Patricia Belt Conrades

# Summer Science Research Symposium

September 26, 2024

Ohio Wesleyan University

# KRISTEN ASTORIAN

OWU ’14 | OWU STEM CAREER CATALYST

“The SSRP was an integral part of my development as a scientist during my time at OWU — I learned how research is done in real settings and how much I loved to read and critically think about research and its goals. The difficulties and triumphs of repeated experiments, exposure to research procedures and writing, the collaboration and networking are all components of a career in science that cannot be taught in a classroom or educational lab setting. I got the opportunity to learn more about my professors and their journeys to their goals that sparked my excitement for my own future.”

# THE PATRICIA BELT CONRADES SUMMER SCIENCE RESEARCH SYMPOSIUM

The crises that are upending our world — from the lasting impact of the COVID-19 pandemic to the long-term existential threat of global climate change — have boldly reminded us of our reliance on science, mathematics, and technology. We turn to scientists and their research to help us understand and solve such global challenges.

Now in its 32nd year at Ohio Wesleyan, the Summer Science Research Program, which culminates in the Patricia Belt Conrades Summer Science Research Symposium, prepares OWU students for careers in science research. The program provides an intensive 10-week opportunity for students to tackle complex research issues by working with seasoned, accomplished mentors at OWU and other universities across the country. Students prepare poster displays highlighting their research results for the Symposium event. Please ask the students any questions you wish; they are proud and excited to tell you what they learned and why it matters. After the event, research will be posted at **owu.edu/ssrp2024**.

## CONTENTS



**September 26, 2024 | 1-3 p.m.**

**The Patricia Belt Conrades Summer Science Research Symposium coincides with Ohio Wesleyan's Connection Conference.**

**owu.edu/ssrp**
**owu.edu/ConnectionConference**

# THE MAKING OF A SCIENTIST

## In our ever-changing world, one thing that remains constant is that the talented science students at Ohio Wesleyan continue to make meaningful contributions to scientific research along with their faculty mentors in the OWU Summer Science Research Program (SSRP).

Authentic research is quite different from classroom labs — more challenging, more creative, more frustrating, and, ultimately, more rewarding.

One of the most rewarding parts of SSRP for me is watching the students grow as scientists, seeing them take command of a research project, and knowing that they are gaining the confidence to speak and act as scientists. Science cannot be learned solely from a book. Science must be experienced through research, and at OWU, we encourage students to plunge in, preparing them to be successful researchers both at OWU and at other universities. Many first-year students are surprised to learn that they can contribute in substantive scientific research from the moment they arrive on campus. At Ohio Wesleyan, research is not just for the few.

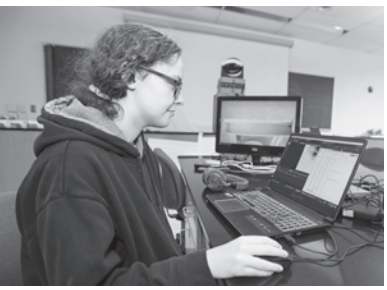
During the Symposium this afternoon, you will have the opportunity to interact with 37 students who performed research at OWU mentored by OWU faculty members and 15 additional OWU students who performed research off campus at other universities. There is no doubt that the results presented here today are exciting and novel. However, equally exciting is the opportunity for you to speak with each of these young scientists about what discoveries they have made.

Be brave! Ask a question! Our research students are eager to interact with you and answer your questions about their work. They are looking forward to interacting with their audience!

So on behalf of all the OWU students and faculty mentors whose research will be featured in the Symposium, thank you for attending. Your presence is greatly appreciated.

Enjoy the Symposium — and be sure to learn something new!

**Laura Tuhela-Reuning**
*Division Chair, Natural Sciences*
*Director, Summer Science Research Program*
*Faculty Member, Department of Biological Sciences*
*Scanning Electron Microscopist*





# 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.

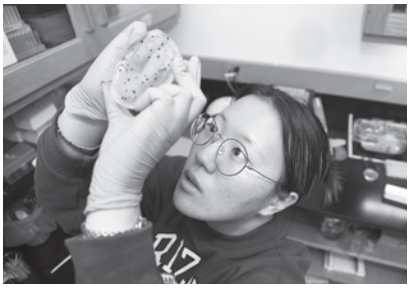
Pat, who passed in December 2021, was a long-time and generous supporter of Ohio Wesleyan’s Summer Science Research Program. She visited campus several times during the summer months to meet with students and faculty conducting research.

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


## BRITTNEY C. PARKS
## DEVON HALEY
## ASHLEY MOLLETT
## GABRIELLE H. PLUNKETT
## TYLER WILLIARD

**Research Mentors:** Eric J. Gangloff and Allison R. Litmer
Department of Biological Sciences


**Ashley Mollett**
Not Pictured


Introduced species can be very harmful to native populations and environments, so it is important to study them. We are monitoring populations of the common wall lizard (Podarcis muralis), a species introduced to Cincinnati from Italy in 1951. We examined differences in populations between human-built environments, where they normally thrive, and more natural forest environments. We found that lizards have successfully established populations in forest environments, though these populations are small. It is important to specifically monitor these wall lizard populations in more natural environments because it is where they are more likely to pose a threat to native species.


## CAPTURE-MARK-RECAPTURE STUDY OF COMMON WALL LIZARDS (PODARCIS MURALIS) BETWEEN FOREST AND WALL HABITATS WITHIN THE URBAN CITY OF CINCINNATI, OHIO


It is important to ensure that introduced species are monitored to limit negative effects on native species, such as through predation, competition, or habitat damage. The common wall lizard (Podarcis muralis) is native to Europe and was introduced in Cincinnati, Ohio in 1951. Wall lizards have since established a large population in Cincinnati, thriving in the warm urban areas and finding shelter in crevices in human-built structures, especially old rock walls. We aimed to better understand how wall lizards are so successful in anthropogenic environments, as well as to discern if they have established populations in forested environments. If wall lizards are able to succeed in these forested areas, they are more likely to pose a threat to native species. To evaluate this, we conducted a capture-mark-recapture study on wall lizard populations at both wall and forested environments to compare population abundance, demographics, growth rates, and individual traits. Specifically, we conducted four standardized surveys where we captured, marked, and collected data on individual lizards, and then released lizards back at their point of capture. Through the surveys, we identified forested habitats where lizards have established populations, though these populations are not as large as the wall populations. Within both environments, we have recaptured lizards from previous surveys and found gravid females, which indicate that individuals are surviving and reproducing in both environments. We plan to use data collected in this study to inform population models and future lab experiments on lizard physiology and reproduction.

Board 2

## ANDREW INAMDAR
## DOYI KIM

**Research Mentor:** Andrea Suria
Department of Biological Sciences

Hawaiian bobtail squid (Euprymna scolopes) eggs are protected from infection by bacteria whose antifungal compounds could be used to treat human diseases. We tested the interactions between these bacteria within the host by injecting our strains of interest into the eggs of a related species, the hummingbird bobtail squid (Euprymna berryi), in order to understand how these bacteria compete to colonize their host.

### CHARACTERIZING COMPETITION BETWEEN SYMBIOTIC SQUID BACTERIA

Hawaiian bobtail squid (Euprymna scolopes) eggs are protected from fungal fouling by symbiotic bacteria whose, potentially novel, antifungal compounds could be effective against human pathogens. Little is known about the genetic mechanisms bacteria use to create these compounds. One strain isolated from the accessory nidamental gland (ANG) of E. scolopes, Leisingera sp. ANG-M7, produces antimicrobial compounds that kill another strain, Leisingera sp. ANG-DT. A mutant strain of M7, P24E3, was previously created and no longer has the ability to produce a diffusible antimicrobial. For this project, we injected our strains of interest into the egg jelly coats of a related species, the hummingbird bobtail squid (Euprymna berryi), to determine if this antimicrobial is necessary for competition between bacteria within their host. E. berryi eggs were treated with an antibiotic cocktail containing five antibiotics to remove their native bacteria prior to injection. We then injected 5 µL of each of our test mixes and controls into the eggs and allowed them to incubate for up to one week. We sampled the eggs at days 0, 4, and 7 and determined the number of colony forming units (CFUs) present of each strain. Our results were consistent with previous in vitro trials and show a reduction in killing by the mutant strain P24E3 compared to the M7 wild type. While the structure of the antimicrobial is still unknown, understanding its activity in the presence of a eukaryotic embryo is important for potential future drug development. Future experiments will focus on identifying the native bacteria of E. berryi eggs and uncovering the genetic mechanisms behind antimicrobial production in other E. scolopes isolates.

Board 3

## ANDREW WEISGERBER

**Research Mentor:** Chris Wolverton
Department of Biological Sciences

Our lab studies the common Thale Cress plant as a model organism for how all plants respond to gravity during development and growth. We have previously identified 124 genes associated with this response, the subject of this specific study being the gene AT2G41810, a protein coding gene which has been shown by our lab to be expressed in exactly opposite ways between the regular plant and starchless mutants. Now we seek to identify the underlying cause of this linkage and discover the purpose of this protein within the larger biological processes of the Thale Cress.

### GROWTH RESPONSE ASSAYS ON LOCUS AT2G41810 IN ARABIDOPSIS THALIANA

Gravitropism is an important response in plants that directs roots downward and shoots upward. Previous research in our lab has shown that locus AT2G41810 is one gene expressed in lesser amounts in Columbia (Col-0) wild type Arabidopsis plants and in equally greater amounts in PGM starchless mutant plants during gravitropic stimulation, yet it remains a protein of unknown function and significance to Arabidopsis cellular processes. The long term goal of these experiments is to identify the role of this gene in the gravitropic response. The protein for AT2G41810 has Arabidopsis paralogs that have been studied and found to be significant in processes such as cell wall elongation, responses to exogenous or endogenous stimuli, development of lateral root primordia, and hypocotyl development. We hypothesize that in the case of Col-0 wild type plants and AT2G41810 gene knockout plants, stimuli treatments will yield contrasting differential growth responses. We found that the T-DNA insertion mutant SALK_034338 results in reduced expression of the AT2G41810 gene, indicating a knockout of this gene. Mutants show significant defects in gravity response relative to wild type. Results from additional experiments will be presented at the symposium.

Board 4


## ANUSHKA SHARAD
## JULIA WALSH
## MACK FINCHAM

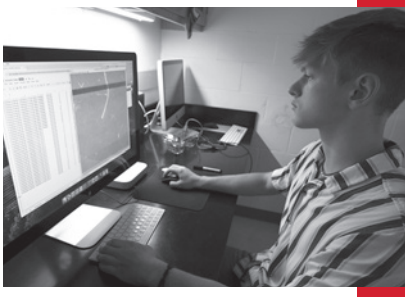
**Research Mentor:** Robert Harmon
Department of Physics and Astronomy



We investigate starspots on the star LO Pegasi using the Light-curve Inversion (LI) technique. Starspots are areas with strong magnetic activity similar to the sunspots on the Sun. By examining them, we learn about the magnetic behavior of stars, which helps us understand similar processes on the Sun. Starspots are darker and cooler than the rest of the stellar surface because the higher magnetic field in these regions reduces the flow of heat into the spot from hotter and deeper layers below it. Hence, the brightness of the star varies as the star rotates and starspots are carried in and out of view. To measure these brightness variations, we obtained digital images of LO Pegasi and surrounding stars of constant brightness at OWU's Perkins Observatory using a telescope and specialized digital camera. We used a program called AstroImage to compare the brightness of LO Pegasi to these other stars. Then using LI we created a map of the starspots and compared it to previous maps from 2014-2023.


