic mustard (Alliaria petiolata), an herbaceous plant native to Europe, has invaded the understory of many temperate forests in North America. As invasive species are harmful to the environment, studies of garlic mustard can provide insights on the impacts to native plant species and inform forest management decisions. We collected data over a 21-year period on the effects of invasive garlic mustard on understory plant species diversity in the Ohio Wesleyan University Kraus Preserve in Central Ohio. This included five surveys, in 2005, 2007, 2014, 2018, and 2026, during which we counted garlic mustard individuals within 2x2 meter plots installed at the beginning of the study. We also identified and counted every species found within a 1x1 meter corner of each plot that was revisited at each survey. We quantified plant species diversity within each plot and found a positive correlation between diversity and garlic mustard presence. We also used NMDS to analyze the effects of varying garlic mustard intensity on species composition across years and found that there was no significant effect. Over the course of the study, the amount of garlic mustard within our plots declined on their own. Our data, which is one of the longest observational datasets involving garlic mustard, suggest that (1) garlic mustard does not affect understory plant diversity as strongly as once feared, (2) garlic mustard may persist in relatively favorable microsites that are also beneficial for other plants, and (3) garlic mustard populations tend to decline in the years following initial invasion. These results may be useful to temperate forest managers working to control invasive garlic mustard.

Board 4

HAYLEY READ

Research Mentor: Krystal Cashen
Department of Psychology,
Ohio Wesleyan University

Project Summary: This study aimed to examine how microaggressions are associated with mental health symptoms in marginalized populations like emerging adults with LGBTQ+ parents. Although we hypothesized, using the Temporal Intersectional Minority Stress model, that more LGBTQ+ family microaggressions would be correlated to more mental health symptoms, our study illustrates these two variables were not associated with each other in this sample. These results demonstrate the resilience in emerging adults with LGBTQ+ parents' lives when encountering microaggressions. This study demonstrates that more research is necessary to identify what types of protective factors play a role in mitigating negative effects of microaggressions.

LGBTQ+ FAMILY MICROAGGRESSIONS AND ITS IMPACT ON EMERGING ADULTS WITH LGBQT+ PARENTS MENTAL HEALTH SYMPTOMS.

Abstract: Children of LGBTQ+ parents experience unique microaggressions called LGBTQ+ family microaggressions, which convey harmful stereotypes about an individual's marginalized family status. Previous research found that microaggressions have been associated with more mental health symptoms (Bos et al., 2025, Koh et al., 2019). Though, past studies focused only on families with same-gender or cisgender parents, overlooking LGBTQ+ family structures with different-gender or transgender/nonbinary parents. Using the Temporal Intersectional Minority Stress Theory (Rivas-Koehl et al., 2023) we hypothesized that more microaggressions would be correlated with more mental health symptoms. The data used comes from a larger study about emerging adults with LGBTQ+ parents. The sample included 134 participants between the ages of 18-29 years old ($M = 24.22$, $SD = 3.04$), had at least one LGBTQ+ parental figure, and lived in the United States. A correlation test was used between the LGBTQ+ Family Microaggression Scale (Farr et al. 2024) and the General Health Questionnaire-12 (GHQ-12; Goldberg & Williams, 1988). Participants reported an average score of 2.24 ($SD = 0.79$) on the LGBTQ+ family microaggressions scale and 2.41 ($SD = 0.69$) on the GHQ-12. LGBTQ+ family microaggressions and GHQ-12 scores were not significantly correlated, $r(132) = 0.13$, $p = 0.138$. This study expands the field about the mental health resilience of emerging adults with LGBTQ+ parents, by showing how microaggressions did not correlate with mental health symptoms of this study's sample. This study also adds onto other research examining LGBTQ+ families with different-gender and transgender/nonbinary parents.

Board 5

MARCUS BODE

Research Mentor: Hanliang Guo
Department of Mathematics & Computer Science, Ohio Wesleyan University

Project Summary: Bacteria outnumbers human cells within the body, making the study of them an extremely important task. Most bacteria travel through the human body by rotating a single tail (called a flagellum) to propel their movement. In this project we created 2 mathematical models of a bacteria swimming and mapped its movement through a fluid. We do this by solving hundreds and sometimes thousands of Partial Differential Equations in minutes with coding. We then ran simulations of pairs of bacteria swimming near each other and studied their interactions.

MODELING SWIMMING BACTERIA USING STOKES EQUATION

Abstract: Flagellated bacteria propel themselves by rotating one or more semi-rigid flagella through a specialized rotary motor. In this work, we study the swimming of monotrichous bacteria numerically using the method of regularized stokeslet. Specifically, we tested two different types of models for the bacteria. The first is by modeling the flagellum as a rigid structure that rotates at a constant angular velocity relative to the body. The second is by connecting the motor on the body and the flagellum with a short flexible structure called the hook that works as a universal joint. This model rotates with a constant Torque. We investigated the trajectories of single bacteria and pairs of bacteria with both models, changing characteristics of the tail and observing the change in results. We found that while the average swimming velocity of a single swimmer increases with the spring stiffness, the average transverse velocity varies non-monotonically with respect to the spring stiffness, indicating an optimal spring stiffness to minimize the “wobble”. We also investigate the spring and geometry heterogeneity within a bacterial pair.

Board 6

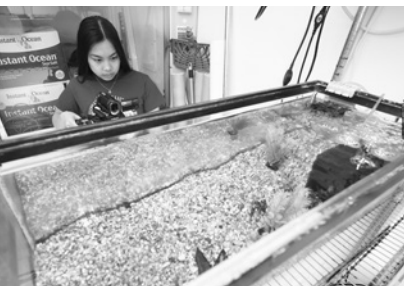
EL HEALEY
MATTISON HYLAND
AIDEN WALZ

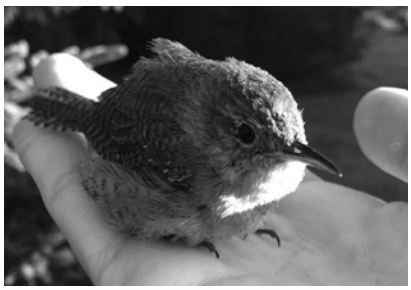
Research Mentor: Kayce Tomcho
Department of Chemistry, Ohio Wesleyan University

Project Summary: The Glycine Receptor is vital for many functions in the human body. A portion of this receptor is not fully understood, specifically how it moves in relation to the cell membrane when the receptor is doing its job. The goal of this project was to take portions of the portion of the receptor and see if they interact with a mimic of a cell membrane by piercing the membrane therefore classifying them as cell penetrating peptides.

CELL PENETRATING PEPTIDES AND MEMBRANE INTERACTIONS—A LOOK INTO THE GLYCINE RECEPTOR'S M3-M4 LOOP

Abstract: The glycine receptor (GlyR) is a pentameric ligand gated ion channel responsible for cell hyperpolarization via facilitating chloride ion influx with dysregulation of the receptor being linked to hereditary hyperekplexia and chronic pain. Treating these conditions requires full comprehension of the structure of the receptor to understand its function. Though high-resolution structures exist of GlyR, elucidated via Cryo-EM, the structure remains partially unresolved, particularly the characteristic M3-M4 loop. Previous studies using cross-linking MS have helped to elucidate the loop's structure and dynamics as well as leading to the hypothesis that the M3-M4 loop may act as a cell penetrating peptide (CPP). The possibility of GlyR as a CPP can be tested by using a model lipid membrane and various peptides within the M3-M4 loop. The interactions between the model lipid membrane dipalmitoylphosphatidylcholine (DPPC) and the peptides LLLLLR, LLLLSR, SPEEMRK, and KLFIQRAK were examined. SPEEMRK and KLFIQRAK are found in the M3-M4 loop, while LLLLLR and LLLLSR are not. These peptides were instead examined specifically to observe the effect of having a polar residue versus a hydrophobic residue in the position next to the terminal R after previous studies in our lab observed key differences in the peptides KIDKISR and QHKELLR. Isotherms were obtained using a Langmuir trough using a subphase of a peptide of interest (LLLLLR, LLLLSR, SPEEMRK, or KLFIQRAK) and a monolayer of DPPC to measure the surface pressure as the mean molecular area decreased. Preliminary results from KLFIQRAK isotherms show no difference from baseline water isotherms, indicating no interaction with DPPC. The isotherm data for SPEEMRK and LLLLSR both showed a shift to the right, indicating elongation, and thus, interaction with DPPC. These results indicate the potential for SPEEMRK and LLLLSR to act as CPPs. The LLLLLR isotherms instead showed a shift to the left, indicating that due to the nonpolar leucine residues, the LLLLLR molecules are moved towards the water-air surface via the hydrophobic effect and pack closely together until the peptide may eventually flip up out of the subphase and solely interact with the monolayer. Further trials are necessary to further understand the effects of successive nonpolar residues. Collectively, this novel information of peptide interactions with DPPC indicates that the peptides in the M3-M4 loop may function similarly to CPPs and improves our understanding of peptide and lipid interactions.





Board 7

SHELBY MATT
MADDI PITTSENBARGER

Research Mentor: Kyle Pellegrin
Department of Physics & Astronomy,
Ohio Wesleyan University

Project Summary: Spectroscopy is the study of how light and matter interact with each other and is an important technique within astronomy. With 3D printing technology it is now possible to build a spectrograph using off the shelf optical components, making this technique much more accessible to ameture astronomers and small institutions. This project constructed the Sol'Ex and Star'ex spectrographs, designed by Christian Buil and Valérie Desnoux, in order to image the surface of the sun and study the emission of stars across the night sky.

SOL'EX & STAR'EX: 3D PRINTED SPECTROGRAPHS

Abstract: Spectroscopy is the study of how light and matter interact with each other. A device called a spectrograph allows astronomers to study light at specific wavelengths across the electromagnetic spectrum. The Solar Explorer (Sol'Ex) and Stellar Explorer (Star'Ex) are 3D printable spectrographs created by Christian Buil and Valérie Desnoux to make astronomical spectroscopy accessible to amateur astronomers and small institutions. After constructing each spectrograph, the Sol'Ex was used to create images of the sun's photosphere while the Star'Ex was utilized to acquire low resolution spectra of various bright stars in the night sky.

