Patricia Belt Conrades

Summer Science Research Symposium

September 27, 2021

Ohio Wesleyan University

AIDAN SHUMAKER '20

Microbiology

"Through my research with Dr. Anderson I was able to understand the importance of the ecosystem around us and a better love for this world. I also got to understand how to collect and utilize large complicated and impactful data sets which I now work with on a daily basis, as well as how to communicate these data across disciplines."

THE PATRICIA BELT CONRADES SUMMER SCIENCE RESEARCH SYMPOSIUM

The crises that are upending our world — from the immediate dilemma 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 29th 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/ssrp2021**.

CONTENTS

Monday, September 27, 2021
Opening remarks by President Rock Jones

owu.edu/ssrp2021

THE MAKING OF A SCIENTIST

While so many things have changed over the past year, one thing that remains a 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).

This summer, students had the opportunity to work with OWU faculty mentors both on campus and remotely. Careful preparation and appropriate precautions like vaccination and wearing facial coverings allowed on-campus students to collect data at Ohio Wesleyan. In both cases, 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 16 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 the 53 OWU students and 19 OWU faculty mentors whose research will be featured today 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
Department of Biological Sciences
Scanning Electron Microscopist
Summer Science Research Program Director




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, Patricia 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. The endowment that will fund the program in perpetuity follows Ms. Ferry's support of the program through gifts she has made annually for several years.

Through her contacts with SSRP participants, Ms. Ferry has observed how the program introduces students to the excitement of science and original research and provides familiarity with the many career options available in the disciplines.

Ms. Ferry's interest in the sciences is longstanding, including her years at Case Western Reserve University, where she worked in the medical school directing its medical education program. She graduated from Ohio Wesleyan with majors in psychology and sociology and as a member of Alpha Xi Delta sorority.


OHIO
WESLEYAN

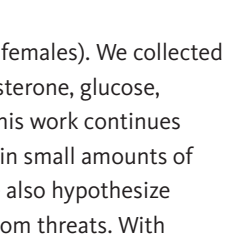
Board 1

PRINCETON VAUGHN
WYATT MCQUEEN
SIERRA SPEARS
CIARA PETTIT
CAITLYN COLWELL

Research Mentors: Eric Gangloff and Laura Tuhela-Reuning
Department of Biological Sciences

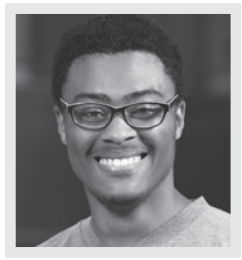
When urbanization occurs, many factors can challenge organisms: introduction of humans, altered food webs, human-made habitats, and exposure to new urbanized predators. For our study, we focused on an invasive species of lizard in urban Cincinnati, Ohio, known as the Common Wall Lizard (*Podarcis muralis*). We collected blood from adult male, gravid female, and non gravid female lizards, and quantified 3 physiological markers found within the blood plasma: corticosterone, glucose, and triglyceride. Corticosterone is a hormone that correlates with stress and energy balance, glucose is a carbohydrate that is the main source of energy throughout the body in the form of sugar, and triglyceride is a fat (or lipid) that is utilized for long-term energy storage. Together, these markers can help us characterize physiological differences among groups of lizards, distinguish what could cause these differences, and identify how a species like *Podarcis mualis* is able to thrive in highly urbanized environments versus other relative species.

THE PHYSIOLOGICAL ADAPTATIONS OF *PODARCIS MURALIS* IN URBANIZED LOCALITIES



Urbanization plays an impactful role in the survival of organisms, biodiversity, and the quality of an environment. Many species of organisms are driven out of localities when ecosystems are altered or destroyed. In some instances, animals have adapted to these significant changes and can successfully coexist in urbanized environments and anthropogenic structures. A small species of lizard known as the Common Wall Lizard (*Podarcis muralis*) was introduced into urban areas of Cincinnati, Ohio in the 1950s. For our experiment, we are interested in determining how *Podarcis* physiologically adapt to the conditions of urbanization. We collected data on lizards from five different sites around Cincinnati: two city parks and three roadside walls (51 males, 32 gravid females, and 8 non-gravid females). We collected blood samples with glass capillary tubes in the right post-orbital sinus (~30 µL per individual). We will measure corticosterone, glucose, and triglyceride found in the plasma, which serve as excellent markers for stress, energy, and stored available energy. This work continues research from last academic year when our protocols were validated to measure each of these physiological indicators in small amounts of blood. We hypothesize that gravid females will have higher levels of corticosterone due to the process of gestation. We also hypothesize that lizards will have higher levels of glucose and triglycerides in more open environments due to the need to escape from threats. With our findings, we can identify how these physiological markers vary based on the sex and locations of lizards, and how this variation affects survival and reproduction.