## INVESTIGATING STARSPOTS ON LO PEGASI VIA LIGHT-CURVE INVERSION


We investigate starspots on the star LO Pegasi using the Light-curve Inversion (LI) technique. Starspots are areas with strong magnetic activity similar to the sunspots on the Sun. By examining them, we learn about the magnetic behavior of stars, which helps us understand similar processes on the Sun. Starspots are darker and cooler than the rest of the stellar surface because the higher magnetic field in these regions reduces the flow of heat into the spot from hotter and deeper layers below it. Hence, the brightness of the star varies as the star rotates and starspots are carried in and out of view. We used photometry to study the brightness variation of the star due to the starspots. We obtained digital images of LO Pegasi and surrounding stars over several nights in July 2024 at Perkins Observatory using a Meade Schmidt Cassegrain 12-inch telescope and a Quantum Scientific Imaging (QSI) charge-coupled device (CCD) camera, and used AstroImageJ software to compare the brightness of LO Pegasi with other stars of constant brightness. Then we used LI to create a map of the starspots and compared it with the maps created from 2014-2023, which we present here.

Board 5


## CALLIE KAMPE

**Research Mentors:** Chelsea Vadnie[1] and Colleen McClung[2]
[1]Departmant of Psychology, Neuroscience Program at OWU
[2]Department of Psychiatry, Translational Neuroscience Program at University of Pittsburgh



Jet lag, a temporary sleep/wake disorder caused by crossing multiple time zones, produces acute symptoms like sleep/wake disruption, irritability, and cognitive impairment. Since chronic disruption of sleep/wake rhythms or circadian rhythms is associated with diseases and disorders, it is important to identify therapeutics to mitigate circadian rhythm disruption for vulnerable individuals. Here, we studied two novel therapeutics, one that targets the main brain region that regulates circadian rhythms, the suprachiasmatic nucleus (SCN), and one that targets melanopsin receptors on intrinsically photosensitive retinal ganglion cells (ipRCs) which send light information about the environment to the SCN. Further experiments are necessary to determine the therapeutic potential of the compounds


## DEVELOPING PHARMACOLOGICAL TREATMENTS FOR JET LAG

Jet lag, a circadian rhythm disorder caused by travel across time zones, results in misalignment between the body's clocks and the environment. Acute jet lag causes symptoms such as sleep/wake disruption, irritability, and cognitive impairment. Chronic jet lag or circadian misalignment is associated with various diseases and disorders. Currently, there are limited treatments available for jet lag. The suprachiasmatic nucleus (SCN), the central pacemaker in the brain, synchronizes the body's clocks and entrains them to the environment using primarily light cues. The SCN receives light cues via intrinsically photosensitive retinal ganglion cells (ipRGCs) that express melanopsin receptors. Arginine vasopressin signaling through the V1a receptor in the SCN then plays a key role in entraining rhythms. Here we explored two potential jet lag treatments, aAVP) V1a receptor antagonist (SRX246) and a melanopsin receptor agonist (975). We hypothesized that SRX246e will enhance entrainment and that 975 may shift rhythms and enhance light-induced phase shifts. The V1a receptor antagonist SRX246 (0.5 or 2 mM) was delivered to mice via an osmotic minipump connected to a brain implant in the 3rd ventricle above the SCN. Mice were then individually housed in wheel-running cages to quantify activity rhythms during an 8-hr advance and delay of the light cycle. For the 975 experiment, mice were placed into constant darkness to obtain their baseline free-running rhythms. The onset of wheel running (CT12) was calculated for each mouse. We then delivered 10 μl of 975 (1 mM, 10% DMSO, 90% castor oil) or vehicle to each eye, 3 hrs after its onset (CT15), a time when blue light causes phase delays. We hypothesized that 975 would mimic the effects of blue light. For the results, SRX246 did not accelerate entrainment relative to controls. However, control mice entrained faster than expected. The higher dose of SRX246 reduced wheel running and caused cell death in the hypothalamus. 975 alone may phase delay females. Further experiments that troubleshoot the experimental design and drug dosing may allow for new jet lag treatments.




Board 6


## AVERY PANOZZO
## AVA SWANSON

**Research Mentor:** Dustin Reichard
Department of Biological Sciences


Predation is a major threat to nesting songbirds, and we predicted that house wrens would respond differently to predators of varying sizes. We presented nesting wrens with three model chipmunks of different sizes and measured their aggressive behaviors. Both males and females responded aggressively to the small and medium-sized models, but they reduced their aggression towards the large model. These data suggest that house wrens use a sized-based threshold to determine their antipredator response.

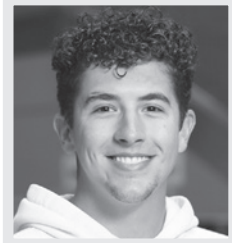
### HOW PREDATOR SIZE AFFECTS THE STRENGTH OF NEST DEFENSE BEHAVIOR IN HOUSE WRENS

In most species, predation is the greatest threat to an individual's reproductive success and natural selection should favor behaviors that effectively defend offspring from a range of predators. We hypothesized that predator size would affect the strength of nest defense behavior and tested this hypothesis in house wrens (Troglodytes aedon). We predicted that the house wrens would react less aggressively to large predators because the size disparity makes them unlikely to succeed in physically driving those predators away. To create identical predators of different sizes, we 3D printed and painted three separate models resembling an eastern chipmunk (Tamias striatus). One model was the size of a normal chipmunk and the remaining models were scaled to 0.5 or 2 times that size. Then, we observed house wren nesting activity from the months of May through July and measured how aggressively wrens responded to the three predator models when they had nestlings between 4-9 days old. Each wren pair experienced one trial per day involving the model chipmunk being placed on top of the nest box for five minutes. During the trial we measured the number of hits, dives over the model, closest approach to the model, and time spent within five meters of the nestbox by both the male and female. We found that, on average, male and female wrens responded less aggressively to the large chipmunk decoy. This result supports our hypothesis that house wrens use a sized-based threshold during nest defense.

Board 7


## CARSON FOX

**Research Mentor:** Brad Trees
Department of Physics and Astronomy

Superconducting devices are some of the most sensitive magnetic field detectors in the world, and they allow for precise measurements in instruments like MRI machines, scanning SQUID microscopes, gravity wave detectors, etc. We are interested in whether more of these devices connected in series will result in more precise measurements and improved technology.

### SYNCHRONIZATION IN SERIAL DC SQUID ARRAYS

The study of superconducting devices such as SQUIDs (Superconducting Quantum Interference Devices) leads to improved magnetic field detectors in numerous technologies such as MRI machines, scanning SQUID microscopes, gravity wave detectors, etc. One interesting question that arises is if multiple SQUIDs are connected in a serial array will synchronized voltage outputs across them result in a more sensitive/accurate device? The first step is understanding the synchronization behavior of SQUIDs when in a serial array. We studied the voltages across the SQUIDs numerically for the cases of one, two, and three SQUID systems, and we observed synchronization behavior within the two and three SQUID serial arrays, in which all SQUIDS oscillate with the same average voltage. We were able to obtain both numerical and approximate analytical solutions for the boundary of the synchronization region in a two-SQUID serial array as a function of applied bias current and magnetic field. We also have preliminary code for studying the voltages in a serial array with arbitrary number N of SQUIDs.

Board 8


## DEVON HALEY
## BRITTNEY C. PARKS
## GABRIELLE H. PLUNKETT
## TYLER WILLIARD,
## JASMYN D. ZIMMERMAN

**Research Mentors:** Allison R. Litmer and Eric J. Gangloff
Department of Biological Sciences


Ohio has over 80 species of reptiles and amphibians living within its borders. As a lab group, we surveyed locations all over Ohio to locate and study the reptiles and amphibians. We captured and examined many different species to better understand the health of the population and the environment they inhabit. A simple survey can reveal a lot of information about a target population like distribution, population size, and behavior.

## SURVEYING OHIO REPTILE AND AMPHIBIAN SPECIES

There are over 80 species of reptiles and amphibians living in Ohio, each with their own role in their respective habitats. Surveying these species can inform us about the health of different populations and the conditions of the ecosystems they inhabit. Over the summer we surveyed multiple sites to get a clearer understanding of the herpetological species that inhabit Ohio. In Cincinnati, our lab group surveyed four different populations of common wall lizards *(Podarcis muralis)* in human-made and forest sites to determine the spread and possible impact of this introduced species. We also surveyed a site in Columbus for common wall lizards to remove the introduced species and slow down the invasion. We traveled to Killdeer Plains in Wyandot County to survey snake populations in conjunction with the Ohio Department of Natural Resources. Some rare and endangered species were identified and captured including the venomous Massasauga rattlesnake *(Sistrurus catenatus)* and the plains gartersnake *(Thamnophis radix)*. At Gallant Woods in Delaware County, we swabbed amphibian species to test for the presence of an incredibly harmful chytrid fungus that could be detrimental to amphibian populations in Ohio. On a trip to Vinton Furnace State Forest in Vinton County, with collaborators from Ohio University, we surveyed eastern fence lizard *(Sceloporus undulatus)* populations. Tail clips and blood samples were collected to further examine the physiology of the species. Surveying reptiles and amphibians can reveal population density, species behavior, and morphology and is crucial to understanding the health of an ecosystem and the creatures living in it.

Board 9

## GRACE MARTIN

**Research Mentor:** Matthew McCurdy
Department of Math and Computer Science *(former OWU professor)*

This research project explores the implementation of self-grading in a college-level Calculus I class to enhance student learning outcomes and metacognitive development. By providing students with a detailed rubric for assignments, having them self-assess their work, and compare their evaluations with the instructor's feedback, the project aims to foster reflective practices and a deeper understanding of the material. Over time, the rubric becomes more student-created, encouraging students to take ownership of their learning and actively contribute to the evaluation criteria.

### EXPLORING SELF-GRADING IN MATHEMATICS: A PEDAGOGICAL APPROACH TO FOSTER METACOGNITION IN A COLLEGE MATHEMATICS CLASS

Traditional homework assignments in college-level math classes often pose challenges to students and instructors alike due to the time-consuming feedback process, penalties for mistakes, and lack of encouragement for correcting errors. To counter these issues, this project explores the development and implementation of self-grading in a college-level Calculus I class. By providing assignments with a clearly defined rubric, students grade their work alongside the instructor, compare their assessments, and identify areas for improvement. This structured process promotes reflective practices and metacognitive development.