Board 8

ARIANA NJOROGE
PAYTON HODGES

Research Mentor: Carolina Barbosa
Environment & Sustainability
Department, Ohio Wesleyan University

Project Summary: Our project focuses on the effects of road salts and other pollutants on the Delaware Run and Olentangy River. Road salts applied in the winter have adverse effects on the aquatic and human life that rely on these water ways. As such, we investigated seasonal and spatial changes in water quality indicators along those water systems.

SALINIZATION TRENDS IN THE DELAWARE RUN WATERSHED, OHIO: ANTHROPOGENIC AND ENVIRONMENTAL FACTORS

Abstract: Salts are applied on roads during periods of heavy snowfall, and they contain chemicals such as sodium chloride that can have harmful effects on local water systems. We investigated the effects of road salts on the water quality of the Delaware Run and Olentangy River. We also investigated the effects of water salinization on human health. Field data was collected at three sites along the Delaware Run and two sites along Olentangy River between October 2025-July 2026.

A water quality probe was used to measure physico-chemical parameters such as pH and DO%. Additional research was conducted to find background information on demographic information in Delaware. The results suggest that highly variable levels of salinity in the winter are related to road salt application events, and the waterways tested were able to somewhat stabilize their salinity levels throughout the warmer seasons.

We also found that Delaware residents who live upstream from the local water treatment plant receive water that is less contaminated than residents who live downstream from the plant. In addition, certain individuals may be more sensitive to contaminants in drinking water than the general population, such as immunocompromised persons, some elderly and infants. As such, those who live downstream from the local plant may be more at risk of developing health complications due to the reduced water quality.

The next steps following this research would be to gather information about general perceptions around water quality in Delaware and continue monitoring water quality changes within Delaware's hydrological systems to track any additional changes or factors we had not considered previously.

Board 9

RUKEVWE DIOHWO
JACOB BLUBAUGH

Research Mentor: Benjamin Douglas
Department of Psychology, Ohio Wesleyan University

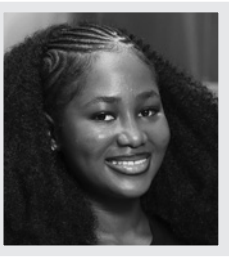
Project Summary: Social norms are societal expectations about how people should behave. Researchers communicate these norms with social norms messages. There are (broadly) 3 types of social norms messages: injunctive and descriptive norms messages, and (newly identified) behavioral requests. We tested the effectiveness of these 3 messages for changing human behavior.

TESTING DURATION OF NORMS MESSAGING EFFECTIVENESS FOR BEHAVIOR CHANGE: EVIDENCE FROM FIELD EXPERIMENT

Abstract: Study 1: Following our preregistered method, we placed signs on a bike path encouraging bikers to signal when passing pedestrians. Each sign communicated one of the 3 types of norms messages (or a no-message control condition). We walked down the bike path and recorded the rate of signaling within each condition. Across 518 bikers, we found that use of norms messages was significantly more effective than the no-message control condition. Additionally, as we moved further from the signs, behavioral requests became less effective faster than the other norms messages.

Study 2: Study 2 is a replication of Study 1. Data is currently being collected with a plan for final analysis by Oct. 1st. Overall, we find that behavioral requests are effective for short-term behavior change, but norms messages are more effective in the long-term. Strengths of Sample: Our sample size for both studies was based on an a-priori power analysis to detect a small effect. We needed a minimum of ~400 participants, and over-sampled in both studies. If Not All collected: We have completed data collection for 1 of the 2 studies and will have all data analyzed for both studies by October 1st, 2026. (a) 1,000 participants. (b) 500 participants. (c) NA (this is a field experiment). (d) NA. (e) September 15th, 2026. (f) Yes.

Board 10



ESTHER FOSU
KENNEDY ELFERS

Research Mentor: Elizabeth Nix
Department of Health & Human Kinetics, Ohio Wesleyan University

Project Summary: Traditional wives or "tradwives" are a popular group on social media that is primarily made up of women who promote ideas of traditional gender roles which includes housekeeping, taking care of the kids, and cooking. Our research consisted of identifying keywords and common themes in tradwife media in order to understand how they promote nutrition information. We analyzed these keywords and themes to explain how nutrition is related to gender role ideology.

GENDER ROLES AND NUTRITION: THEMES IN TRADWIFE MEDIA

Abstract: Traditional wives or "tradwives" are a popular group on social media that is primarily made up of women. Tradwives promote ideas of traditional gender roles, which includes housekeeping, taking care of the kids, and cooking. Tradwives commonly discuss food and appear to have an aversion to "processed foods." Initially beginning the research, we hypothesized that each tradwife influencer we studied would have a perception of women as the "gatekeepers" to nutrition in the home. We sought to determine how different tradwife influencers use nutrition and wellness keywords, and what those language patterns reveal about their content and portrayal of tradwife or stay at home mom responsibilities. We used concepts from gender role theory, social constructionism, and the double shift theory to understand how tradwife influencers talk about women's roles. We created a system of keyword extraction, theme identification, and timestamping in order to analyze content and gather data on how often they discussed food and nutrition and under what context. Across both long and short-form videos, creators consistently emphasized food-centered domestic themes. The most repeated topics were cooking from scratch (26; 54 short), homemaker routines (26), recipe experimentation (35), purity of food (18), and feeding the kids (21). These results allow us to see how influencers discuss nutrition online, allowing us to identify the patterns and themes that shape how they frame food, health, and everyday domestic life. A notable pattern we identified was that tradwives often emphasized cooking from scratch and the purity of foods, while also representing the responsibility of feeding the family.

Board 11

RYAN SCHWIRIAN

Research Mentor: Mehwish Abbasi
Department of Mathematics & Computer Science, Ohio Wesleyan University

Project Summary: This research explores whether next-generation quantum computers can improve how computers learn from data and make predictions compared to standard modern computers. Using real-world housing data, we built and tested traditional machine learning models, specifically standard neural networks and decision-tree forests, directly against their experimental quantum-powered equivalents. We measured each model's speed and accuracy to understand where quantum systems show promise and where current technical limits hold them back. Overall, this project helps researchers pinpoint the practical strengths and realistic boundaries of using quantum technology for everyday data science tasks.

EMPIRICAL EVALUATION OF QUANTUM MACHINE LEARNING: CLASSICAL VS. QUANTUM NEURAL NETWORKS AND RANDOM FORESTS FOR REGRESSION

Abstract: This research project evaluates quantum computing as an alternative computational paradigm for machine learning regression tasks by directly comparing classical algorithms against their quantum counterparts. As machine learning models grow in complexity and computational cost, exploring whether quantum approaches offer advantages in efficiency or scalability becomes increasingly vital. This study conducts an empirical, data-driven comparison featuring classical Neural Networks (NN) and Random Forests alongside Quantum Neural Networks (QNN) and Quantum Random Forests (QRF). Using the standard California Housing dataset, each architecture is trained on a well-defined supervised regression task. Model performance is evaluated using key standard metrics, including Mean Squared Error (MSE), R-squared Score, and inference time. The quantum models are built using open-source quantum computing frameworks. By systematically benchmarking classical models against quantum neural and tree-based paradigms, this project provides critical insights into the practical strengths, scaling bottlenecks, and near-term feasibility of quantum machine learning for real-world data science applications.

Board 12

ADDIE BECK
SCARLETT LOEVENGUTH

Research Mentor: Sarah Kaka
Department of Education,
Ohio Wesleyan University

Project Summary: This project examined how teachers learned to design social studies lessons that encourage students to investigate questions and use historical and other primary sources as evidence. We studied five teachers who participated in a professional development program focused on creating short, structured inquiry lessons and looked at how their ideas and confidence changed throughout the experience. We found that teachers began to view inquiry as more flexible and manageable, although creating strong questions and choosing the right sources remained challenging. The experience also helped teachers think more carefully about how to adapt lessons and sources to meet the needs of students at different grade levels.

DESIGNING INQUIRY WITH PRIMARY SOURCES: MICRO-INQUIRY PROFESSIONAL DEVELOPMENT AS A SCAFFOLD FOR TEACHERS' INQUIRY DESIGN CAPACITY

Abstract: Inquiry-based social studies education asks teachers to build learning experiences around investigation: students pose and pursue questions, analyze sources, develop interpretations, and support claims with evidence. In this qualitative multiple-case study, we examined how five participants designed inquiry-based lessons with primary sources during a Micro-Inquiry professional development experience and how they described their confidence in doing that design work. Participants came to see inquiry as more flexible and manageable, encountered persistent difficulty with compelling question writing and source selection, and used coaching and scaffolds to adapt sources and supports for particular grade levels. Taken together, the cases suggest that Micro-Inquiry can serve as a professional learning scaffold for developing inquiry design capacity.

Board 13

SAMUEL BAER

Research Mentor: Carolina Barbosa
Environment & Sustainability Department, Ohio Wesleyan University

Project Summary: Old Woman Creek, a freshwater estuary that flows into Lake Erie, is surrounded by a mix of agricultural and urban areas that can affect water quality. This study examined how land use in the watershed changed between 2002 and 2024 and whether these changes were associated with changes in nutrient levels in the water. Over the same period, levels of nitrogen and phosphorus increased, even though the amount of cultivated farmland in the watershed decreased. These findings suggest that factors beyond agricultural land use may be contributing to changes in water quality and highlight the need to consider multiple sources when managing and protecting freshwater ecosystems.