Board 2



PRINCETON VAUGHN

Research Mentor: Eric Gangloff
Department of Biological Sciences

A fundamental idea in biology is that morphology (how an organism's body is shaped) affects performance (how effectively it carries out tasks like sprinting and climbing). This relationship changes in different environments. For example, if a polar bear was suddenly moved to a desert, it wouldn't have the adaptations necessary to survive. Our study examines this relationship in the common wall lizard, a small lizard species that has become established in urban Cincinnati in the early 1950s. This experiment examines how climbing speed and gripping strength change due to differences in body structure and how this relationship changes on different surfaces. This research allows us to investigate how these lizards can respond to new kinds of habitats, provides insight into how invasive species survive in new environments, and explores how species respond to urbanization.

LIZARD PERFORMANCE IN VARIOUS ENVIRONMENTS DEMONSTRATES MORPHOLOGY-PERFORMANCE TRADE-OFFS

An organism's morphology affects its performance, but this relationship changes in different environments and contexts. As urban environments expand, more natural substrates (the material on which an organism lives and moves) are being replaced by anthropogenic materials. As a result, many species are being negatively affected. This change in substrate impacts how animals perform important tasks like running, climbing, digging, etc. Investigating this morphology-performance relationship is necessary to understand how urbanization impacts species and why some invaders are so successful when responding to environmental change. We tested the morphology-performance relationship in the common wall lizard (*Podarcis muralis*), a small lizard species that has become established in urban Cincinnati. We measured climbing and clinging performance on different materials that mimic substrates that *P. muralis* is likely to encounter in nature. We performed every trial at two temperatures, 34° C and 24° C to test for the impact of temperature on performance. Each lizard was tested under two climbing conditions (cork and turf) at both temperatures each and tested on three clinging (cork, turf, and sandpaper) substrates with two temperatures each, for a total of 10 trials per individual lizard. We tested the influence of whole-organism morphology and claw size and shape on clinging and climbing performance. Claws from each lizard were then imaged with a Scanning Electron Microscope (SEM). Using geometric morphometrics, we extracted shape, curvature, and other dimensions from the SEM images of the lizard claws and tested the hypothesis that variation in claw morphology would impact climbing and clinging ability. This research will allow us to see the influence of body dimensions, claw shape and size, and temperature on performance. These results provide insight into how invasive species survive and even thrive in new environments, such as cities.




Board 3

CAITLYN COLWELL

Research Mentors: Eric Gangloff and Laura Tuhela-Reuning
Department of Biological Sciences

Have you ever used a microscope to look at slides up close? While many labs use a light microscope, about the size of a blender, Ohio Wesleyan University is fortunate to have the powerful Scanning Electron Microscope (SEM), which is about the size of a barstool. This summer, I took pictures of lizard claws under the SEM to see which characteristics benefit the lizards. What is allowing them to thrive as an invasive species in urban Cincinnati?

SCANNING ELECTRON MICROSCOPY AND *PODARCIS MURALIS*

Urbanization, which often reduces natural resources and displaces wildlife, provides an excellent habitat for the common wall lizard (*Podarcis muralis*) to live and thrive. This species' resilience may be accredited to their durable claws, which allow them to scale stone walls and other anthropogenic surfaces in Cincinnati Ohio, where they are invasive. *P. muralis* claws were collected from field-caught and preserved museum specimens from the 1980s. The most distal phalanx of the longest digit was collected from the right rear foot of each specimen. Samples were prepared for scanning electron microscopy through ethanol dilution, critical point drying, and gold sputter coating to ensure image quality. All samples were imaged using a ZEISS EVO LS10 Scanning Electron Microscope. Images were obtained with focus on claw shape and roughness. The claws were strikingly unique, each exhibiting distinguishable features and wear. This may be due to differences in specimen age, behavior, size, or genetics. Using geometric morphometrics, we plan to extract shape, size, and curvature data from each image and compare it with performance data to test whether these variations hold functional significance for the species.