The methodology follows three steps: assignment and rubric development, self-grading, and comparative analysis. Initially, a comprehensive rubric guides students, which gradually transitions into a student-made tool, fostering a sense of ownership. Students then engage in self-grading, utilizing the rubric as a benchmark and contributing to its refinement over time. Finally, students compare their assessments with the instructor's feedback, identifying disparities and refining their strategies. This iterative approach emphasizes feedback as a catalyst for academic growth.

This work investigates the effectiveness of self-grading on student learning outcomes, motivation, and metacognitive development. By blending traditional grading with student-led assessment and reflection, we aim to empower students to become active participants in their academic journey, contributing valuable insights into evolving pedagogical practices.

Board 10

## EBUKA OKPALUME
## CLAIRE HEUMASSE

**Research Mentor:** Chris Wolverton
Department of Biological Sciences

Our Lab focuses on understanding how plants grow and respond to gravity. Normally plants use tiny starch-filled structures to sense gravity, but some plants without these structures can still sense gravity somehow. We plan on understanding how these plants do this by knocking out genes involved in sensing gravity.

### CREATING DOUBLE MUTANTS USING RNA-SEQ TO STUDY GRAVITY PERCEPTION IN PLANTS

Plants rely on environmental signals to guide their growth and development, with gravity being one of the most consistent and influential factors. Normally, plants sense gravity through dense, starch-filled structures inside their cells, known as statoliths. However, starchless mutants, which lack these statoliths, still retain some ability to sense gravity, indicating the presence of additional gravity-sensing mechanisms.

In our study, we focused on uncovering these alternative mechanisms. We identified genes that show different expression levels in normal plants compared to starchless mutants. By examining knockout mutants in these genes, we discovered 14 mutants with a reduced response to gravity. To further explore this, we created double-mutants by crossing each of these 14 mutants with the starchless mutant. We then checked for starch presence by staining lateral root tips with Iodine.

We predict that these double mutants will exhibit an even weaker response to gravity than either single mutant alone. If this is the case, the genes we identified play a role in helping starchless plants sense gravity. This experiment aims to enhance our understanding of how plants perceive and respond to gravity, which could be important for growing plants in various environments, including space. Understanding these mechanisms could provide significant insights into plant biology and agriculture, particularly in optimizing growth conditions in different environments.



Board 11

## LILY REKOW

**Research Mentor:** Sean McCulloch
Department of Math and Computer Science

We designed a digital version of the board game Pastiche. All the physical elements like the tile, painting, and color cards are represented graphically. Then, we wrote an agent program to make moves in this digital game, so it can play against a human player. The program runs through possible options and takes the move that will result in the most amount of points.

### ARTIFICIAL INTELLIGENCE FOR MODERN BOARD GAMES

There exist a wide variety of programs to play popular games like chess and checkers. These programs frequently can play as well or better than a human. There are many newer games that do not have programs like this yet. We are developing a digital version of a board game called Pastiche. It is a game that involves placing tiles to obtain color cards with the goal of completing paintings that will earn points. Using the Java language and its built-in libraries, we have translated the card and tile elements of the game into a graphical interface that can be played between two players. The frame class regulates the game by having buttons that help move through phases of a turn like placing tiles and swapping colors. We have also designed an agent program to play the game intelligently against a human. The AI class makes moves that will focus on obtaining colors included in paintings in the hand to maximize the paintings it can complete. When choosing which tiles to place and where as well as what colors to swap, the program runs through each possible option and calculates what percentage of the paintings are completed in that scenario. These possible percentages are compared to find the highest percentage and make that move.

Board 12


## GABRIELLE H. PLUNKETT, TYLER WILLIARD, LOGAN FRAIRE, SIERRA SPEARS, EMMA G. FOSTER, DEVON HALEY, ALYSSA HEAD, MAYA M. MOORE, BRITTNEY PARKS & JASMYN ZIMMERMAN

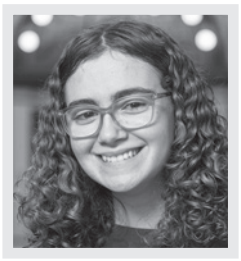
**Research Mentor:** Shala J. Hankison, Allison R. Litmer, and Eric J. Gangloff
Department of Biological Sciences











The ability to behaviorally maintain a stable body temperature (thermoregulation) is important for animals such as ectothermic lizards that are unable to internally produce their own body heat and therefore must rely on their surroundings. Maintaining a stable body temperature becomes challenging for lizards, such as the common wall lizard (Podarcis muralis), living in a city since the temperatures are often higher than in their natural habitat. We researched the factors associated with thermoregulatory decision-making in introduced populations of the wall lizards in Cincinnati, Ohio, USA. Such information will allow us to have a better understanding of how environmental factors associated with cities affect lizards' ability to maintain suitable body temperatures.


### WHICH FACTORS AFFECT THERMOREGULATORY DECISIONS IN COMMON WALL LIZARDS (PODARCIS MURALIS)?

The ability to effectively thermoregulate is important for ectotherms, such as the common wall lizard (Podarcis muralis), because their body temperature determines the rates of nearly all physiological processes. However, we lack understanding of which environmental factors affect thermoregulatory behaviors and how effective these lizards are at thermoregulating, especially in the hot urban habitat of Cincinnati, Ohio. Such data can inform our monitoring efforts of these introduced populations, including information on wall lizards' prime habitat, preferred weather conditions, and active times. Using infrared thermography (a thermal imaging camera), we conducted standardized surveys to track the body temperatures of active lizards every 30 minutes across their normal activity period (08:00 to 20:00) in multiple locations. We also measured wind speed, air temperature, humidity, solar radiation, and UV radiation while 3-D printed operative temperature models measured potential available temperatures throughout the activity period. Preliminary data from surveys conducted in 2023 indicate that wall lizards are highly effective thermoregulators; we will further assess this finding with data from an additional three surveys conducted in summer 2024. By analyzing the collected thermographic and environmental data, we can test the hypothesis that lizards' thermoregulatory behavior changes, alongside their ability to obtain an optimal body temperature under various environmental factors. Such data on thermoregulatory effectiveness, especially in an urban habitat, provides great insight into how wall lizards can thrive in cities and have the potential to expand their current range.

Board 13


## LOGAN MCFARLAND

**Research Mentor:** Nathan Rowley
Department of Environment and Sustainability



The use of drones is a growing platform in the world of mapping and monitoring the environment. Our research used a drone-mounted visible light sensor and laser scanner with 3d modeling abilities to map and analyze water and vegetation in the Delaware, Ohio area. For water mapping, we worked with multiple processing programs to determine where water will flow on the terrain and create underwater topography models, but preliminary data suggests that we should focus on vegetation analysis because our sensors are more suited for terrestrial applications. For vegetation mapping, we have begun investigating the use of our visible light sensor in conjunction with a thermal camera for harmful algal bloom predictions.


## UTILIZING UAVS FOR HYDROLOGIC AND ECOLOGICAL MAPPING

UAVs (Unoccupied Aerial Vehicles) are a growing platform in remote sensing and environmental science. Researchers use UAVs to map and monitor landscapes and their evolutions. Our 2024 summer research utilized a drone-mounted multispectral sensor (Micasense Dual Red-Edge) and LiDAR (DJI Zenmuse L1) sensor to explore mapping hydrology and ecology in the Delaware area. To identify our sensors' limitations, we collected data from a variety of sites including: the quad and nearby stream (Delaware Run) at Ohio Wesleyan University, a sloping area leading to a pond at the Methodist Theological School of Ohio (MTSO), several reservoirs managed by Delco Water, and the Delaware Hayes High School campus.

For our hydrologic mapping work, we processed LiDAR point clouds in DJI Terra Pro then created Digital Surface Models (DSMs) and Digital Terrain Models (DTMs) in ArcGIS Pro for watershed mapping. To model the complete watershed, bathymetric mapping – topography below the water surface at our pond and river study sites – was necessary. Our work showed that the Zenmuse L1 is extremely sensitive to water depth and water turbidity, thus yielding maximum depths of 0.4 m in clear water (e.g. , Delaware Run). To advance this work, we will attempt to acquire an additional LiDAR sensor that is calibrated for hydrologic purposes.

Our ecological mapping work includes the use of algae-specific multispectral indices (e.g., Alharbi, 2023) in conjunction with a thermal camera (DJI H20T, borrowed from DelCo) for algal bloom prediction modeling. Preliminary work indicates promising results from our Dual RedEdge sensor.




Board 14


## JASMYN D. ZIMMERMAN, DEVON HALEY, BRITTNEY PARKS, GABRIELLE H. PLUNKETT & TYLER WILLIARD

**Research Mentors:** Allison R. Litmer and Eric J. Gangloff
Department of Biological Sciences



Our study examines how the introduced common wall lizard, Podarcis muralis, thrives in a novel urban environment. We conducted population surveys for lizards in Columbus and Cincinnati, Ohio. We examined various aspects of the response to urban environments, such as testing for lead in lizard blood, comparing changes in gut bacteria, and quantifying energy use for survival and reproduction. By studying wall lizards, the G.L.A.R.E. Lab aims to gain insights into the spread of invasive species and the adaptation of animals to city life.


### STUDYING URBAN POPULATIONS OF THE COMMON WALL LIZARD (PODARCIS MURALIS)

Urbanization introduces disturbances such as habitat fragmentation and degradation, pollution, and warmer temperatures, which can significantly impact wildlife populations. While urbanization negatively impacts most animals, some appear to thrive. The current study investigates the common wall lizard, Podarcis muralis, as a model organism to understand how animals can succeed in urban environments. P. muralis was introduced to Cincinnati, Ohio in the 1950s, and has since established abundant populations. Our study utilized multiple approaches, including population monitoring, analyzing lizard blood for lead, quantifying energetics, and comparing fecal microbiomes in lizards occupying anthropogenic and natural environments in urban areas. Blood samples from urban populations revealed that P. muralis had lead levels deemed dangerous for animals, indicating significant exposure to pollutants. We collected fecal samples from anthropogenic and natural sites to quantify and compare P. muralis microbiomes. Additionally, future lab experiments are planned to measure digestion to gain a better understanding of performance and fitness in urban environments. Our findings highlight that despite the challenges of urbanization, such as high lead levels, P. muralis has established stable populations in Cincinnati. Continuing research into gut microbiome changes and energetics will allow us to further understand invasion biology and the adaptation of animals to urban settings.

Board 15


## STEPAN DOBRIANSKYI

**Research Mentor:** Chris Wolverton
Department of Biological Sciences


The goal of this project is to understand the gravitropic and phototropic response of WOX5 mutation since previous experiments showed that the mutant was less responsive to gravity. WOX5 mutant was found to be responsive to auxin (a hormone that makes the root tip bend away from the light), thus we performed various experiments with different concentrations of NAA (a synthetic auxin) to observe a change in the growth rate of the mutant vs the wild-type Arabidopsis thaliana plants. Mutants were placed from plain growth media to a growth media containing synthetic auxin to observe the growth rate of a plant over 24 hours. Performing various auxin treatments for this mutant will help us to understand whether auxin affects the gravitropic response of the WOX5 mutant.