SPATIO-TEMPORAL ANALYSIS OF THE OLD WOMAN CREEK WATERSHED, OH

Abstract: Old Woman Creek (OWC) is located in northern Ohio, and is a freshwater estuary that flows in Lake Erie. The OWC watershed contains large amounts of both agricultural and urban areas, which can influence water quality through nutrient runoff and other sources of contamination. This study analyzed land use/land cover (LULC) change over the past two decades (2002 - 2024) and evaluated trends in nutrient concentrations to better understand the relationships between land use and water quality. Water quality data collected over a 22-year period was analyzed for trends in nitrate, ammonia, and orthophosphate concentrations using Mann-Kendall and Sen's slope analyses in RStudio. LULC changes were analyzed using ArcGIS Pro and the MRLC datasets from 2002 and 2024. Changes in each LULC class were quantified by calculating acreage gained or lost. A change-indication map was developed to show the land-use change. Results showed increasing trends in both forms of nitrogen and orthophosphate. However, These increases occurred despite a decrease in cultivated cropland within the watershed, suggesting that agricultural land use alone may not explain the observed changes in nutrient concentrations. These findings highlight the complex nature of nutrient dynamics within estuarine watersheds and can inform environmental management and conservation efforts.

Board 14

JOSIAH MONTGOMERY

Research Mentor: Craig Jackson
Department of Mathematics & Computer Science, Ohio Wesleyan University

Project Summary: The project centered on combining traditional textile construction with computer automation through the use of a digitally controlled loom. We developed a new camera-based program to detect motor failures on the loom and alert the weaver when problems occur. We also produced a full-size rug that explores the differences between traditional weaving techniques and the new possibilities offered by digital control.

NEW MECHANISMS FOR GENERATIVE TEXTILE WEAVING

Abstract: The integration of computational tools with traditional weaving practice allows for new approaches to generative textile design and production. The SHED collective (OWU's generative textile laboratory) employs numerical algorithms, computational automation, and electro-mechanical engineering to expand the pattern complexity made available by traditional weaving methods. Our project centers on the use of a digitally controlled loom composed of independently operated servo motors, allowing the weaver access to the full pattern space.

For our project, we developed, tested, and refined a fault detection system using computer vision and cluster analysis to improve the reliability of the loom. Our method uses webcams mounted above the loom to capture images of the servo motors, which we then compare to a calibration image to determine whether each servo is in an up or down position. The weaver is alerted as soon as an error is detected, allowing faults to be addressed as they occur rather than relying on the weaver to notice the defect in the cloth. This creates a more consistent and responsive weaving process while reducing material and labor lost to undetected mechanical faults.

In addition, we produced a new full-sized textile constructed using the digitally controlled loom. The piece combines both intermediate and traditional shaft-switching techniques within triangular design fields to interrogate the visual and structural differences between these two approaches.

Together, the technical and material components of our project explore how digital tools can enhance traditional textile practices.

Board 15

RYLEIGH JONES

Research Mentor: Michele Nobel
Department of Education,
Ohio Wesleyan University

Project Summary: Burnout and stress are two of the most leading causes of teacher turnover throughout the United States. Teacher resilience is vital for sustaining high quality instruction, preventing burnout, and fostering positive student outcomes. Teachers can foster resilience by cultivating trust, showing empathy, and creating a classroom environment where every student feels seen and valued. Further understanding of how to foster resilience will aid preservice and early career teachers when they encounter hardships.

EXPLORING RESILIENCE IN PRESERVICE TEACHERS

Abstract: Understanding exactly how teachers are able to work long hours, keep their students engaged, and work with administration without getting overwhelmed is crucial. Fostering resilience and self care is extremely important for helping individuals persevere over time. Our research this summer focused on how professors at various universities are fostering resilience and growth mindsets for their teacher candidates. We found that a vast majority of universities do not have many lessons on these topics. We formulated mini-modules based on Elena Aguilar's Onward ranging from topics including understanding oneself, focusing on the bright spots, and building community. The Education Department will be implementing these mini-modules in education classes starting this fall. For our next research steps, we plan to survey recent OWU alumni, university professors, and public school teachers to gauge their resilience, and offer to send them these modules to complete and work through. We hope to have them reflect on things that they encountered as university students and as early career professionals. Continuing this research will support the OWU Education Department and help prepare teacher candidates for their student teaching semester and early teaching careers.

Board 16

ALEX BZDAFKA

Research Mentor: Laurel Anderson
Department of Biological Sciences,
Ohio Wesleyan University

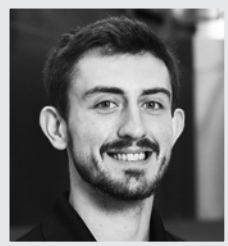
Project Summary: Plants store carbon in their tissue when they use sugars from photosynthesis to grow. Plants in warmer parts of the world are able to store more carbon since they're growing seasons are longer (i.e. it is warmer for longer). We assessed how the carbon storage of forests in Canada and Ohio differed, we hypothesized that the Canadian forest would store less carbon because it has a lower average temperature than Ohio. However we found that forests of similar ages in both Canada and Ohio did not differ significantly in how much carbon they stored.

DIFFERENCES IN TREE CARBON SEQUESTRATION IN TEMPERATE AND ECOTONAL FORESTS

Abstract: As carbon dioxide in the atmosphere increases and intensifies the greenhouse effect, leading to rising global temperatures, there has been much interest in the capacity of forests to absorb and store carbon. As trees photosynthesize and grow they store carbon, and there is an exponential relationship between carbon storage and the size of a tree. Growing season length and community composition play critical roles in the carbon storage of forests, such that forests with longer growing seasons should have larger trees and store more carbon. We assessed the carbon storage of three forests, one a boreal forest ecotone in Blind River, Canada (Battlepoint), with the other two being temperate deciduous forests in Delaware County, Ohio (Kraus and Bohannan). We hypothesized that both forests in Ohio would store more carbon than Battlepoint. We found that despite Ohio being lower in latitude and having a higher average temperature (10-15 Celsius) than Canada (2-8 Celsius), there was no significant difference between Kraus and Battlepoint which were similar ages, and Kraus was the only forest to have significantly higher carbon storage (when outliers were included). Our results suggest that the more northern forest has similar carbon storage capacity to forests in Ohio, in spite of cooler temperatures. We plan to continue monitoring these three forests for tree growth and carbon storage over time, to see if our changing climate affects this critical ecosystem service.

Board 17

JAYSON DYER



Research Mentor: Chelsea Vadnie
Department of Psychology and
Neuroscience Program,
Ohio Wesleyan University

Project Summary: Anxiety disorders are among the most common mental health conditions, and stressful experiences during adolescence are known to increase the risk of developing them. Our project examined whether adolescent stress changes the amount of an important protein in a brain region that is implicated in anxiety disorders. By studying these biological changes, we hope to better understand how stress during adolescence produces long-term effects on brain function and behavior.

INVESTIGATING THE EFFECTS OF VARIABLE ADOLESCENT STRESS ON ADULT EXPRESSION OF THE GABAA α3 SUBUNIT IN THE MEDIAL PREFRONTAL CORTEX

Abstract: Anxiety disorders are highly prevalent and often diagnosed in late adolescence or early adulthood, with stress as a major risk factor. Previous work in our lab demonstrated that a six-day variable adolescent stress paradigm increased anxiety-like behavior in adulthood and reduced the expression of the α3 subunit of the GABAA receptor in the adult medial prefrontal cortex (mPFC). Here, we used the same six-day variable adolescent stress paradigm to investigate whether reduced mRNA expression of the α3 subunit of the GABAA receptor is accompanied by changes in α3 protein levels in the mPFC by using immunofluorescence. Male and female C57BL/6J mice were assigned to stressed or control groups (n=4 per sex per group). From postnatal day (PND) 25-30, stressed mice were exposed to one type of variable stressor each day (forced swim, restraint, elevated platform), while control mice were not exposed to the experimental stressors. In adulthood, brains were collected, sectioned, and processed using immunofluorescence staining to label the α3 subunit in the mPFC. Fluorescence microscopy was used to visualize and capture images of the tissue, and fluorescence intensity will be quantified to compare α3 levels between stressed and unstressed mice. These findings will determine whether adolescent stress produces long-term changes in α3 protein expression that may contribute to anxiety-like behaviors.

Board 18

HAYLEY BROWNING

Research Mentor: Chelsea Vadnie
Department of Psychology and
Neuroscience Program,
Ohio Wesleyan University

Project Summary: Stress experienced during adolescence can have lasting effects on mental health, but many of these long-term effects are still not fully understood. We used mice to study how stress early in life influences behavior in adulthood. Previous research found that adolescent stress increases behaviors associated with anxiety, so our project examined whether it also affects social interactions and disrupts the ability of an animal to synchronize its rhythms with the environment. Our findings may improve our understanding of how stress during adolescence contributes to long-term changes in brain function and behavior.

INVESTIGATING THE EFFECTS OF VARIABLE ADOLESCENT STRESS ON ADULT SOCIABILITY & DIURNAL RHYTHMS

Abstract: Adolescence is a sensitive period of brain development during which exposure to stress can produce long-lasting changes in behavior, including increased anxiety-like behaviors in adulthood. In adult rodents, stress can disrupt sociability and sleep/wake rhythms, but it is unclear if exposure to variable physical stressors during early adolescence has lasting impacts on these behaviors. To investigate this question, we used a previously established six-day stress paradigm to examine the long-term effects of adolescent stress in male and female C57BL/6J mice. Mice were separated into stressed and unstressed (control) groups (n=4 per sex per group). Stressed mice experienced six consecutive days of unpredictable stressors (forced swim, restraint, elevated platform), with one type of stressor administered each day, from postnatal day (PND) 25-30 during the light phase. Control mice were not exposed to these experimental stressors. Sociability was assessed in adulthood (PND 60-61). Wheel-running activity was then monitored for two weeks while mice were housed under a 12:12 light/dark cycle. Sociability and behavioral rhythm measures will be compared between stressed and control mice to determine whether adolescent stress produces long-term changes in these behaviors.