Board 4

CIARA PETTIT
SIERRA SPEARS

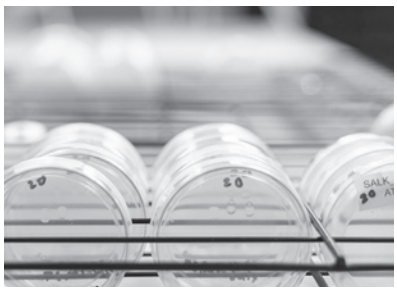
Research Mentor: Eric Gangloff
Department of Biological Sciences

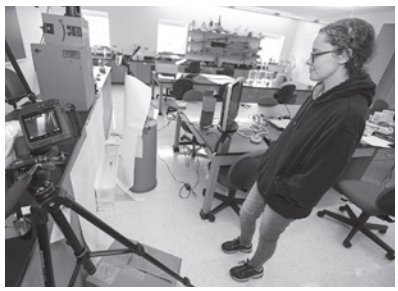
Ectotherms, or "cold-blooded" organisms such as the common wall lizard (*Podarcis muralis*) depend on their environment to regulate their body temperature. This is quickly becoming a problem, as climate change is causing environmental temperatures to rise and precipitation rates to become less predictable. Our study examines how wind can affect the rates of dehydration in *P. muralis* and patterns of thermoregulatory behavior. This is important to understand so we can quantify the potential effects of the ongoing climate crisis.

LAZARUS LIZARDS "THERMOREGULATION AND WATER LOSS IN THE *PODARCIS MURALIS* (COMMON WALL LIZARD)"

Climate change is progressing, subsequently warming the environment and altering precipitation patterns. This can inhibit the ability of wildlife to carry out natural behaviors, and therefore reduce fitness in their natural habitat. Ectotherms are affected by climate change because they rely on the environment to thermoregulate. Wind has a profound impact on the thermoregulation of animals, as it reduces their body temperature by cooling the animal and substrate, and impacts water loss. We can determine the water loss (or dehydration levels) by studying the hematocrit levels (ratio of red blood cells to plasma in blood). New statistical approaches to analyzing animal movement patterns, such as hidden Markov models (HMMs), give us insight into how behavior is affected by dehydration. We studied these phenomena in the Common Wall Lizard (*Podarcis muralis*), an invasive species brought from Europe to Cincinnati in 1951.

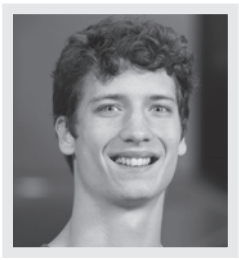
To study the effects of wind on thermoregulation, we conducted thermal preference trials in arenas with a gradient of 20-55°. We did two experiments on each lizard, one with wind and the other without. The lizards then underwent a waiting period of 12 days, and then another thermal preference trial was conducted, this time with the opposite wind treatment. During the trial, we used a thermal imaging camera to collect body temperature data, and a digital camera to track the lizards' movement. We predicted that the *P. muralis* would prefer the cooler side of the windy gradient to reduce their water loss, as wind is a constraint on their thermoregulation. These results provide insight as to how *P. muralis* are affected by the oncoming climate crisis.





Board 5

MYLES STEED



Research Mentor: Allen J. Pistner
Department of Chemistry

Burning fossil fuels has caused great environmental health concerns. Constructing new green energy alternatives are vital to creating a better environment. My research has involved making a chemical that improves the usage of hydrogen fuel cells, one of the most promising green energy alternatives that is on the market today. It works by assisting in the chemical reaction of converting oxygen in the atmosphere into water, a necessary process in hydrogen fuel cell functioning.

THE DEVELOPMENT OF DIPYRRIN PLATFORMS FOR OXYGEN REDUCTION

A redox-active ligand scaffold, dipyrrin, was synthesized in the interest of activating oxygen. The synthesis of the scaffold was modified from previous pathways. The original pathway used a Negishi-coupling followed by condensation with a benzaldehyde using pyrrole and di-tert-butyl anisole before being demethylated using either boron tribromide or a thiolate. The modified synthesis constructs the scaffold with a Negishi-coupling followed by a condensation with a benzaldehyde using pyrrole and a silyl protected di-methyl-phenol before being deprotected using triethylamine trihydrofluoride. The new pathway provides the opportunity limit toxic reagents and improve the overall efficiency of the synthesis. The dipyrrin scaffold was synthesized with differing phenol and naphthol groups and was analyzed using UV-vis spectroscopy and electrochemistry. These compounds display a strong long-wave absorption and reversible redox activity, making these promising candidates to support catalytic activity. Attempts in the formation of metal complexes are currently underway.