## A MUTATION IN WOX5 SHOWS REDUCED GRAVITROPISM AND PHOTOTROPISM

AT3G11260 (WOX5) was identified as one of 124 genes of Arabidopsis thaliana in Dr. Wolverton's lab shows contrasting expression between wild type and starchless root tips during early gravitropic response. WOX5 is expressed in the quiescent center and is necessary for columella stem cell maintenance. Columella cells have starch-filled plastids that sediment upon root displacement and have been shown to be critical for gravity sensing. We tested the role of WOX5 in gravitropism by identifying a T-DNA insertional mutant (SALK_147644) and testing its phenotype. Mutants were allowed to grow for 4 days, then they were subjected to time lapse experiments involving rotation and free responses. Each time lapse experiment lasted 200 minutes with pictures being taken every 10 minutes. Time lapse experiments with WOX-5 mutants showed no significant difference from wild type in rotation response but were significantly less gravitropic in free response compared to wild-type (Col-0). The phototropism experiment was conducted to observe the responsiveness towards light of mutant (SALK_147644) and wild-type (COL-0) plants. To gather more accurate data, the plants were planted on the black membrane containing 1% agar and allowed to grow for 4 days. Then, they were subjected to the phototropism experiment with the light shining from one side of the plate. After 24 hours of the phototropism experiment, root tips of wild-type and mutant plants were measured. By conducting a student T-Test (p-value ≈ 0.0001), we found out a wild-type (COL-0) being more responsive towards light than mutant plants (SALK_147644C), indicating a potential role for WOX5 in response regulation for both phototropic and gravitropic growth.

Board 16


## EVAN LUCAS
## HALEIGH STOVER

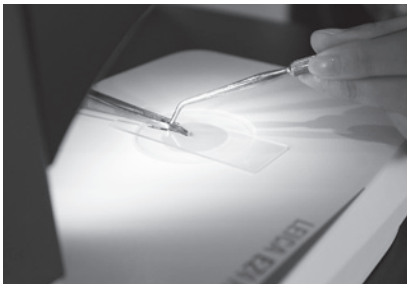
**Research Mentors:** Bethany Rudd and Kayce Tomcho
Department of Chemistry



The relationship between structure and function is integral to the study of biochemistry, meaning that if the structure of a protein is understood then its function can be modulated, and more targeted therapeutics can be developed. Our protein of interest is the glycine receptor (GlyR), which is found in the cell membrane and a complete picture of its structure is unknown. We believe a particular piece of this protein can penetrate the cell membrane. In this work, we used simple model systems of GlyR and the cell membrane to better understand the interactions between them, which will provide a more complete structural picture of the receptor.


## INTERACTIONS BETWEEN A PHOSPHATIDYLCHOLINE MODEL MEMBRANE AND POLY-ARGININE

Fully understanding the structure of proteins can eventually lead to the design and implementation of better therapeutics to treat diseases and disorders that are linked to a protein of interest. The glycine receptor (GlyR) is an integral membrane protein that facilitates inhibitory neurotransmission via the influx of chloride ions and has been linked to chronic pain and hereditary hyperekplexia. GlyR is a pentameric ligand-gated ion channel (pLGIC); each subunit consists of a large extracellular domain, four transmembrane helices, and intracellular loops. Of interest to our studies is the M3-M4 loop, a defining characteristic of the pLGIC family, located in the intracellular domain. Currently, it is unresolved in all available crystal structures and thus, its structure is unknown. Previous studies using cross-linking mass spectrometry (CX-MS) have shown that attaching a crosslinker to residues in the extracellular domain can interact with the intracellular loop which is outside the bounds of the crosslinking restraints leading to the hypothesis that the M3-M4 loop may be acting as a cell-penetrating peptide (CPP). Poly-arginine was selected for this study as arginine accounts for 10.4% of the amino acids in the M3-M4 loop, and is known to be able to penetrate the membrane. A Langmuir monolayer of the phospholipid dipalmitoylphosphatidylcholine (DPPC) was used as a simple model system of a cell membrane. The interactions between poly-arginine and the DPPC monolayer were observed and analyzed with surface pressure-area isotherms collected using a Langmuir trough. The isotherms collected show an expansion of the DPPC monolayer in the presence of poly-arginine. These results indicate that arginine is interacting with the DPPC, suggesting that these parts of the M3-M4 loop could act as a CPP.



Board 17


## WILLOW BRYN ROSSER

**Research Mentor:** Krystal Cashen
Department of Psychology



In 2023, changes in abortion access and discriminatory legislation targeting LGBTQ+ people were introduced across the United States. This study provides some insight into the perceived impact felt by LGBTQ+ people regarding this shifting political climate and examines how it has affected family-building decision-making across demographic groups. This research allows us to academically validate real-world issues and provides a framework to support LGBTQ+ individuals as they make family-building decisions, combating the many barriers that LGBTQ+ families face. Additionally, understanding these contextual forces can help us predict health outcomes and support the well-being of LGBTQ+ individuals and their families.


### IMPACT OF LEGISLATIVE CONTEXT ON LGBTQ+ FAMILY FORMATION DECISION MAKING BY SEXUAL AND GENDER IDENTITY

Discriminatory anti-LGBTQ+ legislation and changes in abortion access swept the United States in 2023 (ACLU, 2024); experiences of such discrimination vary across LGBTQ+ identity groups and have been correlated with differences in parenting desires and intentions (Riskind & Tornello, 2017). Research with current LGBTQ+ parent families found that these legislative changes impacted their parenting behaviors (Goldberg, 2023). Our study aimed to build on this by examining how LGBTQ+ people in the United States were adjusting their plans for future parenthood and testing for group differences by sexual and gender identity. Participants (N=374, Mage=30.32) identified as LGBTQ+ and were not current parents. Data was collected using an online survey that measured parenting desires, intentions, and perceived impact of anti-LGBTQ+/ anti-abortion legislation with Likert scale items. ANOVA and post hoc analyses revealed that cisgender men reported significantly lower impact of anti-LGBTQ+ legislation (M=1.87, SD=1.18) than binary trans (M=2.75, SD=1.44, p=.001) and nonbinary/gender nonconforming people (M=2.46, SD=1.37, p=.013), as well as significantly lower impact of anti-abortion legislation (M=1.47, SD=0.91) than cisgender women (M=2.31, SD=1.42, p=<.001) and nonbinary/gender nonconforming people (M=2.17, SD=1.52, p=.004). Independent samples t-tests revealed that plurisexual participants reported a higher impact of anti-abortion legislation (M=2.19, SD=1.45) than monosexual participants (M=1.75, SD=1.18), t(285.42)=-3.14, p=.002. Implications for understanding differences across sexual and gender identity groups will be discussed.

Board 18


## MANNAT SIKAND
## MELAYNA RIOS

**Research Mentor:** Kira Bailey
Department of Psychology,
Neuroscience Program



This study explores how playing video games impacts our ability to control, coordinate, and sequence our thoughts and actions in accordance with goals, also known as cognitive control. Participants were divided into high and low gamers and then performed a task to measure cognitive control while their brain activity was monitored. Low gamers returned for another session where they underwent exposure to a strategy or first-person shooter game before completing the task again. Based on previous research, we anticipate a reduction in cognitive control for high gamers and low gamers that underwent exposure to the first-person shooter video game.


### ARE YOU GAME? EXAMINING THE EFFECTS OF VIDEO GAMES ON COGNITION

Following prior research (Rice et al., 2021; Bailey et al., 2010), this study examined the relationship between video games and the neural correlates of cognitive control using event-related potentials (ERPs). Cognitive control refers to the ability to regulate, coordinate, and sequence thoughts and actions in accordance with internally maintained goals. The Dual Mechanisms of Control theory posits that cognitive control is composed of two types of control: proactive and reactive. Proactive control involves the selection and maintenance of goal-relevant information before the task, as observed by the N2 and slow-wave ERP components. In contrast, reactive control is activated during the task as needed, as observed by the SP ERP component. Notably, proactive control recruits significantly more resources, but can result in fewer errors. All participants completed two counting-Stroop tasks: one with reward in the form of visual and auditory feedback, and one without. We hypothesized that high gamers (> 5 hours per week) would depict a reduction in proactive control, as indicated by smaller amplitude of the N2 and slow wave ERP components compared to low gamers. The reward version of the task was added to determine if this would offset the negative association between gaming experience and proactive control. Participants categorized as low-gamers (≤ 5 hours per week) were invited to a second session, where they were randomly assigned to play either Unreal Tournament (UT), a first-person shooter game, or Starcraft, a strategy game, for thirty minutes before completing the same tasks with ERPs. We hypothesized that participants assigned to UT would exhibit a decline in proactive control in the non-reward version of the Stroop task, but not in the reward version.

Board 19

## MELAYNA RIOS
## MANNAT SIKAND

**Research Mentor:** Kira Bailey
Department of Psychology,
Neuroscience Program

This study examines how specific personality traits are related to role selection in the popular game, League of Legends. We gather data through a survey questionnaire, where participants undergo tests including a personality test. This research is crucial as it helps us understand how personality influences game choices, broadening our knowledge of how players' personalities influence their gameplay.

### BEHIND THE MASK: HOW PERSONALITY SHAPES ROLE CHOICES IN LEAGUE OF LEGENDS

This study examines the relationship between role selection in the video game League of Legends, which had an estimated 180 million monthly active players in 2022, and personality. Personality is defined as the pattern of behaviors that people present in their relationships with others in different contexts of life that tend to become stable over time (Roberts & Mroczek, 2008). To measure personality the study uses HEXACO-PI-R, which assesses specific personality dimensions—openness to experience, conscientiousness, agreeableness, extraversion, honesty-humility, and emotionality. Participants are asked to fill in a survey questionnaire collecting basic demographic data, general video game information, the HEXACO-PI-R (60 item personality test), an attention measure, and an IGD (Internet Gaming Disorder) measure. Overall the findings aim to shed light on the influence of psychological factors on behavior and decision making within a popular video game.

Board 20

## PARTHEY VASANI

**Research Mentor:** Yunhua Ding
Department of Physics and Astronomy

This project focuses on testing foundational spacetime symmetries, which state that the laws of physics stay the same upon flipping charge, inverting space, and reversing time, or upon changing velocity and orientation of the system. We identified possible symmetry-violating signals by studying how a neutron's spin motion would change if such symmetries were allowed to be broken in nature. Using existing experimental data on the spin motion of neutrons, we constrained the sizes of those symmetry-violating signals.