Board 19

WILLOW BROWN

Research Mentors: Robert Harmon and Rachael Roettenbacher
Department of Physics & Astronomy, Ohio Wesleyan University and Department of Astronomy, University of Michigan

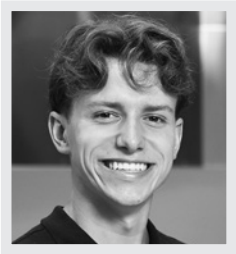
Project Summary: This project aims to determine how stellar magnetic activity depends on stellar properties like mass, rotation rate, and surface temperature, using data from the Kepler Space Telescope. Kepler's main mission was to search for exoplanets by detecting dimming caused by the planet passing in front of the star. It also detected starspots, which are darker, cooler regions on a star's surface associated with regions of strong magnetic fields, because starspots also cause dimming as they are carried into and out of our view by the star's rotation. We are analyzing tens of thousands of Kepler light curves (plots of brightness vs. time), using a program created by Dr. Harmon called Light-Curve Inversion (LI), which creates maps of starspots on the surface based on these brightness variations. Since we are analyzing so many light curves, selecting the best surface map for each stellar rotation by hand would be impossible. Instead, I created a convolutional neural network (CNN), a type of machine learning program that can analyze and classify images. This will allow us to study our results to look for trends in spot coverage, how they change with time, and how they relate to stellar properties.

DEVELOPING A CONVOLUTIONAL NEURAL NETWORK TO IDENTIFY STARSPOTS USING KEPLER SPACE TELESCOPE DATA

Abstract: This summer, we studied starspots on thousands of stars observed by the Kepler Space Telescope, whose main mission was to search for exoplanets by detecting dimming caused by the planet passing in front of the star. The Kepler Space Telescope also detected starspots, which are darker, cooler regions on a star's surface associated with regions of strong magnetic fields, because starspots also cause dimming as they are carried into and out of our view by the star's rotation. Studying starspots helps us understand stellar magnetic activity. Using a program created by Dr. Harmon called Light-Curve Inversion (LI), which creates maps of starspots on the surface based on these brightness variations, we are analyzing hundreds of thousands of light curves (plots of brightness vs. time) produced by starspots. Selecting the optimal surface map for each stellar rotation by hand would be impractical. To solve this issue, I developed a convolutional neural network (CNN), which is a type of machine learning model commonly used in image analysis that stacks artificial "neurons" in layers. My program, called Spot Classifier, classifies stellar surfaces based on the number of starspots, selecting the surface map whose light curve best fits the data while not being covered in noise artifacts.




Board 20



COLBY SPRAGUE
JAIME RIECHMANN

Research Mentor: Susan Gunasti
Philosophy & Religion Department,
Ohio Wesleyan University

Project Summary: We examined the history, definition, and current proceedings on British Muslim chaplaincy. Through analysis of job postings, curriculum, and a deep dive on the literature, we observed a lack of adequate courses of study for the Muslim chaplain. This lack of sufficient training may be to blame for the excess of volunteer and part-time chaplaincy positions at universities, prisons, and hospitals.

BRITISH MUSLIM CHAPLAINCY: FILLING A NEED

Abstract: The term chaplain originates in Christianity, however, as the pastoral care needs of different religious communities have grown, many have adopted the term chaplain for their own tradition. Irrespective of religion, all chaplains offer pastoral care and guidance to populations in universities, prisons, hospitals, and the military. Within the United Kingdom, the Muslim population has become a large minority. With the immigration of thousands of Muslims in the 1960s and 1970s the need for Muslim chaplains and pastoral care targeted towards Muslims has increased alongside the population. However, the pathways to becoming a chaplain have not been adapted for Muslims to serve their community within the UK which has created a lack of sufficiently trained chaplains for Muslim students, patients, and prisoners.

Board 21

HAYDEN KELNER

Research Mentor: Laurel Anderson
Department of Biological Sciences,
Ohio Wesleyan University

Project Summary: We were studying how much carbon sugar maple trees hold. We set up plots in Canada and Ohio and then collected data on the diameters of the trees. Then using equations from primary literature we were able to calculate how much carbon each tree holds based off of our measurements.

THE PROPORTION OF CARBON STORAGE IN SUGAR MAPLES AT THE KRAUS AND BOHANNAN PRESERVES AND OHIO WESLEYAN BATTLEPOINT ASSOCIATION

Abstract: Sugar maples (Acer saccharum) make up a substantial portion of temperate forests across the east coast, ranging from Tennessee to as far north as Nova Scotia in mature forests. These late successional trees hold significant economic value through lumber and more commonly as sap producers for maple syrup. They also hold a substantial amount of carbon due to their abundance in northern temperate forests, but may not thrive in these sites in the future as the climate warms and the range of sugar maple shifts north. Our goal was to compare the proportion of carbon contained in sugar maple in three different forests, two in Ohio and one in Canada just north of Lake Huron. In each forest, 20m by 20m plots were set up following the Ecological Research as Education Network (EREN) guidelines. Plot numbers ranged from 4 at the Ohio Wesleyan Battlepoint Association (Blind River, Canada) to 8 in the Ohio Wesleyan Kraus Preserve (Delaware County, Ohio). The trees in each plot were tagged with numbered tags, and a paint line was drawn at 1.37m to allow consistent measurements of DBH (Diameter at Breast Height) over time. On average, Kraus had a proportion of 64% sugar maple holding 52% site carbon, Bohannan had 62% sugar maple holding 41% site carbon, while Battlepoint had 32% sugar maple holding 22% site carbon. The proportion of carbon storage in sugar maples between plots ($p = 0.39$) and across sites ($p = 0.5760$ (Bohannan-Battlepoint), 0.2530 (Kraus-Battlepoint), 0.9043 (Kraus-Bohannan)) and the DBH of sugar maples across sites ($p = 0.9479$) were not significant. Although Bohannan and Kraus both showed greater proportion of carbon in sugar maple than Battlepoint, the extreme variability of the data from plot to plot within each site prevented differences among sites from being statistically significant. By establishing these plots, we can monitor shifts in the forest's diversity to help show how climate change affects forest carbon balance over time here in Ohio and in Canada.

Board 22

JENNY KOOB

Research Mentor: Amy Downing
Department of Biological Sciences,
Ohio Wesleyan University

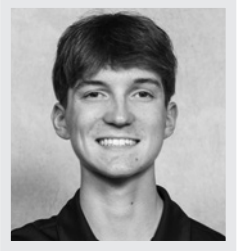
Project Summary: Our research investigates how road de-icing salt runoff impacts local freshwater ecosystems in Delaware County. By measuring salt content and tracking the abundance and diversity of aquatic life across local ponds, we can gain a better understanding of the ecological impacts of human impacts of road-salt on these delicate communities. This work provides clearer insights into balancing human safety with environmental conservation.

THE ECOLOGICAL IMPACTS OF ROAD SALT RUNOFF IN FRESHWATER ECOSYSTEMS

Abstract: Widespread use of road de-icing salts has accelerated natural freshwater salinization, threatening aquatic organisms. This has caused global concern for many freshwater organisms, including zooplankton, as they are highly sensitive to changes in salinity and form the foundation of freshwater food webs. This study investigates the impacts of elevated salinity (chloride) on zooplankton communities across 40 constructed ponds in Delaware, Ohio, spanning a gradient from 1 to 900 mg Cl-/L. Ponds were sampled for phytoplankton, zooplankton, total nitrogen, total phosphorus, pH, temperature, oxygen, conductivity, and chloride. Environmental DNA was also collected to capture phytoplankton and microbial abundance and composition. Preliminary results do not support the hypothesis that increasing chloride concentrations directly reduces overall zooplankton abundance. Instead, zooplankton density varies widely across the full chloride concentration gradient, suggesting that additional environmental factors may contribute to differences in organism abundance. As ongoing data analysis proceeds, incorporating upcoming microbial, zooplankton, and phytoplankton community data will give more insight into the complex co-factors that may be influencing these freshwater communities.

Board 23

ASHTON GALIFFO
REAGAN FIANDT
NICK DYE



Research Mentor: Grant Walby
Department of Chemistry,
Ohio Wesleyan University

Project Summary: Protein Tyrosine Phosphatases (PTPs) are a group of enzymes that help regulate key processes in the body, such as insulin signaling and cell division. Sometimes these enzymes behave abnormally, which can contribute to the development of conditions like diabetes and cancer. Our lab is towards synthesizing a naturally occuring compound called drazepinone that is capable of inhibiting two of these PTP enzymes, PTP1B and TCPTP.

SYNTHESIS OF (-)-DRAZEPINONE

Abstract: Protein tyrosine phosphatases (PTPs) are a class of enzymes that play a key role in several medically important metabolic pathways, including insulin signal transduction and control of cellular proliferation. When they are abnormally active, they contribute to the development of human diseases such as diabetes and cancer. A compound produced by marine fungi, (-)-drazepinone, has the unique ability to selectively bind and inhibit two key enzymes of this class - PTP1B and T-Cell PTP (TCPTP). Our lab intends to improve upon a recent synthesis of drazepinone to selectively form the - enantiomer and access a key intermediate to enable the synthesis of related compounds with the goal of assessing their binding abilities to PCP1B and TCPTP.

Board 24

MACY MILLER
CAMRYN BRUNNER

Research Mentor: Elizabeth Starns
Department of Health and Human Kinetics, Ohio Wesleyan University

Project Summary: The ultimate goal of our project is to deduce why surgeons choose to do one surgical technique over another. In our case, the technique we are studying is whether or not to resurface the patella in a total knee arthroplasty. We plan to send out both a qualitative and quantitative evaluation to a group of surgeons to help understand their decision-making processes; however, we have not submitted for approval from the IRB yet. In an effort to better understand and evaluate our topic, we have conducted a systematic review this summer in preparation. We plan to finalize and submit our survey and interview questions to the IRB before taking the next steps in our research.