Board 6

MAXIMOS GOULAKOS

Research Mentors: Craig Jackson and Amy Downing
Department of Mathematics and Computer Science
Department of Biological Sciences

Our research is mainly concerned with the different aspects of ecosystems that affect how stable the populations are. We see how different species interact with one another and study these relationships to see whether or not any of these tend to have a strong impact on the behavior of the populations. Because scientists have a multitude of different ways to measure stability, we are also concerned with how consistent the observed effects are across these different measures.

EXPLORING ECOLOGICAL STABILITY IN REAL COMMUNITIES USING MATHEMATICAL AND MODELING APPROACHES

In any ecosystem, the populations within all interact with one another in a multitude of different ways, and these interactions are what determine the dynamics of the system as a whole. When these interaction strengths are measured, they can be used to quantify the stability of the ecosystem in various different ways; each of these measures analyze different aspects of the population change over time, but they all are related to the general movement back to the ecosystem's equilibrium position. It is understood that the presence of many weak interactions tends to stabilize the effects of a few strong interactions in plankton ecosystems, but what is generally unknown is how the different types of interactions will affect the measures of stability. We ran sensitivity analyses on various zooplankton and phytoplankton population data sets that were gathered in 2012 to observe which particular interactions were most likely to change the dynamics of the ecosystem given a perturbation of the interaction strength itself. For each individual interaction, there were 8 unique measures of sensitivity calculated. From these values, tentative statistical analysis shows that interspecies interactions (interactions between two different species) tended to be less stabilizing than intraspecies interactions (interactions between the members of one species on itself). Furthermore, there seem to be no statistical differences between the contributions of bottom up interactions, top down interactions, and interspecies interactions; however more studies need to be done on other sets of data to validate these results.

Board 7

MACKENZIE WADE

Research Mentor: Ashley Allen
Department of Environment & Sustainability

Nutritional food has been shown to be less accessible within areas of lower socioeconomic status, thus leading to disproportionate health issues within low-income communities. We studied this correlation within the Columbus metropolitan area by mapping the current locations of food access points such as grocery stores, fast food restaurants, and discount stores. We also conducted surveys to better understand how residents get their food and perceive their food accessibility.

MODELING A CENTRAL OHIO REGIONAL FOOD NETWORK FOR SUSTAINABLE OUTCOMES

Creating and maintaining sustainable food systems, particularly networks of distribution and access, is becoming more and more imperative as humans are faced with a changing climate, as well as social, political, and economic stressors. The global food system is incredibly complex, so researchers are attempting to assess these potential impacts by examining 'local' (or more accurately, scaled-down) networks of food production, distribution, and access to understand the sustainability and resilience of our current food systems, as well as what could be done to mitigate loss in the case that these networks are interrupted (Savary et al. 2020). To contribute to that research, we have created and analyzed GIS visualizations of the current food systems within the Columbus metropolitan area with the intention of moving toward a more just system of food distribution. To do this, we have collected spatial data of all food access points within the central Ohio region. We have also conducted surveys of current Central Ohio residents to better understand the complexities of local food systems on an individual scale. Our data shows that areas of lower socioeconomic status tend to have less access to grocery stores and consequently increased reliance on food with low nutritional value, making Central Ohio's food systems consistent with those reflected in prior studies. These findings further provide evidence that residents in minoritized and/or low-income neighborhoods have higher access to foods that can lead to chronic health issues after prolonged consumption over time.

Board 8

LOVE AYINDE

Research Mentor: Sean McCulloch
Department of Mathematics and Computer Science

This summer, Dr. McCulloch and I worked on understanding and advancing the use of Artificial Intelligence (AI) in a card game called Battle Line. At the start of the summer, the program already played a strong game against its human opponents, but it mostly "gave up" when it had a nearly 0% chance of winning a flag, making it easier for the opponent to win. We added into the AI strategy a concept known as the "You-curve" which helped remove that deficiency. With the new improvement, my mentor and I played the game using both the old and new strategies 20 times each, and we found that our work made the game more challenging, improving the 5%-win rate of the original program to 35%.