### TESTING LORENTZ AND CPT SYMMETRIES WITH NEUTRONS

Lorentz and CPT symmetries are foundational symmetries of our current best theories describing nature. The two symmetries state that the laws of physics are invariant under Lorentz transformation or combined transformations of charge conjugation (C), parity inversion (P), and time reversal (T). However, tiny violations of these symmetries could occur in a more fundamental theory. This project investigated possible signals for Lorentz and CPT violation arising from experiments searching for a nonzero electric dipole moment for neutrons (nEDM). We started with the free Dirac equation and obtained the free-particle solutions. We then extracted operators for Lorentz and CPT violation from the Standard-Model Extension framework and applied perturbation theory to derive the energy modifications for spin-up and spin-down neutrons due to Lorentz and CPT violation. The contributions to the spin precession frequency of a neutron were then obtained by taking the energy differences between different spin states. To transform the results from the laboratory frame to the Sun-centered frame, we applied a general rotation matrix that involves the Earth's sidereal frequency and the colatitude of the laboratory. We found that any Lorentz- and CPT-violating signals would oscillate with the Earth's sidereal frequency. Finally, we used existing bounds of nEDMs reported by experiments and constrained the relevant coefficients for Lorentz and CPT violation

Board 21

## AUGUST LEMERT

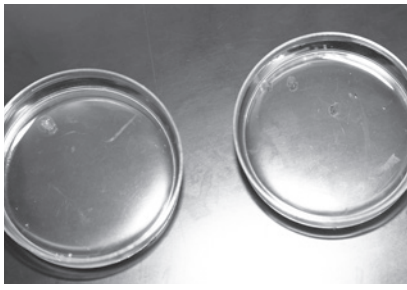
**Research Mentor:** Chris Wolverton
Department of Biological Sciences

Gravity is an essential component affecting the formation of root tips in plants. By examining genetically modified seedling lines of a plant called Arabidopsis thaliana, types of protein called cysteine endopeptidases can be questioned for their role in affecting its root tip growth. Using the additional variable of gravity stimulation, the lengths and sizes of root tip cells were measured and data was analyzed to see the differences. This research serves a purpose in providing more explanations on how gravity can be used to affect plant and agriculture growth and provides further studies into the genome of the model organism.

### EVALUATION OF THE EFFECTS ON CYSTEINE ENDOPEPTIDASES IN THE ARABIDOPSIS THALIANA GROWTH RATE WITH SIMULATED GRAVITROPIC CONDITIONS

Previous research in our lab identified a cysteine endopeptidase (CEP3) to show contrasting expression during gravity responses between wild-type and starchless roots in plants. To further explore the contribution of this gene and a closely related one affected by gravity, two mutants of the common model organism Arabidopsis thaliana were chosen to examine the effects of gravity on their meristem cell size, growth response, and gravity responses. The two genes AT3G48350 (CEP3) and AT3G48340 (CEP2) were manipulated through SALK mutant lines using T-DNA inserts to remove the selection from the genome; SALK_016791C and SALK_079519C respectively. These mutant lines were confirmed to be homozygous using PCR and gel electrophoresis before they were subjected to gravity stimulation using free rotation and controlled, continuous rotation to assess gravitropism response using the root tip angle. The roots were then stained with propidium iodide to highlight cell walls and meristem cell sizes were examined and recorded on the various mutant lines using a fluorescent microscope. The data was evaluated using ImageJ software and was compared with the wild-type Col-0 line. The CEP3 mutant SALK_016791 showed a significantly reduced gravity response for both free response and continuous rotation experiments relative to the wild type, indicating a role for this gene in gravity signaling or response. Additionally, the SALK_016791 mutant showed significant results in comparison to the Col-0 line during a growth rate period of 24 hours. Both lines will be evaluated further and compared when germination conditions are further improved. Additionally, the experimental data will be expanded upon in the future using a double mutant cross as another experimental object for observation. Results will be shared when evaluated.



Board 22


## NICHOLAS MANKOWSKI

**Research Mentor:** Hanliang Guo
Department of Math and Computer Science



Looking at different driving tendencies and how they affect the formation of traffic jams can provide a meaningful insight for safe driving habits. By running mathematical simulations of traffic, we found that an increased driver reaction time results in more traffic forming. Similarly, we found that aggressive driving tends to result in minimal gain in average velocity but a significantly increased risk to people on the road.


## UNDERSTANDING TRAFFIC JAMS AND LANE CHANGING

Traffic congestion with no apparent cause, often called a phantom traffic jam, is a frustrating reality for people on the road. These sorts of jams cost drivers time and pose an increased risk on the roadways. By studying this form of traffic and how different driving tendencies affect their formation, we aim to provide helpful insights into safer and more efficient driving habits. Using a velocity equation that maps a car's headway to its velocity, we were able to analyze two different driving parameters and how they affect road safety and flow rate. More specifically, we were able to analyze how a finite reaction time impacts the stability of a traffic system as well as the consequences of aggressive driving. Our results showed that in a single lane traffic scenario, a small reaction time led to system stability and overall similar behavior to zero reaction time. Increasing the reaction time past a certain threshold resulted in the system becoming unstable, ultimately creating traffic jams. In a two lane traffic system, we found that aggressive driving tended to result in a minimal increase in overall displacement (<2%) compared to a control driver. Similarly, we found that aggressive driving significantly increased the number of lane changes in both non-aggressive and aggressive drivers, resulting in less safe driving conditions. Our results suggest that an increase in driver aggressiveness and reaction time can lead to the formation of traffic jams, ultimately leading to longer travel times and decreased road safety.

Board 23

## COOPER CHRISTIE

**Research Mentor:** Chris Wolverton
Department of Biological Sciences

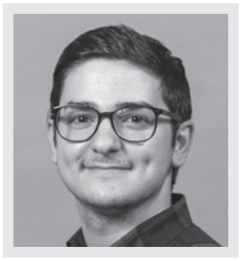
How are plant roots able to know which direction they should grow? To study this phenomena, we rotate young plants and measure the change in the angle of the root tip over time. Each of these experiments are hours long, and a large amount of data is required to make solid conclusions. Due to this, my project was to write programs which would better automate the spinning and photo capturing of root tips, as well as using computer vision techniques to calculate root tip angles.

### COMPUTER VISION FOR ROOT TIP ANALYSIS

Starch sedimentation is known to inform the plant-gravity response. Despite this, starchless Arabidopsis mutants still possess a level of gravity perception. In the effort to identify other mechanisms of gravity response, it is necessary to make comparable measurements of gravity responsiveness in different mutant lines. This is accomplished by rotating the seedling to a standardized degree and measuring the change in the angle of the root tip as it grows over time. Making these measurements for a large sample size is laborious and prone to error, leading to the creation of an automated system using a motor and a camera to collect photos for a period of time after rotation. However, angle measurements made from these images were still taken manually. To increase efficiency and lower bias, a program was written to automatically isolate root tips from experimental photographs and take angle measurements. The machine-calculated angles had an average difference of 6.22 degrees from manual measurements, with a standard deviation of 6.80. This system was also used to develop a new experimental setup which accounts for the variable responsiveness at different root tip angles. The angle of the root tip is measured repeatedly during the experiment, allowing the motor to be rotated to maintain a 90 degree angle as the root grows. Responsiveness is then found from the total rotation required over the experimental timeline. We are applying this new software to the analysis of mutants in genes currently under investigation for their role in gravity sensing or response regulation.

Board 24

## GIORGI BEDIASHVILI



**Research Mentor:** Nick Dietrich
Data Analytics Program

Which factors are most influential in determining the American public's support for international interventions? Using a relative choice survey method, the research project identified the key determinants of support and their relative importance to the American public's decision-making process. We found that Americans were most likely to rate the possible threat to U.S. national security, attackers' access to nuclear weapons, and potential human rights abuses as the most important factors.

### DETERMINANTS OF SUPPORT FOR INTERNATIONAL INTERVENTION: EVIDENCE FROM A RELATIVE CHOICE SURVEY OF A REPRESENTATIVE SAMPLE OF AMERICANS

Which factors are most influential in determining the American public's support for international interventions? The U.S. government considers public opinion when deciding whether to intervene in international conflicts through humanitarian, economic, and/or military assistance. Existing research suggests that particular features of the conflict – like whether the countries involved are democracies, or the perceived cost of intervening – influence public support for intervention. A pervasive weakness of existing literature, however, is the inability to draw conclusions about the relative importance of different determinants of support. Using a Max-Diff analysis of a relative choice survey of a representative sample of Americans, we ranked 21 different features of international conflict in order of importance. Our findings indicate that across different demographic groups, the most important determinant of support was the possible threat to U.S. national security and attackers' access to nuclear weapons. Potential human rights abuses and the attacker's history of human rights violations were also important factors in our sample. At the same time, the possible deployment of U.S. troops and either major political party official's support for intervention were relatively less important for respondents.

Board 25

## ASHLEY HAYWARD

**Research Mentor:** Jeffery Chancellor
Louisiana State University,
Department of Physics and Astronomy

When sending astronauts into space, one type of radiation that needs to be understood is galactic cosmic rays, which are high-energy, heavy particles. Interactions between this type of radiation and thick targets, such as those used for shielding, present a significant challenge for data analysis. My goal for the summer was to create a code to approach this challenge analytically, by comparing the calculated/expected energy deposition with the experimental energy deposition in a number of detectors.

### DEVELOPMENT OF ANALYTICAL FRAMEWORK FOR DETERMINING THICK TARGET CHARGE-CHANGING CROSS-SECTIONS

This research focuses on the development and application of advanced analytical tools to determine thick target cross-sections from experimental data collected at the NASA Space Radiation Laboratory (NSRL). Accurate cross-section measurements are crucial for understanding the interactions between cosmic rays and various materials, which has significant implications for space exploration. The NSRL provides a unique environment for conducting experiments that replicate the exposure to cosmic radiation encountered in space. However, interactions between high-energy particles and thick targets present a significant challenge for data analysis. To address these challenges, we leverage the ROOT framework, an object-oriented data analysis platform widely used in high-energy physics. ROOT's tools for statistical analysis, histogramming, and data visualization are ideal for analyzing the intricate datasets produced at the NSRL.

Our approach involves developing custom scripts and modules within the ROOT environment to automate the calibration and cross-section calculation processes. The modular nature of ROOT allows for the continuous refinement of our methods. Preliminary results demonstrate that our ROOT-based analytical tools significantly improve the precision of thick target cross-section determinations, offering new insights into the behavior of cosmic rays in various materials. This research not only contributes to a deeper understanding of space radiation interactions but also supports the design of more effective shielding techniques for future space missions, ensuring that we can better protect astronauts and equipment from the hazards of cosmic radiation.

Board 26

## AUBREY GERHARDT

**Research Mentor:** Marcus Smolka and Mateusz Wagner; Weill Institute for Cell and Molecular Biology, Cornell University, Ithaca, NY

DNA replication is essential for organisms to survive, playing a role in cell division and facilitating tissue growth and repair. Protein machinery, known as the replisome, carries out DNA replication, however, it may face obstacles that can negatively impact this process. These barriers have many causes such as environmental factors or chemotherapeutic drugs used in anticancer therapies. Our goal is to investigate how these proteins may vary in response to obstacles on the DNA. To do this, we developed a sensitive approach to label nearby proteins so we can explore the composition of the replisome and study how the composition may change when there are obstacles hindering DNA replication.