PATELLAR RESURFACING IN TOTAL KNEE ARTHROPLASTY

Abstract: Total knee arthroplasty (TKA) is one of the most common surgeries, increasing with life expectancy. The decision whether or not to resurface the patella during TKA remains highly controversial and varies depending on who is performing the surgery. The aim of this study is to collect and evaluate the evidence regarding the use of patellar resurfacing in TKA. A systematic review of previous studies was performed to compare outcomes and factors between patients who received patellar resurfacing and those who did not during primary TKA. The outcomes reported and evaluated were anterior knee pain, Knee Society Score, Oxford Knee Score (OKS), and rate of reoperation. The databases searched for systematic reviews were PUBMED, MEDLINE, and CINAHL published between January 1st, 2016, and May 27th, 2026. Our original search produced 37 articles, and after screening for pertinence to our study goals, 14 studies remained that met our criteria. Patellar resurfacing during primary TKA was associated with lower rates of anterior knee pain and reoperation rates compared to non-resurfacing. Several studies found improvements in Knee Society Scores, while OKS, functional outcomes, and range of motion generally showed no significant differences between patellar resurfacing and non-resurfacing. These findings support a potential benefit of routine patellar resurfacing for reducing anterior knee pain and reoperation risk. Continuing to collect data from large, well-designed randomized controlled trials with standardized outcome reporting will be beneficial in the decision regarding patellar resurfacing in TKAs.

Board 25

GRACE SMITH

Research Mentor: Yunhua Ding
Department of Physics & Astronomy, Ohio Wesleyan University

Project Summary: We were investigating how the precession of a particle will change when there are outside variables acting on it. The precession motion being when a particle is spinning on its axis and the path that the axis is going in is a circle around another axis going through the center of the object. In a regular precession path, it will most likely be a circle that goes around the center axis. In a modified precession path, the circle may tilt off to the side.

LORENTZ TESTS WITH STORAGE-RING EXPERIMENTS

Abstract: Lorentz symmetry states that physical laws are invariant in any frame of reference under Lorentz transformations and lays down the foundation for the theory of General Relativity and the theory of the Standard Model of Particles. While these theories dealing with quantum mechanics and gravity are separated, it was found that the symmetry is violated when the theories were unified. In this project we tested out the symmetry using storage rings that were able to measure the spin precession of particles due to the magnetic field. For our research we studied the Lorentz violations when background fields are acting upon the particle in addition to the magnetic field. We started out with a theoretical equation where we performed a Foldy-Wouthuysen Transformation on the 4*4 relativistic Hamiltonian matrix. After that it was broken down into an effective 2*2 Hamiltonian matrix where we could analyze the spin dynamics of the precession using the Heisenberg equation to see the violating terms. Finally, we created a Mathematica simulation to visualize the original precession trajectory, and the modified precession trajectory with the Lorentz-violating background fields. This work provided us a theoretical and visual understanding of how violations in Lorentz symmetry can produce measurable spin dynamics signals in storage-ring experiments.

Board 26

ABDUL RAFAY
LILY VONDRELL
ALI JAN
SHANNON BARR

Research Mentor: Chris Wolverton
Department of Biological Sciences, Ohio Wesleyan University

Project Summary: Plant roots use starch particles at their tips to sense gravity. Studying this in completely starch free plants causes overall health defects that complicate experiments. We are using precise gene editing to remove starch only in the root tip. This keeps the plant completely healthy, giving us a clearer view of how roots navigate gravity without their primary system (it is turned off in the roots by removing starch free roots).

ROOT CAP-SPECIFIC GENE EDITING USING A TISSUE-SPECIFIC PROMOTER WITH CAS9 AS A TOOL FOR DISSECTING ROOT GRAVITROPIC SIGNALING

Abstract: Roots of land plants are adapted for anchorage and the uptake of water and mineral ions from the soil. They accomplish these roles by sensing and responding to a variety of environmental cues such as light direction, moisture gradients, and ion concentration. Earth's gravity vector also serves as a constant directional stimulus, resulting in an overall root system having vertical primary roots and non-vertical lateral roots. Gravity sensing in roots is localised to a population of cells in the root cap that contain starch-filled plastids that sediment, or sink, to the lowest points in the cell. The importance of these organelles for gravity sensing is illustrated by the strong reduction in gravity responses when starch biosynthesis is disrupted through mutation, as is the case in the pgm1 mutant. However, the loss of starch synthesis capability throughout the plant leads to pleiotropic effects, such as reduced growth rates and altered circadian rhythms, complicating interpretation of gravitropic phenotypes in starchless mutants. To overcome this limitation, we sought to edit the PGM1 gene in a restricted region of the root containing the root cap using CRISPR guide RNAs specific for the PGM1 gene and driving the expression of the Cas9 nuclease with the SOMBRERO promoter, expressed only in the central and peripheral regions of the root cap. Heritable non-mosaic lines with Cas9 driven by EC1.2 egg cell specific promoter were done in parallel to provide a whole-plant starchless control. Edited lines will be tested with assays for their gravitropic-response, initiation time, and growth rate using ROTATO, a rig of rotation, used to image four-day old seedlings under IR light in dark. These tissue-specific mutants offer a greater physiologically controlled system for investigating starch-independent mechanisms.

Board 27

FENG YUAN

Research Mentor: Robert Harmon
Department of Physics & Astronomy,
Ohio Wesleyan University

Project Summary: Starspots are darker and cooler regions on a stellar surface that are associated with strong magnetic fields. As the star's rotation carries the dark starspots in and out of view, the star's brightness varies as a result. We use high-precision brightness measurements from NASA's Kepler Space Telescope, which was designed to detect planets orbiting other stars via the dimming they cause when passing in front of the star. We use the Light-curve Inversion (LI) algorithm created by Dr. Robert Harmon to generate maps of starspots on stellar surfaces based on brightness variation. I created a Python program called Spot Identifier. It identifies spots on these maps automatically and computes the latitudes and longitudes. This will allow us to systematically study differential rotation (different latitudes take different amounts of time to rotate once around the star's axis), the percentage of the surface covered by spots, evolution of the spots over time, and so forth to look for how those properties are correlated with stellar properties such as mass, rotation period, and surface temperature.

CREATING A PYTHON PROGRAM TO DETECT STARSPOTS'S POSITION BASED ON DATA COLLECTED BY THE KEPLER SPACE TELESCOPE

Abstract: Starspots are darker and cooler regions on a stellar surface that are associated with strong magnetic fields. As the star's rotation carries the dark starspots in and out of view, the star's brightness varies as a result. We use high-precision brightness measurements from NASA's Kepler Space Telescope, which was designed to detect exoplanets via the dimming they cause when passing in front of the star. We use the Light-curve Inversion (LI) algorithm created by Dr. Robert Harmon to generate maps of starspots on stellar surfaces based on brightness variations. I created a Python program called Spot Identifier that identifies the spots on these maps automatically and computes the latitude and longitude via a centroiding algorithm described herein. This will allow us to systematically study differential rotation (different latitudes have different rotation periods), the percentage of the surface covered by spots, evolution of the spots over time, and so forth to look for how those properties are correlated with stellar parameters such as mass, rotation period, and surface temperature.

Board 28

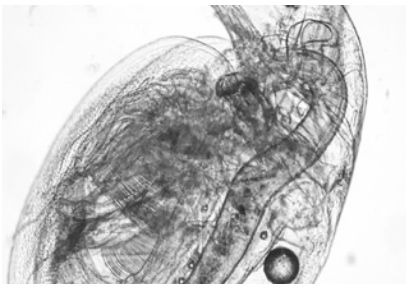
HARUNO TADOKORO

Research Mentor: Chris Francis
Stanford Doerr School of Sustainability, Stanford University

Project Summary: My research focuses on understanding how certain microscopic organisms, called archaea, transform ammonia into other nitrogen compounds, a vital natural process that unfortunately causes environmental damage when it happens in man-made systems like wastewater treatment plants. Specifically, I am investigating a particular protein within these organisms that is believed to play a critical role in their survival and chemical activity. By scanning genetic databases, modeling protein shapes, and successfully growing this target protein in a laboratory setting, I was able to map out its unique structure and confirm it can be isolated for deeper study. Ultimately, discovering how this protein works will help us design innovative strategies to control these microbes and prevent their harmful impacts on our engineered environments.

CHARACTERIZATION OF A PUTATIVE COPPER-CONTAINING NITRITE REDUCTASE (NIRK)—A KEY ENZYME FROM THE ENVIRONMENTALLY-RELEVANT GROUP OF MICROORGANISMS KNOWN AS AMMONIA-OXIDIZING ARCHAEA (AOA)

Abstract: Nitrification—the microbially mediated aerobic oxidation of ammonia to nitrate—is a key process in the nitrogen cycle. The first step is performed by ammonia-oxidizing microorganisms, especially ammonia-oxidizing archaea (AOA), one of the most ubiquitous prokaryotic groups on Earth. While AOA are indispensable in natural environments, their activity in engineered environments results in environmentally-damaging processes. Despite their importance, AOA biochemistry remains poorly understood. Notably, a putative copper-containing nitrite reductase (NirK) is thought to be important in their metabolism, yet its physiological function remains unresolved. Therefore, my project focuses on characterizing AOA NirK. Sequences encoding AOA NirK with a tethered protein partner were identified via BLASTp and subjected to phylogenetic analysis and structural prediction. A single sequence was selected and biochemically characterized via heterologous expression in E. coli, purification via affinity chromatography, and analysis via SDS-PAGE, size exclusion chromatography, and UV/vis spectrophotometry. Structural prediction shows this subset of AOA NirK has the core structure of canonical NirK plus a tethered protein partner. Phylogenetic analysis reveals it only occurs in small clusters within the Nitrososphaeraceae. Biochemical analysis indicates it can be heterologously produced and isolated to relatively high purity. Characterizing AOA NirK facilitates a better understanding of AOA biochemistry and their role in nitrification. This research also lays the foundation for novel strategies to mitigate nitrification impacts in engineered environments.