ARTIFICIAL INTELLIGENCE FOR BATTLE LINE

This summer, Dr. McCulloch and I worked on understanding and advancing the use of Artificial Intelligence (AI) in a card game called Battle Line. This game has similarities to Poker and Solitaire. The game program was constructed using Java by my predecessor students. The game program allows us to play against the computer and also against another person. At the start of the summer, the program already played a strong game against both new players and former world champions. We worked to improve the game strategy of the computer program in order to improve its win rate. We figured out that the existing game strategy mostly "gave up" when it had a nearly 0% chance of winning a flag, making it easier for the opponent to win. Therefore, we decided to add into the strategy a concept known as the "You-curve," which helped remove that deficiency. The "You- curve" makes decisions by adjusting the probability of winning a flag using a quadratic equation. The curve gives a higher value when the final probability is very close to 0 and 1 and gives very low value when the final probability is around 0.4 to 0.6. With the new improvement, we tested both the old and new strategies 20 times each, which improved the 5%-win rate of the original program to 35%. We also started modifying the program to allow the computer strategy to play against itself or another computer strategy. We hope this modification can be completed in a future summer.

Board 9

JOSEPHINA H. FORNARA

Research Mentor: Dustin G. Reichard
Department of Biological Sciences

I spent my summer studying how mother house wrens — a common backyard songbird — respond to two different nest predators. I compared how the wrens defended their nests against a model of a black rat snake versus a taxidermied Cooper's hawk, both of which frequently prey on young wrens. Hawks also pose a significant threat to adult wrens, whereas snakes do not. The female house wrens frequently dove at and hit the snake model but never demonstrated these defense behaviors against the hawk model, suggesting that house wrens change their behavior to match the perceived level of risk to themselves and to their nestlings.

THE HAWK-SNAKE GAME: RESPONSES OF FEMALE HOUSE WRENS (*TROGLODYTES AEDON*) TO SIMULATED NEST PREDATORS

Surviving encounters with predators is a problem faced by most — if not all — animals, including humans. Here, we compared the anti-predator responses of female house wrens (*Troglodytes aedon*) to two different simulated nest predators: a black rat snake (*Pantherophis obsoletus*) and a Cooper's hawk (*Accipiter cooperii*). Both predators pose a significant threat to house wren nestlings; however, unlike snakes, hawks also pose a significant threat to adult house wrens. We predicted that mother house wrens would defend their nests less aggressively against a hawk than against a snake in order to ensure their own survival and to maximize their lifetime reproductive success. To observe anti-predator behaviors, female house wrens with 3-6 day old nestlings were presented with a predator model for seven minutes. We recorded the defense behavior of each female, including the amount of time she spent responding to the predator model and how many times she hit or dove at the model. Female house wrens frequently hit or dove at the snake model, but never demonstrated those defense behaviors against the hawk model. These results suggest that female house wrens modulate their anti-predator behavior to match the perceived level of risk from different predators, which is the strategy that should maximize lifetime fitness.

Board 10

HANNAH LITTLEFIELD

Research Mentor: Shala Hankison
Department of Biological Sciences

Sailfin mollies are a fish species that have a variety of courtship and mating behaviors that are used in an attempt to win over females and produce offspring. Trials were unable to begin this summer due to the stress levels of the fish. The goal of this project was to figure out which behaviors were the most successful by watching the fish behaviors and determining the paternity of the offspring.

COURTSHIP BEHAVIOR AND PATERNITY OUTCOMES IN THE SAILFIN MOLLY (*POECILIA LATIPINNA*)

The males of the fish species sailfin molly (*Poecilia latipinna*) display a variety of courtship and mating behaviors behaviors that range from elaborate displays where the dorsal fin of the male is raised and the male chases the female to more sneaky attempts at copulation. Specimens were collected from the area surrounding the Florida State Marine Lab and were then acclimated to the lab environment at Ohio Wesleyan. Fish were too stressed to perform their normal behaviors during the Summer Science Research Program, but future directions for the research will include observing and recording courtship behaviors, as well as male-male interactions, and paternity testing to determine if certain behaviors correlate with mating success. This would allow us to know which behaviors increase fitness in this species.

Research Mentor: Tami Panhuis
Department of Biological Sciences

Poeciliopsis fish have different strategies for providing nutrients to developing embryos. The strategies range from producing yolk to sustain the embryo prior to fertilization to providing constant nutrients throughout development using specialized placenta structures. We compared ovaries of closely related Poeciliopsis species to learn about how and why these differences evolved.