### PROTEOMIC EXPLORATION OF THE EUKARYOTIC REPLISOME

DNA replication is an essential process carried out by a protein machinery known as the replisome. The replisome encounters many obstacles that may negatively impact the fidelity of the replication process and genome stability. How cells maintain the integrity of stressed replication forks is not completely understood. Our objective is to study the composition of the replisome using proteomic approaches and identify transiently associating proteins that may reveal novel mechanisms for protecting fork integrity. We have generated three new constructs of PCNA and biotin ligase system (also known as TurboID) for proximity labeling of both core replisome proteins and those transiently bound to the replisome. These constructs consist of different combinations of PCNA fused to TurboID, with eGFP and/or a long flexible linker in between to increase the range of proximity labeling. Vectors encoding these constructs were transfected into human cell lines and biotin was added for nearby proteins to be biotinylated. Western blotting confirmed the biotinylation of proteins and immunofluorescence was applied to verify the localization of PCNA constructs to replication forks. To identify replisome-associated proteins and test which constructs enable more efficient protein biotinylation, streptavidin pulldowns were analyzed by mass spectrometry. Results from these experiments help us gain a better understanding of the replisome composition. Future work may use genotoxins to cause fork stalling or breaks to study the mechanisms and replisome composition changes during fork remodeling, as well as focusing on the role of particular proteins identified in the proximity labeling experiments.

Board 27

## CHASE ELLIS

**Research Mentor:** Ieva Roznere
Watters Aquatic Conservation Center
and Ohio State University

Freshwater mussels are one the most endangered group of animals in North America due to habitat destruction, over hunting, and difficulties reproducing. In the wild, mussels require a host fish for their larvae to parasitize and grow but a lot is unknown about this interaction for many species. In vitro propagation allows us to bypass that part of the life cycle and reproduce mussels more successfully. This study compares two different forms of media used during this process.

### COMPARISON OF MEDIA FOR IN VITRO PROPAGATION OF FRESHWATER MUSSEL LAMPSILIS SILIQUOIDEA

Freshwater mussels (Unionidae) are the most endangered group of animals in North America. Propagation is a conservation technique that has the potential to restore declining populations. Although freshwater mussels have a parasitic life stage and require a host fish to transform from the larval to the juvenile stage, in vitro propagation bypasses the need for a host fish. M199 culture media has been successfully used to transform the larvae, called glochidia, from most freshwater mussel species, but L-15 has recently been discovered to work for species that were previously difficult to transform. The objective of this study was to determine whether the use of M199 or L-15 media results in higher transformation rates for in vitro propagation of Lampsilis siliquoidea (Fatmucket). Glochidia were extracted from the gills of a gravid female L. siliquoidea and cultured in Petri dishes that contained either M199 or L-15 media. After 15 days, the media were diluted with water and observed for 24 hours before transfer to a primary rearing system for grow-out. Live glochidia were counted when first put into Petri dishes, before dilution on the 15th day to observe survival rate, and post-dilution to observe final transformation rate. No significant difference in survival rates pre-dilution was observed between the two media types. However, transformation rates post-dilution were significantly higher in glochidia cultured in the M199 media. The results from this study suggest that M199 media may still be the best media type to transform glochidia from certain species.

Board 28

## CHLOE SULLIVAN

**Research Mentor:** Travis D. Carney[1] and Halyna R. Shcherbata[2]
[1]Mount Desert Island Biological Laboratory
[2]Mount Desert Island Biological Laboratory, Hannover Medical School

The stem cell niche is a critical environment that provides signals to stem cells, prompting them to divide and mature. This process is vital for maintaining health and reproductive success in both humans and animals, as mutations can disrupt the niche's signaling abilities and can lead to serious health issues, including a lower quality of life and potentially cancer or tumors. By experimenting with mutations and observing the stem cell niche in fruit fly testes (the hub), scientists gain a better understanding of the genetic mechanisms and interactions that maintain the stem cell niche and ultimately develop better treatment for patients.

### GENETIC MECHANISMS REGULATING STEM CELL NICHE MAINTENANCE

The stem cell niche is a specialized microenvironment that provides optimal conditions for stem cell proliferation and differentiation. These niches are present in various organs and systems and are crucial for maintaining proper bodily functions. Disruptions to these niches, such as physical displacement, can impair their ability to support stem cell development and may ultimately lead to the loss of stem cells of that niche. In Drosophila melanogaster testes, the hub serves as the stem cell niche and plays a vital role in signaling to germline stem cells (GSCs) to proliferate and initiate spermatogenesis. Hub displacement may disrupt these signals, potentially leading to altered GSC dynamics and infertility. This study investigates the genetic mechanisms underlying proper hub localization in Drosophila and its effects on GSC maintenance. By utilizing specific mutant alleles, informed by prior lab research, the genetic interactions involved in hub attachment can be better understood. Discussion will cover the genetic assays conducted and how the findings enhance researchers' understanding of niche maintenance, along with potential future research directions.

Board 29

## EL HEALEY

**Research Mentor:** Janeen Leon,
David Kaelbur, and Tykie Theofilos
MetroHealth

The goal of this study was to get parents to quit smoking and see if they are more motivated when aware of there being evidence of second hand smoke in their child's blood. As an in-person recruiter, I worked in the pediatric clinic five days a week screening every patient there for annual check-ups, specialty appointments, or urgent care visits. If a parent-child pair was eligible, I would obtain informed consent and go through the baseline survey with them thus enrolling them in the study.

### IN-PERSON RECRUITMENT FOR ABC QUIT SMOKING CESSATION STUDY IN PEDIATRIC CLINICS

Smoking is the leading cause of preventable deaths in the United States contributing to 1 in 5 deaths and 1 in 3 cancers. More than 34 million Americans smoke (14% of the adult US population), leading to 58 million nonsmokers being exposed to secondhand smoke. While smoking cessation programs have been implemented in some clinics, parent smokers are an underserved population. It has been shown that when parent smokers quit, their life expectancy increases by 10 years, tobacco-caused poor pregnancy outcomes are eliminated, children's exposure to secondhand smoke drops immensely or is eliminated, and children are 4 times less likely to become smokers themselves. We aim to create more smoke-free families by motivating parents to quit through their child(ren)'s well-being. To do this, we use a metabolic blood test called cotinine, a measure of a person's exposure to nicotine through tobacco smoke. The safe level of this test is zero. MetroHealth pediatric clinics were chosen due to high patient diversity and trust. Parents of children under 13 can be recruited if they smoked a combustible tobacco product in the last week. Parents are randomized into the control or intervention arm, with initial and follow-up surveys a year apart. The intervention arm has access to free nicotine replacement therapy (patches, lozenges, gum, and Chantix medication), biocounseling, and, if their child had blood taken recently or will in the next year, a cotinine test that is discussed with the biocounselor; the control arm only has access to nicotine replacement therapy. This study is in its infancy, but we found that in-person recruitment is more effective than phone recruitment.

Board 30

## EMMET RITCHIE

**Research Mentor:**
Steve Tuhela-Reuning
OTC Industrial Technologies

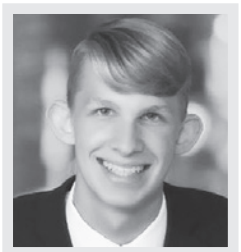
While interning at OTC Industrial Technologies this summer, I created a new version of a PowerShell script in order to ensure synchronization between the local code repository on each team member's computer and Azure DevOps, the service used to store and organize information and code for the ManageAir software. In order to manage large amounts of data efficiently, I utilized a database management system called SQL Server in order to easily identify the files that needed to be recreated. This project was highly important for the ManageAir team to ensure organization and automate a task that would take days on end to complete by hand..

### USING SQL SERVER AND POWERSHELL SCRIPTING TO SYNCHRONIZE A LOCAL CODE REPOSITORY WITH AZURE DEVOPS

When working on a large scale software project utilizing Azure DevOps, oftentimes mismatches can occur between files in the local code repository and the work items created and stored using Azure DevOps. When projects are moved in Azure or the repository, they can manifest as deleted or duplicated files, causing Azure DevOps and the local code repository to become out of sync. While working with the ManageAir development team at OTC Industrial Technologies this summer, I was tasked with creating a new version of a previously inefficient PowerShell script that was meant to run regularly in order to clear up any discrepancies between the work items in Azure DevOps and the files in the local code repository. Utilizing SQL Server to manage the data from Azure and the local repository, I used tables, complex queries, and common table expressions to create stored procedures that could be called from a PowerShell script. The PowerShell script could then use the information from SQL Server to create new work items in Azure DevOps with the correct information and in the correct location. The files in the code repository and the work items in Azure DevOps added up to well over 50,000 files combined, so making sure that the functions inside of the PowerShell script and the SQL procedures worked quickly and efficiently was a top priority. This script has a large impact for the ManageAir team, taking the amount of time to complete this task from 25 hours down to below 8 hours, allowing the script to be run every night to ensure synchronization between the local code repository and Azure DevOps.

Board 31

## IAN SANDER



**Research Mentors:** Ahmad El Hellani, Marielle C. Brinkman, and Theodore Wagener
The Ohio State University Tobacco Center of Regulatory Science

Assess the nicotine dimensions and device design of the most popular e-cigarette brands. Device design assessment were conducted including pressure drop, coil resistance, and battery properties. The e-liquids from each product were analyzed for nicotine concentration, form, and isomer using gas chromatography coupled with mass spectrometry, pH measurement, and liquid chromatography coupled with mass spectrometry, respectively. The results of this research will lead to future studies that manipulate nicotine dimensions to assess their effects on product appeal, behavior, and toxicity in youth and adults and in turn, provide evidence to inform the FDA's regulation of e-cigarettes.

### FROM DESIGN TO NICOTINE DELIVERY: A COMPREHENSIVE CHARACTERIZATION OF POPULARLY USED E-CIGARETTES

E-cigarettes are the most used tobacco product among adolescents and young adults. While likely less harmful than conventional cigarettes, the e-liquids within e-cigarettes contain varying amounts of nicotine, flavoring chemicals, humectants, toxicants, inorganics, and carcinogens and are associated with increased risk of coughing, wheezing, and respiratory inflammation. The rising popularity of e-cigarettes among smokers and non-smokers, especially among youth, necessitates an investigation into their toxicity and health effects to inform the US Food and Drug Administration on how to effectively regulate these products. Further examination is needed to understand the characteristics of e-cigarettes, especially nicotine dimensions (concentration, form, and isomer) and device design characteristics that affect e-cigarette addictiveness and toxicity. Device design assessments were conducted including pressure drop, coil resistance, and battery properties in addition to nicotine dimension analyses of the e-liquids to fully characterize these popular tobacco products. The results of this research will lead to future studies that manipulate nicotine product dimensions to observe effects on product appeal, behavior, and toxicity in youth and adults and, in turn, provide evidence to inform the FDA's regulation of e-cigarettes. This includes product standards that will help dissuade first-time users and youth from initiating e-cigarette use, while still appealing as a reduced-risk alternative for current smokers.