Board 29

BROOKLYN UPP
BRITTNEY PARKS
TYLER WILLIARD

Research Mentor: Eric Gangloff
Department of Biological Sciences, Ohio Wesleyan University

Project Summary: Wall lizards have been successful invaders in numerous cities worldwide, including the Italian wall lizards San Diego, California. Students traveled to Taormina, Italy to collect data on native Italian wall lizards to compare to the introduced population in San Diego. These data can be used to determine if the introduced population has become different from the native population.

COMPARISON OF NORTH AMERICA'S INTRODUCED WALL LIZARDS TO NATIVE POPULATIONS

Abstract: Biological invasions can pose a massive threat to ecosystems, as they are a major cause of biodiversity loss. Due to the large effect that invasive species have on ecosystems, it is important that their establishment and spread is monitored. When a species is introduced to another ecosystem outside of its native range, it becomes disconnected from the native source population. This can lead to a genetic bottleneck or a differentiation of important traits. Differences in both genetic and morphological (body size and shape) between native and introduced populations have been recorded in wall lizards. Wall lizards have been successful invaders in several cities worldwide. The Italian wall lizard (*Podarcis siculus*), has been known to have outcompeted other lizard species to extinction. The invasion success of wall lizards makes them an ideal species to evaluate the way invasive species begin to differentiate from their native counterparts over time, which is important because it provides insights into evolutionary mechanisms and what can be done to mitigate the potential damage of introduced species. To investigate this, data were collected on native Italian wall lizards in Taormina, Italy to compare to data previously collected in the introduced population in San Diego, California. Morphological measurements, like limb and body dimensions, and blood samples were collected for both male and female lizards to compare to the San Diego population. This information can be used to draw conclusions on how the San Diego population of Italian wall lizards has developed since its introduction.

Board 30

BRET BECKER

Research Mentors: Outi Keinaenen, Hannah Mabie, and Olga Khaybullina
Chemistry Department, University of Alabama at Birmingham (UAB)

Project Summary: An extraction process was used to obtain microplastic samples from environmental water samples (from the Cahaba River). Along with this, nanoplastics were synthesized in the laboratory. These plastics were extracted and synthesized in preparation for a larger exposure study involving the model organism, Daphnia pulex.

ISOLATION OF ENVIRONMENTAL MICRO- AND NANOPLASTICS AND LABORATORY SYNTHESIS OF NANOPLASTIC PARTICLES FOR DAPHNIA PULEX EXPOSURE STUDIES

Abstract: Microplastics (1 μm - 5 mm) and nanoplastics (<1 μm) are widespread pollutants that are gaining significant attention for their potential effects on environmental and human health. Previous studies have shown evidence of respiratory, gastrointestinal, and inflammatory problems, along with other adverse health effects as a result of micro- and nanoplastic (MNP) exposure. These MNPs can also adhere to other pollutants, such as heavy metals, that can exacerbate negative health effects.

To investigate Birmingham water ecosystems, a published extraction procedure was used to extract MNPs from Cahaba River water. Also, nanoscale polymers with known characteristics were synthesized in the lab for use in exposure studies. Polystyrene (PS), polyethylene (PE), nylon-6,6 (N66), and polyvinyl chloride (PVC) MNPs were synthesized. A pilot experiment was performed by exposing Daphnia pulex to synthesized PS nanoparticles to investigate potential health effects at different concentrations. Daphnia pulex are planktonic crustaceans found in freshwater systems throughout the planet. As primary consumers and food sources for larger aquatic organisms, they are considered keystone species. Because Daphnia have previously been shown to ingest MNPs, they are excellent model organisms for exposure studies.

The pilot study showed potential reduction in reproductive activity in Daphnia pulex colonies chronically exposed to low and high concentrations of PS nanoparticles. These preliminary results warrant further investigation into the effects of MNP exposure on Daphnia. Future work will include a structured exposure study examining co-exposure to MNPs and heavy metals, as well as investigating the differences between synthesized and environmentally-extracted MNPs.

Board 31

AUGUSTINE LEMERT

Research Mentor: Chad Rappleye
Department of Microbiology,
The Ohio State University

Project Summary: In the field of medical mycology, there is a growing need to use functional research for the discovery of therapeutic targets against often neglected fungal pathogens (disease-causing microorganisms) and develop a better understanding of how fungi and host cells interact. The Rappleye lab's research aims to characterize the lifestyle of the environmental fungal pathogen Histoplasma, and most recently, discovering how certain proteins, "chitinases", degrade its cell wall. My project this summer furthered the study of chitinases from Histoplasma and how their activity is necessary for the separation of Histoplasma yeast cells. The results of these experiments can be applied in future translational studies for development of novel antifungal agents or for Histoplasma chitinase inhibitors to control pathogenic effects.

INVESTIGATION OF HOST CHITINASE EFFECTS ON HISTOPLASMA YEAST AGGREGATION

Abstract: Histoplasma spp. are thermally dimorphic fungal pathogens present as a mold in soil or bird and bat droppings. If mold conidia are inhaled, Histoplasma changes morphology to yeast in the host's elevated lung temperature and is then disseminated by phagocytic immune cells. Chitinases are enzymes that degrade chitin, an essential polymer of the fungal cell wall aiding in structure and protection. One of the roles of chitinases is to separate the cell walls of mother and daughter cells upon division. Histoplasma encodes for eight chitinase genes (cts1-8), two of which (cts2, cts4) have been demonstrated prior by the Rappleye lab to be influential in yeast disaggregation while grown in vitro conditions. We explored the sufficiency and necessity of host chitinase, hChit1, and the prevention of Histoplasma yeast aggregation through in vitro experiments. Through cloning and transformation, hChit1 gene sequence was expressed in both mammalian and bacterial cell systems, extracted and purified as recombinant protein, and applied to cts2,4Δ yeast. Sufficient prevention of aggregation was observed. Future work in the Rappleye lab will prioritize optimization for scaling-up recombinant hChit1 production using E. coli for further studies in murine models. Additionally, the necessity of host chitinase expression was explored by using RNAi through shRNA sequences mediated through a retroviral delivery system to transduce murine macrophages and silence chitinase gene expression. Studies on this portion are continuing by using quantitative methods (ie, qRT-PCR) to measure knockdown in chitinase gene expression before observing macrophage infection by Histoplasma.

Board 32

DOYI KIM

Research Mentor: Kou-San Ju
Department of Microbiology,
The Ohio State University

Project Summary: Phosphonates are naturally produced compounds that can have useful biological properties, including the ability to fight harmful microbes. This project studied a group of genes from a deep-sea bacterium that may be responsible for producing a previously unknown phosphonate compound. These genes were introduced into a well-studied laboratory bacterium to determine what compounds they produce and how different genes contribute to the process. The goal of this research was to better understand how bacteria make phosphonates and potentially discover new natural compounds with useful biological activities.

CHARACTERIZATION OF A PHOSPHONOALANINE BIOSYNTHETIC PATHWAY FROM ABYSSISOLIBACTER FERMENTANS MCWD3

Abstract: Phosphonates are a diverse class of natural products that contain a carbon-phosphorus bond and often exhibit useful biological activities, including antimicrobial properties. Genome mining has revealed numerous phosphonate biosynthetic gene clusters, yet the products encoded by many of these pathways remain unknown. This research investigates a putative phosphonate biosynthetic gene cluster from Abyssisolibacter fermentans, a deep-sea Gram-positive anaerobic bacterium. The gene cluster contains phosphoenolpyruvate mutase, a PLP-dependent aminotransferase, a dipeptide epimerase, a nucleoside diphosphate kinase, and three ATP-grasp ligases, suggesting the potential to produce a previously uncharacterized phosphonoalanine-derived natural product. To investigate the products encoded by this pathway, genes from the A. fermentans gene cluster are being heterologously expressed in Bacillus subtilis. Following optimization of culture conditions, metabolite extracts will be analyzed by 31P NMR to identify phosphonate-containing compounds. This work seeks to determine the products produced by the A. fermentans gene cluster and expand our understanding of phosphonate biosynthetic diversity.

Board 33

AIDEN THOM

Research Mentors: Sylvia Lee and Amaresh Chaturbedi
Department of Molecular Biology and Genetics, Cornell University

Project Summary: My project focused on studying how the activity of a specific neuron in the nematode worm *C. elegans* regulates the release of eggs. Our initial hypothesis was that the movement of the egg through the reproductive tract (ovulation) caused the uterine walls to stretch, which activated the neuron to trigger egg-laying behavior. Our data shows that this neuron is inactive in worms that do not ovulate their eggs, but unexpectedly became active again when both sperm and eggs were absent. This finding suggests that egg laying may be controlled by a more complex model than we initially believed.

NEURONAL REGULATION OF ECTOPIC EGG LAYING IN FEMINIZED *C. ELEGANS*

Abstract: The nuclear hormone receptor NHR-49 is a likely functional homolog of mammalian PPARs, regulates fat metabolism during metabolic stress, and has recently been implicated in oocyte activation and ovulation in C. elegans. While self-sterile feminized (fem-1(-)) mutants exhibit attenuated oocyte maturation and egg-laying behavior, inactivation of nhr-49 in fem-1(-) worms has been shown to cause ectopic oocyte activation and egg release, resulting in a significant decrease in longevity. Despite ectopic release of oocytes, it remains unclear whether downstream machinery in the egg-laying circuit is activated. Hermaphrodite-specific neurons (HSNs), which innervate the vm2 vulval muscles, are required for egg laying. We hypothesized that HSN firing would be attenuated in fem-1(-) mutants and restored in fem-1(-) worms with NHR-49 expression knocked down. Additionally, we sought to determine whether HSN firing is dependent on oocyte ovulation into the uterus. To test these hypotheses, we used RNAi in worms expressing a genetically encoded calcium reporter (as a proxy for neuron firing) in HSN neurons to generate strains with distinct egg-laying and germline phenotypes. These worms were then mounted on slides and immobilized for visualization of calcium signaling using fluorescence microscopy. We found that HSN firing is blocked in fem-1(-) worms and restored upon inactivation of nhr-49 using RNAi. Interestingly, germline-less (glp-1) worms do not show blocked HSN firing, and glp-1 RNAi on fem-1(-) mutants restores HSN firing. Taken together, these results support a model in which inhibition of oocyte ovulation (oocyte stacking) in the proximal gonad inhibits HSN firing.