HISTOLOGICAL COMPARISON OF OVARIAN STRUCTURE IN *POECILIOPSIS* FISH

Fish in the genus Poeciliopsis give live birth and vary in their degree of placentation depending on the amount of post-fertilization maternal nutrient provisioning to the developing embryos. In matrotrophic species, little yolk is produced prior to fertilization and thus placental structures that allow the mother to transfer nutrients to the embryos have evolved. Histology slides of gestated ovaries of 4 closely related Poeciliopsis species were analyzed and compared to identify morphological differences to learn about how specializations in the placenta structures evolved. To accomplish this, oocytes and embryos at varying stages, as well as follicle and embryo sac structures were photographed from the slides and compared between species to reveal how the morphological traits vary.




Board 11

GRAM DICK
JAY MCCONKEY

Research Mentor: Nathan Rowley
Department of Environment & Sustainability

Power outages are a significant inconvenience on the Ohio Wesleyan campus that could be mitigated if the University opted to utilize solar panels. In this work, we use a Phantom 4 drone to capture images of all campus buildings to generate 2D and 3D representations. Using Pix4D and ArcGIS software programs, we are able to estimate the amount of sunlight each rooftop receives on the summer (maximum) and winter (minimum) solstices.

USING A SUAS TO CALCULATE SOLAR POWER POTENTIAL AT OHIO WESLEYAN

Over the past two years (2019-2021), Ohio Wesleyan University has experienced 120 hours of power outages (roughly 50% greater than the state of Ohio average). This causes a lack of productivity, leads to food waste, and hurts the university's reputation.

To address the significant number of power outages at Ohio Wesleyan's campus, renewable energies seem to be the ideal solution. As such, larger-scale projects, like Google's Project Sunroof have generated a first-cut set of resources that can guide small-scale (e.g., private homes and Ohio Wesleyan University) implementation of renewable energy sources, like solar power. Project SunRoof provides users with straightforward information like displaying optimal placement for solar panel installation based on a building's areas receiving the highest insolation (incoming solar radiation). However, there are limitations to Google's methodology and product. For example, Project SunRoof only covers densely populated urban areas but has not yet reached suburban and rural areas like Delaware, Ohio (and the Ohio Wesleyan campus). In addition to the lack of coverage, Project Sunroof relies on satellite imagery, which has a coarse spatial resolution (on the order of 15 m per pixel). To increase the availability of data and to increase the spatial resolution, we (Remote Sensing Laboratory; RSL) apply a similar methodology to that of Project SunRoof, but our use of small unmanned aerial vehicles (sUAS) increases the resolution significantly to the scale of 1 inch. This in turn provides immensely improved accuracy in both the visible map and, more importantly, the three-dimensionality of our data products.

Board 12

ALI AMER

Research Mentor: Bethany Rudd
Department of Chemistry

Everyone has taken over-the-counter (OTC) medication at some point, be it for pain relief or for reducing a fever or inflammation. However, what we don't always know is how these drugs interact with the membranes of our cells. Our study focuses on understanding the nature of interactions between ibuprofen and a component of our cell membranes. Investigating this piece of the puzzle helps us to understand how ibuprofen and other medications work in our bodies.

INTERACTIONS BETWEEN IBUPROFEN AND PHOSPHOLIPID MONOLAYERS IN CELL MEMBRANE MODEL SYSTEMS

The interactions between the lipid components of a cell membrane and amphiphilic drugs are directly related to the efficacy of the drug itself and how it works. This study focuses on the interactions between ibuprofen, a common over-the-counter medication, and a model phospholipid monolayer system, dipalmitoylphosphatidylcholine (DPPC). Surface pressure-area isotherms were recorded through the compression of the DPPC monolayer in a Langmuir trough with and without ibuprofen. Previous studies in the literature put forward a controversy centered around the method of introduction of ibuprofen into the model system (introduction via the aqueous subphase versus co-spreading with the DPPC monolayer) and how the drug interacts with the Langmuir monolayer in these two scenarios. In this work, significant effects were observed in surface pressure-area isotherms upon subphase introduction of ibuprofen whereas no observable change was observed with co-spreading. Further analysis of the isotherms was carried out through the calculation of the compressibility modulus to determine the fluidizing effect of ibuprofen on the DPPC monolayer. The disappearance of phase transitions between the gas, liquid expanded and liquid condensed regions of the isotherm was found to be more pronounced as the concentration of ibuprofen was increased in the subphase. The compressibility modulus values indicated that at high ibuprofen concentrations (50 μM), the monolayer became more fluid. This work represents the beginning stages of our study of ibuprofen with DPPC model membrane systems. Future work will focus on identifying the moieties involved in these interactions as well as increasing the complexity of our model system to better mimic human body conditions.