Board 32

## SPENCER YATES

**Research Mentor:** Stanley Perlman, Noah Schuster, and Lu Tan
University of Iowa

Middle east respiratory syndrome coronavirus has an accessory protein called open reading frame 5 (ORF5). The overall function and structure of ORF5 is not well understood. This project works to determine the potential interactions ORF5 has with the immune system and the theoretical protein structure of ORF5. We found that ORF5 may be a transmembrane protein that acts as an immune antagonist.

### A PRELIMINARY CHARACTERIZATION OF THE ORF5 PROTEIN FOUND WITHIN MIDDLE EAST RESPIRATORY SYNDROME CORONAVIRUS

In the genomes of all coronaviruses (CoVs), there exists multiple genes that encode for unique accessory proteins. Found residing within Middle East respiratory syndrome CoV (MERS-CoV) is open reading frame 5 (ORF5), which encodes for an accessory protein that has gone largely undescribed. We present initial findings that indicate the ORF5 protein contains a disordered N-terminal region, followed by a distinct three-helical transmembrane bundle, and lastly a partially structured C-terminal domain. By comparing ORF5 sequences found within other related CoVs, we uncovered a conserved stretch of seven residues at the C-terminal end. A phylogenetic tree identified three major clades, independent of host or geographic origin. In terms of its function, our work suggests the ORF5 protein is a potential innate immune antagonist. Collectively, this work describes the ORF5 protein as a diverse membrane-associated protein but is likely to be serving the role as an innate immune antagonist to enhance pathogenicity.

Board 33

## INESH TICKOO

Allegis Group

This summer, I interned as a Business Intelligence Developer at Allegis Group, where I worked on developing and improving data dashboards and reports using Tableau. My project focused on creating real-time visualizations to help track key performance indicators, making it easier for the company to monitor and evaluate their new hire onboarding process. This experience allowed me to apply my classroom knowledge to real-world scenarios and gain valuable insights into data analytics and its practical applications in business.

### ENHANCING BUSINESS INTELLIGENCE WITH REAL-TIME DATA ANALYTICS: AN INTERNSHIP EXPERIENCE AT ALLEGIS GROUP

During my internship at Allegis Group, I undertook a project aimed at enhancing the company's business intelligence capabilities through real-time data analytics. Utilizing Tableau, I developed reports and dashboards that provided visibility into key performance indicators (KPIs) for the new hire onboarding process. These visualizations enabled HR teams to track and evaluate employee onboarding experiences more effectively. Additionally, I designed, monitored, and maintained ETL (extract-transform-load) pipelines using Matillion and Tableau Prep Builder, which ensured continuous data availability and reduced downtime. By identifying and debugging data discrepancies, I improved data processing efficiency and accuracy. The project also involved hosting daily Agile standup meetings to facilitate cross-functional collaboration and communication between developers, analysts, product owners, and stakeholders. This experience provided me with a comprehensive understanding of business intelligence, data analytics, and the importance of real-time data in strategic decision-making. Furthermore, I gained valuable insights into the practical applications of data visualization tools and techniques, and how they can drive efficiency and informed decision-making in a corporate setting. This internship has equipped me with the skills and knowledge necessary to contribute effectively to future projects in the field of business intelligence.

Board 34

## JOSEPHINE STARK

**Research Mentors:** Arundhati Kavoor, Rylan R. Watkins, and Karin Musier-Forsyth
The Ohio State University, Department of Chemistry and Biochemistry and Center for RNA Biology

Trypanosoma brucei is the parasite that causes African Sleeping Sickness. Our lab has found a protein previously described as a "non-catalytic scaffolding protein," surprisingly has deacylating activity. Because this is new behavior, the active site of the protein is unknown. This summer, we characterized the protein by creating truncation mutants, to asses the necessity of each domain in the reaction. With this information on MCP1, future studies may lead to the development of therapeutic treatments for African Sleeping Sickness.

### CHARACTERIZATION OF TRYPANOSOMA BRUCEI MCP1

Aminoacyl-tRNA synthetases (ARS) are enzymes that complete the aminoacylation reaction, attaching an amino acid to its cognate tRNA. Trypanosoma brucei (Tb) encodes several ARS species that have shown association in a multi-tRNA synthetase complex (MSC). The MusierForsyth lab has recently shown that within the Tb MSC, MCP1 (MSC protein 1), a hypothesized noncatalytic scaffolding protein, surprisingly deacylated charged Ala-tRNA$^{Ala}$ and mis-charged AlatRNA$^{Pro}$ (Anna Vradi and KMF, unpublished data). The active site of MCP1 is unknown. We conducted a study to determine which domain(s) are responsible for catalysis. Three domains were identified using an Alphafold prediction and bioinformatics analysis: a GST-like domain, an alpha helical linker, and a predicted tRNA-binding domain (TRBD). Truncation mutants were created by removing (Δ) domains: ΔGST, ΔGST +Δ α Helix, ΔTRBD, ΔTRBD + Δ α Helix. Mutant plasmids were created using site-mediated ligase independent mutagenesis (SLIM) and transformed into Rosetta(DE3) E. coli cells. The His6-tagged proteins were purified using affinity chromatography ($Ni^{2+}$ resin). Tb tRNA$^{Ala}$ was prepared by in vitro transcription using T7 RNA polymerase. The tRNAAla was charged with tritiated Alanine ([$^{3}$H]-Ala). Deacylation activity of the wild-type MCP1 and all mutants was monitored and quantified using scintillation counting. Initial results revealed all three domains contributed to deacylation activity. Deletion of TRBD abolishes deacylation activity, and although the GST-like domain is not essential, its deletion significantly reduces the deacylation rate. Future studies may explore MCP1 as a new therapeutic target against the Tb infection.

Board 35

## RAAZIA AAMIR

**Research Mentor:** Wolfgang Windl
Institute for Materials and Manufacturing Research at Ohio State University

It is a research project funded by Intel that aims to understand what metal creates the best contact with 2d material (Molybdenum Disulfide) within a transistor. This will not only increase the transistor's speed but also its longevity. All the metal and Molybdenum Disulfide contacts made were computational simulations in VASP software.

### OPTIMIZING TRADITIONAL SILICON-BASED TRANSISTORS

Traditional silicon-based transistors reduce performance time by decreasing channel size; this limits how fast a transistor can be. Fortunately, the discovery of 2D materials, specifically Molybdenum disulfide (MoS2), holds great promise. They are attractive in Field Effect Transistors (FETs) due to their ultra-small size and thickness, which can reduce scattering between electrons in the transistor channel. Introducing a layer of MoS2 on top of the silicon channel between two metal contacts (source/drain) can result in a faster transistor. The introduction of MoS2 creates a need to study the metal—MoS2 contact. The most convenient method to study the contacts is by creating atomic simulations in the Vienna Ab initio Simulation Package (VASP) software. Analyzing the output from these simulations can confirm all activity, such as attraction, repulsion, or chemical reaction, between the atomic layers of the metal and MoS2. Preliminary results and theories from previous studies suggest that a repulsive interaction between metal and MoS2 possibly results in the most optimal Field Effect Transistor.

Board 36

## KELSEA COOPER

**Research Mentors:** Brittney Keller-Hamilton
The Ohio State University Tobacco Center of Regulatory Science

Nicotine Pouches, like Zyn or ON!, are a new tobacco product that allow users to get their nicotine fix without exposing them to as many tobacco-related harms. While nicotine pouches might pose a public health threat by exposing young people to nicotine, they also present a potential harm reduction benefit for smokers or smokeless tobacco (dip, chew, moist snuff) users who reduce their health risks by successfully switching to nicotine pouches. There is very little data on how people actually use nicotine pouches, however. The goal of my project was to learn how people use nicotine pouches in the real world to inform clinical trials investigating switching from cigarettes or SLT to nicotine pouches.

### FIGHTING GRAVITY: ORAL NICOTINE POUCH TOPOGRAPHY IN REGULAR USERS

One of the newest nicotine products to hit the United States market is Oral Nicotine Pouches (ONPs). ONPs are small pouches that come in a variety of flavors and nicotine concentrations, and they deliver nicotine to the user following placement between the lip and gum. What makes ONPs different from smokeless tobacco (SLT) products is that ONPs do not contain any tobacco leaf. Due to the omission of tobacco leaf, ONPs present an opportunity for smokers and SLT users to satisfy their nicotine cravings while reducing their exposure to tobacco-related harms. There is little data on how ONPs are used, however. Understanding typical ONP usage (i.e., “ONP use topography”) is necessary to help adults successfully transition from more harmful tobacco products to ONPs. To describe ONP use topography, virtual focus groups were conducted. At the beginning of the focus group, participants were asked to put in an ONP, so their typical use topographies were observed and recorded by notetakers. In addition, focus groups were recorded, transcribed, and analyzed qualitatively. Currently, 13 participants have completed virtual focus groups. Nearly every (11/13) participant reported, and were observed, using ONPs in the lower lip rather than in the upper lip as manufacturers recommend. Additionally, participants have also reported using pouches for much longer than the instructed 10-30 minutes. These results will be used to inform participants in a switching study to help them successfully switch from cigarettes/SLT to nicotine pouches and will further inform regulations made to ONPs in the future.

Board 37

## LUKE A. PRZYBYS

**Research Mentors:** Prabhu Parimi
MetroHealth Medical Center Division of Neonatology

Bronchopulmonary Dysplasia (BPD) is a common morbidity or illness that premature infants are diagnosed with. The primary way to treat BPD is with glucocorticoids like hydrocortisone and dexamethasone. However, it is common for these infants to be discharged with altered body composition and increased fat mass, leading to the hypothesis that glucocorticoids lead to high-fat mass. The main result of this study was that steroids are not the only factor leading to high-fat mass.

### GLUCOCORTICOIDS DO NOT INCREASE FAT MASS IN VERY LOW BIRTH WEIGHT INFANTS AT DISCHARGE

Bronchopulmonary Dysplasia (BPD) is a common morbidity that premature <1500g infants face while in the neonatal ICU. Glucocorticoids such as hydrocortisone and dexamethasone have been shown to prevent the severity of BPD due to their impact on regulating inflammation. However, they do lead to protein catabolism and insulin resistance, which led to the hypothesis that glucocorticoid exposure increases fat mass. A PEAPOD unit used the air displacement plethysmography method to measure the infants' fat and lean body mass. This study included patients from 2019-2023 who were <1500g, and data were collected on many variables such as demographics, clinical characteristics, neonatal outcome data, the protein-to-energy ratio between the 7th postnatal day and 40 weeks corrected age, and birth and discharge body composition using PEAPOD. On univariate analysis, the percent of fat mass was higher in infants exposed to steroids (yes), and there was no correlation between hydrocortisone equivalence dose and percent fat mass. Steroids had no independent effect on percent fat mass due to the provision of optimal nutrition countering the impact of steroids on protein catabolism.