Board 34

HUNTER RHOADES

Research Mentors: Carl Lawson and Corey Flynn
Schools of the Health Sciences and the Office of Sustainability in the Health Sciences, University of Pittsburgh

Project Summary: Approximately one-third of college students in the United States experience food insecurity, which exceeds the US population prevalence. Previous research has identified race/ethnicity, financial hardship, meal plan access, and public assistance participation as key risk factors that influence food insecurity on college campuses. However, whether these findings generalize across universities remains unclear due to differences in student populations and local food environments. The central aim of this study is to externally validate previously-identified sociodemographic correlates of food insecurity among University of Pittsburgh college students.

EXTERNAL VALIDATION OF NATIONAL SOCIODEMOGRAPHIC FACTORS AND FOOD INSECURITY AMONG UNIVERSITY STUDENTS

Abstract: Food insecurity, defined as limited or uncertain access to adequate, nutritious food due to financial constraints, is a growing concern among college students in the United States. Approximately one-third of college students experience food insecurity, exceeding the prevalence in the general U.S. population. Previous research has identified race/ethnicity, financial hardship, and public assistance participation as factors associated with food insecurity; however, the generalizability of these findings across universities remains unclear. This study aimed to externally validate previously identified sociodemographic correlates of food insecurity among University of Pittsburgh students. An existing dataset from Dr. Corey Flynn was analyzed as part of the Summer 2026 CDC John R. Lewis Undergraduate Scholars Program at the University of Pittsburgh. Food insecurity was measured using the USDA Six-Item Short Form Food Security Survey Module (0-8). Bivariate associations were assessed using Wilcoxon rank-sum, Kruskal-Wallis, and Spearman correlation tests, followed by ordinal logistic regression. Among 93 students, food insecurity was significantly associated with Pell Grant status, SNAP participation, food pantry use, and ability to pay for basic needs in bivariate analyses. In the adjusted model, Black/Other students had higher odds of greater food insecurity than White students (OR=4.44, p=.012), as did Pell Grant recipients (OR=3.61, p=.007). Findings provide partial external validation of previously identified correlates of college student food insecurity and suggest that universities should assess food insecurity within their own student populations to identify campus-specific disparities and inform targeted interventions.

Board 35

KAVYANJALI SIDHANTA

Research Mentor: Annie Du
College of Pharmacy and Pharmaceutical Sciences, Washington State University

Project Summary: I participated in biotechnological research over the summer. I learned how to make microneedles(MNs), which are a new and upcoming method for drug delivery. Microneedles are particularly prominent because they are painless and have targeted mechanisms of drug delivery. While there are several types of MNs, I focused on learning how to fabricate and load drugs into two types: dissolving MNs and Hydrogel Forming MNs.

POLYMERIC MICRONEEDLE FABRICATION AND CHARACTERIZATION FOR TRANSDERMAL DELIVERY APPLICATIONS

Abstract: Polymeric microneedle (MN) arrays are a minimally invasive transdermal delivery platform capable of overcoming the stratum corneum of the skin to enable efficient local or systemic drug administration. The goal of this project was to fabricate and comprehensively characterize dissolving and hydrogel-forming MNs composed of polyvinylpyrrolidone (PVP), polyvinyl alcohol (PVA), and a 10:1 PVA/PVP blend. Silicone elastomer negative molds were generated using 3D-printed master templates, and 90-needle arrays were cast in 800 µm and 1200 µm geometries. Microscopic imaging confirmed uniform needle morphology across all formulations. Mechanical insertion testing using parafilm evaluated reliable penetration for MNs. Hydrogel-forming PVA MNs increased in volume by approximately 102% over 120 minutes, and 10:1 PVA/PVP MNs increased by approximately 101% over the same period. Dissolution studies conducted using PBS at 37°C showed that 800 and 1200 µm PVP MNs began dissolving within 10 minutes and fully dissolved by 120 minutes. Together, these tests established the structural integrity, mechanical performance, and functional behavior of each MN formulation. Following optimization of fabrication parameters, 1200 µm PVP MNs were loaded with 5Z-7-oxozeaenol, a TAK1 inhibitor relevant to inflammatory disease research, to evaluate drug release performance. A UV-Vis calibration curve was established, and cumulative release from the drug-loaded MNs was quantified. The 1200 µm PVP MNs released approximately 22-25% of 5Z within the first 500 minutes and reached a cumulative release of approximately 75-80% by 2 weeks. Overall, this study establishes reproducible fabrication workflows and rigorous characterization methodologies for polymeric MN systems and demonstrates their suitability for controlled transdermal drug delivery.

Board 36

IAN SANDER

Research Mentors: Daniel J. Spakowicz and Brittney Keller-Hamilton
The Center for Tobacco Research and the Comprehensive Cancer Center, The Ohio State University

Project Summary: Oral nicotine pouches (ONPs) have been the fastest-growing nicotine product category in the United States since their nationwide introduction in 2016. Most commonly placed between the lip and gum, ONPs are routinely marketed as “tobacco-free” alternatives to cigarettes and smokeless tobacco. Despite ONPs’ reduced toxicant burden, differences in their chemical and physical characteristics may lead to adverse changes to the oral microbiome, thereby modulating oral and systemic health outcomes. We seek to stimulate interest among researchers to address this critical knowledge gap in public health research and encourage the integration of microbiological data into the tobacco regulatory framework.

SWAB ONCE, ANALYZE TWICE: A DUAL SEQUENCING APPROACH FOR ORAL MICROBIOME SURVEILLANCE ACROSS TOBACCO TRANSITIONS

Abstract: Oral nicotine pouches (ONPs) have been the fastest-growing nicotine product category in the United States since their nationwide introduction in 2016. Most commonly placed between the lip and gum, ONPs are routinely marketed as “tobacco-free” alternatives to cigarettes and smokeless tobacco. ONPs contain fewer and substantially lower levels of harmful and potentially harmful constituent (HPHC) compared to cigarettes and SLT. Using cigarettes, e-cigarettes, and SLT each lead to dysbiosis of the oral microbiome, but the effects of ONP use on the oral microbiome are unknown. Despite ONPs’ reduced toxicants, differences in their chemical and physical characteristics may lead to adverse changes to the oral microbiome. Given that ONPs possess a reduced toxicant burden relative to conventional tobacco products, switching to ONPs is predicted to improve oral health among current cigarette and SLT users. However, ONP use by people who have never used nicotine could plausibly cause oral dysbiosis. With ONPs’ potential to alter systemic health risks via their effects on the oral microbiome, rigorous investigations of ONPs’ effects on the oral microbiome are urgently needed. We aim to establish a methodological standard for evaluating ONPs’ effects on the oral microbiome and advocate for integration of oral microbiome evidence in FDA regulation of ONPs. This work represents a pursuit for comprehensive evidence, aimed at ensuring that regulatory decisions are grounded in a thorough understanding of the oral microbiome’s contributions to public health outcomes related to the use of ONPs. We seek to stimulate interest among researchers to address this critical knowledge gap and encourage the integration of innovative methodologies into clinical studies, enhancing the regulatory framework surrounding ONPs.

Board 37

ANDREW INAMDAR

Research Mentors: Cynthia St. Hilaire and Rolando Cuevas
Departments of Medicine and Bioengineering, Pittsburgh Heart, Lung, and Blood Vascular Medicine Institute, University of Pittsburgh

Project Summary: Calcific aortic valve disease (CAVD) is the most prevalent valvular heart disorder, characterized by thickening of aortic valve leaflets and calcium build-up. There are currently no medications to slow disease progression; surgical valve replacement is the only treatment. We have shown that two enzymes, TERT and HSP90, play a key role in the disease process for CAVD. We propose blocking the interaction of these enzymes to prevent CAVD progression.

HSP90 INHIBITION SUPPRESSES TERT NUCLEAR TRANSLOCATION DURING OSTEOGENESIS OF HUMAN VALVE CELLS

Abstract: Calcific aortic valve disease (CAVD) is the most prevalent valvular heart disorder, characterized by thickening of aortic valve leaflets and calcium deposition. There are currently no therapeutics to slow disease progression; surgical valve replacement is the only treatment. Calcification is an active process where valve cells undergoing osteogenic reprogramming (OSTR) become osteoblast-like: they calcify and upregulate RUNX2 and ALPL. The precise mechanisms of this process are unknown. We previously found that non-canonical functions of telomerase reverse transcriptase (TERT) are required for human valve interstitial cell (hVIC) OSTR. TERT acts as a transcriptional co-regulator with STAT5 to drive RUNX2 expression. TERT maturation and nuclear localization requires chaperoning by heat shock protein 90 (HSP90). Preliminary data show HSP90 is upregulated in CAVD compared to control valves, and that HSP90/TERT interaction is enhanced during OSTR in hVICs. We hypothesize that inhibiting HSP90 will reduce RUNX2 activation and prevent OSTR in hVICs. hVICs were grown under control or osteogenic conditions for five days and treated with luminespib, pimitespib, or DMSO. We found that inhibiting HSP90 reduced RUNX2 and ALPL expression, but also led to overexpression of HSP90A. Immunostaining showed decreased nuclear localization of TERT with HSP90 inhibitors. We conclude that HSP90 inhibition decreases OSTR and HSP90 plays a role in the nuclear localization of TERT under osteogenic conditions. Future experiments will measure hVIC calcification and selective knockdown of HSP90 isoforms. Ultimately, we propose the HSP90/TERT interface as a druggable target to block OSTR of hVICs.