Board 13

CASSIE FARBER
NAVAMI SHENOY
EMMA ZAJAC

Research Mentor: Kira Bailey
Department of Psychology, Neuroscience Program

Commercial video game consumption has been linked to changes in cognitive control, the processes that allows us to plan and execute our goal-directed behavior. Some studies identify positive changes in cognitive control, while others demonstrate negative changes. Commercial video games are not specifically designed to train cognitive abilities, so it is difficult to know which aspects of the games are causing the various effects. We created video games that allow the researcher to manipulate individual variables to better ascertain the effects of specific game features on brain activity and behavior; the first study will collect data online to assess behavior.

EXAMINING COGNITIVE AND BRAIN FUNCTIONS THROUGH VIDEO GAMES

A growing body of evidence suggests that action video game (AVG) experience is associated with improvements in visual/spatial attention and cognitive control (Green & Bavelier, 2003, 2006, 2007; Green, Pouget, & Bavelier, 2010) and changes in brain function (Knols et al., 2017). The significance of this finding lies in the implication that the skills acquired in an AVG might be transferred to other contexts (Boot, Blakely, & Simons, 2011; Green & Bavelier, 2003). This has led some researchers (Bavelier et al., 2012; Green & Bavelier, 2008) to recommend the use of AVGs in training protocols among populations that would benefit from enhanced visual attention and cognition (e.g., older adults, pilots, military personnel). However, these recommendations may be premature; there are several methodological criticisms of the past research (Boot, Blakely, & Simons, 2011; Bisoglio et al., 2014), one of which is that the use of readily available commercial video games does not allow for strong experimental control over the numerous variables that could influence cognitive skills. The current study used Unreal Engine 4 to create three video games that allow the researcher to manipulate individual variables to better ascertain the effects of specific game features on brain activity and behavior. To show proof of concept, each game simulates a standard laboratory assessment of cognitive control; two simulate the Flanker task (Ericksen & Ericksen, 1974) and the third video game simulates the N-back task (Kirchner, 1958). An online study was designed to collect behavioral data using one of the games based on the Flanker task. The realistic video game used in the study should provide behavioral data comparable to behavioral data obtained from the traditional Flanker task, while also providing insight into the mechanisms for video game effects on cognition.

Board 14

KAELI EVINS

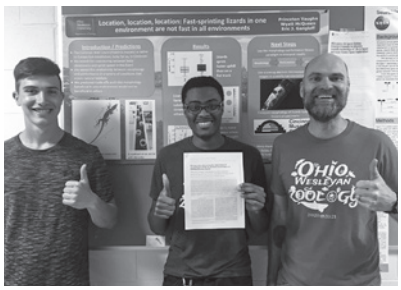
Research Mentor: Danielle Hamill
Department of Biological Sciences

Nematodes, or tiny roundworms, are one of the most abundant animals on Earth and have been used for understanding biological processes, human diseases, and more. This summer I am working to characterize a new species of nematode. My research involves a marked mating approach to determine if males of one species can fertilize and produce viable offspring when mated with the possible new species. The purpose of my research is to establish how our type of worm differs from its more widely studied relative, *C. elegans*, leading to a better understanding of these animals, how they live, and what biological processes they undergo.

CHARACTERIZATION OF NOVEL NEMATODES

Nematodes are a very diverse group of animals. *Caenorhabditis elegans* is the most intensely studied species of nematode. However, it is one of many nematode species, others of which may still be unidentified. Our research focuses on the characterization of a potential new species of nematodes that were found in Ohio and Florida. We expect that identifying and characterizing other species of nematodes will lead to a better understanding not only of these animals but of conserved biological processes as well.

This summer we focused on two types of worms. The first type, based on partial DNA sequences, we have identified as *Oscheius myriophila*. The second type, and our potential new species, was also partially sequenced and found to differ at the DNA sequence level from *O. myriophila* by approximately 1.6%. We believe this level of difference is significant and points to the worms being different species. However, to describe a new species, it's important to consider other parameters as well including morphology, development, and reproductive isolation. This summer we focused primarily on the latter. Specifically we set up reciprocal crosses between *O. myriophylla* and the potential new species. Using a marked mating approach, we stained sperm in one type of worm and set up matings with hermaphrodites of the other type. Our results showed that the two types of worms could copulate, and the labeled sperm from the male could be observed inside of the uterus and in the spermatheca of the hermaphrodite it mated with. However, in spite of being in the right place at the right time, the heterotypic sperm appeared unable to fertilize the eggs; we did not detect out-crossed progeny. This result supports the hypothesis that our second type of worm is a new species, distinct from *O. myriophila*. This work is important not only for the sake of describing a new species, but also for the understanding of nematodes more generally.