Board 38

## MALCOLM HENDERSON

**Research Mentor:** Weichao Tu
West Virginia University Department of Physics and Astronomy

Recent observations from the Van Allen Probes have revealed the fast dropout of energetic electrons and protons in the Earth's magnetosphere. Theoretically, these two populations are collocated with each other and can undergo similar loss processes. However, a comprehensive picture of the coupling between the dropouts of both plasma populations requires detailed comparative data analysis. In this work, using the unprecedented 7-year particle measurements by the Van Allen Probes, we identified the fast dropout events in electrons and protons respectively and compared their locations with known physical loss mechanisms for these particles.

### COMPARATIVE DATA ANALYSIS OF THE DROPOUTS BETWEEN RADIATION BELT ELECTRONS AND RING CURRENT PROTONS

Recent observations from the Van Allen Probes have revealed the fast dropout of both MeV radiation belt (RB) electrons and 100s keV ring current (RC) protons in the Earth's magnetosphere. Theoretically, these two populations are collocated with each other and can undergo similar loss processes. However, a comprehensive picture of the coupling between the dropouts of both plasma populations requires detailed comparative data analysis. In this work, using the unprecedented 7-year particle measurements by the Van Allen Probes, we first identified the fast dropout events in RB electrons and RC protons respectively, by calculating the phase space densities of both populations as a function of $\mu$, K, and $L^*$. The dropout events are then categorized into three types: dropouts in RB electrons only, dropouts in RC protons only, and concurrent dropouts in both populations. Our results indicate that the electron-only dropout events are the most frequent across all, with their occurrence rate overall showing insignificant MLT dependence. The proton-only dropout events are mainly concentrated at $L^*$~4.5, from the afternoon to the dusk sector, which shows high correspondence with the presence of electromagnetic ion cyclotron (EMIC) waves. Concurrent dropout events in both populations show higher occurrence rates at high $L^*$ on the day side, suggesting magnetopause shadowing plays an important role in the losses. On the night side, the concurrent dropout events also display a higher occurrence rate at high $L^*$, which indicates the potential contribution from the field line curvature (FLC) scattering process.

Board 39

## MUSA SALEH REHMATULLAH

**Research Mentor:** Hana Dobrovolny
Department of Physics & Astronomy
at Texas Christian University

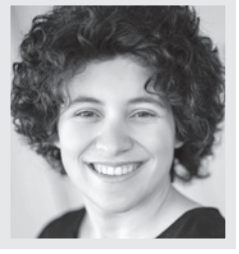
Oncolytic viruses infect cancer cells without harming healthy cells. Previous research indicated potential in using oncolytic viruses to kill cancer in the colon. I used data from that research and applied it to a mathematical model to estimate important characteristics and compare to see what changed when the virus was injected.

### CHARACTERIZATION OF A CELL-ADAPTED ONCOLYTIC VIRUS

The efficacy of oncolytic viruses in cancer treatment depends on their ability to successfully infect and destroy tumor cells. In the manuscript by Elsner et al. (2024), the researchers adapt the oncolytic coxsackievirus B3 to colorectal cancer by serial passaging in the colorectal carcinoma cell line Colo320. After the 10th passage, they determine that there are 5 key mutations that have adapted the virus to the cancer. They engineer a new virus containing those 5 mutations plus a few others that keep the virus from replicating in non-cancerous cells. They then test both the original virus and the engineered virus in tumors in mice. Here, we fit a model to both data sets to estimate important characteristics and quantitatively compare to see what changed when the virus adapted.

Board 40

## SAVANNAH DOMENECH



**Research Mentor:** Rebecca Hale
Smithsonian Environmental
Research Center

Untreated wastewater often contains optical brighteners, a group of chemicals found in many laundry detergents, and their detection in urban streams suggests that untreated wastewater is present. These brighteners glow blue under UV/black light and can also be detected using fluorescence spectroscopy. This project sought to determine the limits of detection of these brighteners using both methods, as well as if untreated wastewater was present at certain sites within the Anacostia Watershed.

### DETECTING UNTREATED WASTEWATER IN URBAN STREAMS THROUGH THE PRESENCE OF LAUNDRY DETERGENT

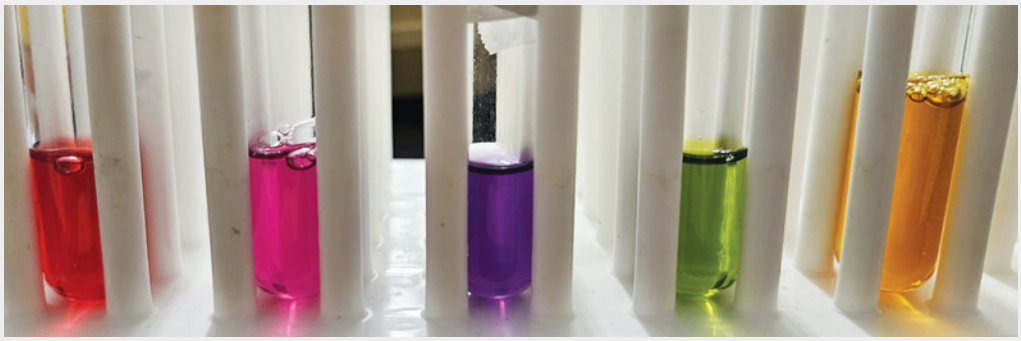
Untreated wastewater threatens the quality of urban streams making its detection paramount to ensure the health of streams and the recreators that utilize them. Untreated wastewater frequently contains optical brighteners (OB), a chemical compound found in many laundry detergents. Using community science (Tampling) and laboratory (Aqualog) methods, we sought to determine the extent to which the presence of laundry detergent can facilitate the detection of untreated wastewater in urban streams. Limits of detection for Tide Original in deionized water were found using both methods, and twelve other detergents, some containing OB and others not, were tested in deionized and stream water at Tide's limit of detection using both methods. 3D fluorescent emission excitation matrices were generated for each sample and analyzed using parallel factor analysis. A terrestrial humic-like component (component 3) and a benzoic acid/monolignol-like component (component 8) were noted to be of interest in detecting laundry detergent. These components, both of which naturally occur in stream water, were examined in Anacostia Watershed synoptic samples to test for the presence of untreated wastewater. Component 8 detected the presence of untreated wastewater at one site, which was confirmed through visual inspection of the site's outfall. Component 3 and the Tampling did not detect untreated wastewater at any of the sites, though this may be because the presence of OB-containing untreated wastewater at the sites was minimal, and, in the case of the Tampling, the characteristics of the stream water may have been preventing the OB from fluorescing.

# 2024 SSRP GAMES

In honor of the Paris 2024 Summer Olympic Games, 36 students, faculty, and staff participated in OWU's 2024 SSRP Games.

## Selecting Potion ▶

Mix the contents of a tube with a Selecting Potion (a pH indicator made from red cabbage) and the resulting color indicates your team for the Games! There were five SSRP teams: Red, Pink, Purple, Green, and Orange.



## Laboratory Skills Triathlon ▶

Race to accurately fill a pipet tip box, pour out exactly 5 g of NaCl, and stretch Parafilm the longest without breaking it.

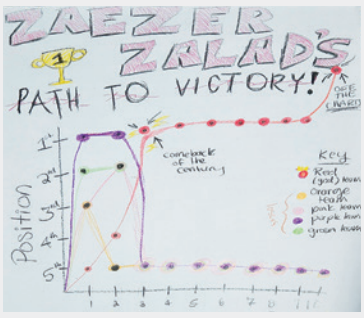
## Black Hole Experience ▶

Complete the corn hole game with a scientific twist.

## Pursuit of Plots ▶

"Pin the Data Point on the Curve" and "Tell a Story by Making a Graph Using Crayons" challenges.

▼




## Use Your Cortex to Aim a Vortex

Compete to see who can knock down the most plastic cups from the furthest distance using an *Airzooka*.

## Mighty Microbes

Partner with a teammate in a relay race around the Science Center balancing a petri dish of microbiological media on your head. Teammates alternate in the relay four times until reaching the finish line. If your plate falls off (and gets contaminated), quickly put it back on your head to complete the relay. The team with the best time and least amount of contamination wins.

## Experiments without Instructions

Devise an experiment with a box of objects and explain the science behind the experiment.

## Jog my Memory

Accurately name and order chronologically (by first use) various historic and current data storage devices (paper, photographic negatives, punch cards, vinyl records, 35 mm slides, cassette tapes, VHS tapes, 3.5 in floppy disks, laser disks, 35 mm slides, zip disks, and thumb drives).


## Grand Awards Ceremony

Winners receive 3-D printed Bronze, Silver, Gold, and Platinum trophies.

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

## SSRP 2024

Aubrey Gerhardt | This summer - Working in Dr. Marcus Smolka's lab at Cornell Molecular Biology and Genetics REU to design a new system to express Cas9 and generate site-specific DNA damage to study how damage at different parts of the genome result in different signaling responses.

Logan Fraire | Graduating in May then beginning internship position with the EPA Division of Surface Water managing/ delineating wetlands and 401 certifications.

Ginny Faeth | Taking a gap year and looking for graduate programs while working as a substitute teacher for the Clyde-Green Springs School District.

Claire Hammond | Participating in the Cincinnati Children's Hospital Medical Center SURF under Dr. Michael Jankowski this summer

Malcolm Henderson | Participating in the West Virginia University Plasma Physics REU

Audrey Propp | Taking the MCAT prep course in Columbus and work at Nationwide Children’s hospital in the neurology department

Elisabeth Madore | This summer - Working for an arts nonprofit, Richland Academy of the Arts and will be attending a conference hosted by the Ohio Arts Council. In the fall: attending a psychology conference with Dr. Cashen and continuing to work with her on her research.

Jazz Zimmerman | Working with Dr. Eric Gangloff at OWU

Ben Buroker | Beginning graduate school in the fall

Josephine Stark | Participating in the Ohio 5 Summer Undergraduate Research Program at OSU working with Dr. Karin Musier-Forsyth in CBC Biochemistry, specifically, “characterizing protein-RNA interactions involved in HIV-1 replication and fidelity mechanisms in protein synthesis.”

## SSRP 2023

Alyssa Head | Starting a Master's program at San Diego State University in the Evolutionary Biology Program in the fall of 2024. This summer I am finishing up my third first-author manuscript on research that I completed in the summer of 2023.

Maya Moore | Ohio Natural Areas and Preserves Association (ONAPA) as an environmental steward

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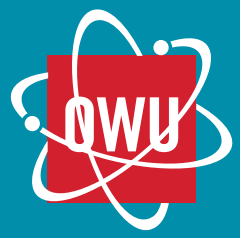


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