Board 38

SOPHIA ROHR

Research Mentor: ChangHwan Lee
Department of Biological Sciences, University at Albany SUNY

Project Summary: My project is looking at development in roundworms that have weaker muscle fibers than normal worms. More specifically, we are looking at a signaling pathway that is involved in maintaining a pool of stem cells which is crucial for development and reproduction. We found that in worms with weaker muscle fibers, differences in signaling seem to be temperature dependent.

INVESTIGATING THE EFFECTS OF STRESS FIBER LOSS ON STEM CELL DEVELOPMENT THROUGH NOTCH SIGNALING

Abstract: *Caenorhabditis elegans* is a transparent, microscopic roundworm that is a common model for studying development. One way to do this is by looking at the Notch signaling pathway which is responsible for maintaining a pool of stem cells in the germline of these worms. Prior research has shown that as the worms age, Notch signaling becomes mislocalized which can lead to premature cell differentiation and reduced reproductive ability. The Notch signaling pathway plays a similar role in humans, and dysfunctional Notch signaling has been linked with cardiovascular disease, cancer, and neurodegenerative diseases. In this project, we were interested in seeing if Notch signaling differs when muscle stress fibers are lost. To test this, we used a mutant strain of worm, fhod-1 (tm2363), that has thinner, weaker stress fibers. We tested our worms at two different temperatures (20°C and 25°C) and two phases of development (day 1 of adulthood/early adulthood and day 4 of adulthood/late adulthood). An experiment known as smFISH was conducted to attach probes to visualize Notch signaling. After smFISH, worm gonads were imaged and analyzed for common signaling measures. Our results show that changes in the development of fhod-1 (tm2363) are temperature-dependent. At 20°C, the phenotype of the fhod-1 (tm2363) germline was smaller and had an increase in Notch signaling in early adulthood. In contrast, at 25°C, the phenotype of the fhod-1 (tm2363) germline remains fixed throughout adulthood with an increase in Notch signaling. Future research will explore what is causing these signaling differences and if differences in signaling correspond to differences in reproduction in these mutants.

Board 39

JORDAN LEWIS

Research Mentor: Sonia Tiquia-Arashiro
Department of Natural Sciences, University of Michigan-Dearborn

Project Summary: We isolated 4 heavy metal tolerant bacterial strains from the Saint Clair River sediments. Each strains heavy metal uptake ability was tested in separate 50 mg/L copper solutions. We found that all four strains bound copper ionically to key functional groups such as -OH, -NH, and -CO.

ADSORPTION KINETICS AND MECHANISTIC MODELING OF COPPER UPTAKE BY ENVIRONMENTAL BACTERIAL STRAINS FROM AN URBAN WATERSHED

Abstract: Industrialization has vastly improved humans' quality of life, but industrial heavy metal byproducts offset those improvements through significant water contamination. Bacterial biomasses offer a cost-effective remediation alternative. Negatively charged hydroxyl and carboxyl groups on bacterial cell walls can bind cationic metals such as copper (Cu2+), regardless of the cells being dead or alive. In this study, four bacterial strains known for Cu2+ absorption (Klebsiella sp. H 19 [R19]), Raoultella planticola [L30], Raoultella sp. IED15 [R31], Raoultella ornithinolytica B6 [R8] were isolated from the Saint Clair River and were exposed to ≈50 mg/L Cu2+ solutions for 5 h. FTIR-ATR was used to identify functional groups involved in Cu2+ binding, and FAAS was used to investigate Cu2+ uptake and absorption kinetics. All strains showed a time-dependent decrease in Cu2+ concentration, with strain R8 showing the highest adsorption capacity (87.30 % ± 0.08) and strains L30 and R31 (73.1% ± 0.1 and 74.98% ± 0.09, respectively) showing comparatively lower uptake. The decrease in Cu2+ concentration was associated with binding to key functional groups such as C-O, O-H, and N-H, as confirmed by FTIR-ATR peak shifts. Cu2+ concentration linearly decreased over time across all bacterial strains (average R2= 0.978). Kinetic analysis revealed a biphasic absorption pattern observed by an initial, slower Cu2+ uptake phase followed by a faster removal phase. FAAS kinetic data and FTIR-ATR spectra support bacterial biomass's potential for large-scale Cu2+ removal from contaminated waters. Using bacterial strains native to contaminated sources also provides an ecosystem-friendly approach to heavy metal remediation.

Board 40

ERIC SANDER

Research Mentor: Justin North
Department of Microbiology, The Ohio State University

Project Summary: This past summer, I contributed to cutting-edge biofuels research in the North lab at The Ohio State University. I helped the lab understand how our bacteria of interest is able to perform its bond-cleaving function and produce clean biofuel byproducts. I spent the summer growing, tagging, and analyzing bacteria to help uncover the microscopic mysteries of sustainable biofuels.

INVESTIGATING METALLOCOFACTOR COORDINATION AND ACTIVE SITE IN METHYLTHIO-ALKANE REDUCTASE MUTANTS

Abstract: Sulfur is an essential element for all life on earth utilized by plants, animals, and bacteria for protein synthesis, cellular protection, and energy metabolism. The dominant form of sulfur in the biosphere is inorganic sulfate (SO42-). When sulfate becomes limiting, bacteria can scavenge sulfur from more complex organic sulfur compounds. Yet, the molecular mechanisms by which bacteria in anoxic environments break down complex organic sulfur compounds to synthesize essential amino acids remains unknown. Rhodospirillum rubrum, a gram-negative facultative anaerobe, possesses a unique Methylthio-alkane Reductase (MAR) system that drives organic sulfur scavenging. This two-part protein complex, composed of a dimeric reductase and catalytic tetramer, is responsible for the reductive cleavage of dimethylsulfide and similar organic sulfur compounds. Two iron-sulfur metallocofactors reside in the MarDK tetramer: a P-cluster-like [8Fe-7S] cofactor called the mar1 cluster and an L-cluster-like [8Fe-9S-C] cofactor called mar2. Preliminary data identified three amino acid mutants surrounding the mar2 L-cluster (MarD H429L, MarD C270A, and MarD A428L) that resulted in no in vivo enzymatic activity. However, the precise mechanisms, roles of specific amino acid residues, and the importance of cofactor coordination within the Mar enzyme remain unknown. Through PCR screening and Western Blot Analyses, we confirmed successful expression of MAR protein synthesis in wild-type control plasmids of interest by quantifying MAR protein synthesis through FLAG tagged immunofluorescence. This is one step closer to understanding the function of the amino acid residues involved in MAR catalysis.


Columbia

HERE ARE SOME OF THE THINGS PAST SSRP PARTICIPANTS ARE DOING NOW.

Raazia Aamir | Technical Innovation Intern at Vertiv

Sharvi Arora | Biology Research Intern at Evommune

Shelby Bay | Patient Service Specialist at NovaCare Rehabilitation

Claire Hammond | Ph.D. Candidate in Neuroscience at the University of Cincinnati

Maddie Hoyt | Doctor of Physical Therapy Candidate at The Ohio State University

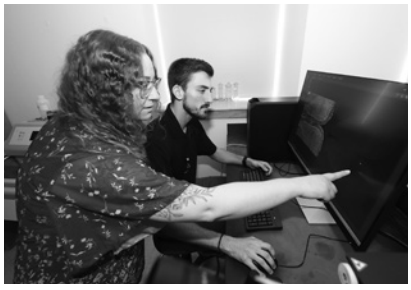
Fallon Keeton | GMP Plasmid Scientist at Andelyn Biosciences

Milo Morton | Seasonal Keeper at The Columbus Zoo and Aquarium

Aninditha Nair | Solutions Architect at QuickSilver Labs

Parthey Vasani | Ph.D. Candidate in Physics & Teaching Assistant at The University of Toledo

Teodora Ilic | Special Education Teaching Assistant at Saint Paul Public Schools

SPECIAL ACKNOWLEDGEMENTS

Sources of Support for the 2026 Summer Scholarship and Research Program

Mary Alice Austin ’41 Endowment for the Ohio Wesleyan University Course Connection Program
Harry Phillip Bahrick Summer Research Fund
Glenn W. Bailey Foundation
Joseph H. ’30 and Elizabeth Brant Collaborative Research Fund
Eleanor Brown Summer of Science Research Endowment
Carlisle Family Endowed Fund for the OWU Connection
John C. Clark - Mathematics
Jack E. ’52 and Joyce A. Cornett Summer Science Research Fund
Anne E. Donnelly ’75
Herbert L. ’61 and Margaret Wright ’61 DuPont Collaborative Summer Research Fund
Ferry Family Foundation
Dr. Kathryn E. Howell ’61 Endowment for the OWU Connection
Dr. James B. Hoy ’57 Endowment
Robert V. and Alice C. Kail Summer Science Research Internship
Alice N. Kraus Endowment
Marcia Kunstel ’69
The Frank McKinney P ’71 and Donalda McKinney P ’71 Endowed Fund
Albert A. Mills Jr. Summer Science Research Program Endowment Fund
Dr. Robert Prentice ’63 and Dr. Sandra Surbrugg OWU Connection Endowment
David O. and Janice S. Robbins Summer Science Research Endowment
Bruce R. Roberts Research Endowment for The OWU Connection
The Reverend Robinson ’54 and Janet Wallace Lapp ’55 Endowed Fund for the OWU Connection
Dr. F. Sherwood Rowland ’48 Memorial Endowment
David H. Smith ’53 Fund for the Sciences
Kara Trott ’83 Endowed Fund for the OWU Connection
Don C. Wendel, Jr. ’44 Endowed Fund for the OWU Connection
Dr. Lawrence E. Young Endowment
Student-Faculty Endowed Research Fund in Chemistry
Ohio Wesleyan University Provost and Academic Affairs Office

Support for the Patricia Belt Conrades Summer Scholarship and Research Symposium

Dr. Nancy Reynolds Schneider ’64

Researchers

Special Thanks

A heartfelt thank you to everyone who supported this year's Summer Scholarship and Research Program! To our mentors, donors, staff, and hard-working scholars—thank you for your generosity, dedication, and collaborative spirit. This program wouldn't be what it is without each of you.

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