Board 15

EVA MULLOY
TIYINOLUWA OLUSHOLA-ALAO

Research Mentor: Bob Harmon
Department of Physics and Astronomy

In the night sky, stars appear to be pinpoints of light because they are so far away, so that we cannot produce detailed images of their surfaces like we can for the Sun. On the Sun we can see sunspots that are cooler and darker than the rest of the surface. Some other stars have starspots that are much larger than sunspots and cause the star's brightness to change significantly as the star rotates and brings the starspots in and out of our view. We are specifically studying a star with prominent starspots called LO Pegasi, located in the constellation Pegasus. This project's goal is to map the surface of LO Pegasi based on its brightness changes in 2021 and compare our results with those obtained from 2014-2020.

STARSPOTS ON LO PEGASI

The goal of this project is to map the surface of the star LO Pegasi using information implied by its changes in brightness over a rotational period. LO Pegasi is a young, variable, main-sequence star of spectral type K about 81.7 light-years away from Earth with a rotation period of 10.153 hours. Due to its relatively rapid rotation, it exhibits a high level of magnetic activity. This causes starspots that are much larger than sunspots (solar starspots) on the Sun. Starspots are dark regions on the surface of a star caused by the suppression of convection in the plasma. This reduces the transport of energy into the starspot from the hotter layers below, causing it to be cooler than the surrounding surface. As LO Pegasi rotates, the brightness varies as starspots come in and out of view from Earth, with the star being dimmer when the starspots are in view. We took a series of digital images of LO Pegasi using a CCD camera through photometric B (blue), V (visual), R (red), and I (infrared) filters. We performed aperture photometry to measure the brightness of the star over time and then plotted the results to produce light curves. These light curves were then processed through a Light-curve Inversion (LI) program to map the surface of LO Pegasi to show changes in its starspots from 2014 to 2021.

Board 16

DAVID JINDRACEK

Research Mentor:
Bradley Trees
Department of Physics and Astronomy

Superconductors are widely studied for their potential to be useful in developing technologies. This study is taking a dive into the behaviors of modeled RF SQUIDs, a superconducting device used to measure external magnetic fields. Particularly, this study is modelling a group of these RF SQUIDs, with all of them being different.

ENTRAINMENT OF DISORDERED RF SQUIDS ON AN EXTERNAL MAGNETIC FIELD

Our study is observing the behaviors of the mathematical model of a superconducting device called an RF SQUID. We created Python code to solve for and plot the behavior of the model, and numerically solve for the magnetic flux through the SQUID as a function of time. We used these flux values to calculate a quantity called the order parameter, which was shown to dip at values of resonance for the SQUID array. Additionally, through Floquet theory, we analyze the stability of the long term behavior of the array. Continuing off of last year's research on uniform SQUID arrays, the task was to generalize new and improved Python code for an array of superconducting RF SQUIDs that had differing self and mutual inductance strengths.

Board 17

BRIANNA DEMUTH

Research Mentor: Nicholas Dietrich
Data Analytics Program

When foreign countries commit human rights abuses, other countries can respond with different political strategies in the hope that the country changes their behavior. However, action is costly and public opinion for intervention can vary from person to person. Our study looked at the relationship between support for action, type of government, and how people want to be governed — either freely or more controlled. We call this authoritarianism and found that support for action generally went down in people with more authoritarian views.

EXPLAINING SUPPORT FOR HUMAN RIGHTS ACTIONS: EXPERIMENTALLY STUDYING ACCOUNTABILITY, DEMOCRACY, AND AUTHORITARIANISM

How do authoritarian attitudes affect support for international action against human rights abuses? Does the status of democracy and patterns of repression create thresholds of opposition for accountability? In this study, we investigated how people come to conclusions about human rights violators to gauge public support for accountability against foreign countries. Public opinion is the cornerstone of activism, and research into global leadership is characterized by patterns of crises and conflict resolution. In terror management theory, society develops a deep homeostatic understanding of life which is prone to political extremism, especially when danger is apparent. To test this, we conducted an online survey through Amazon Mechanical Turk to determine whether support for actions against human rights violators changes with democracy and autocracy, repetition of repression, and degree of personal authoritarianism. We define personal authoritarianism as a scaled representation of how people see centralized power and want to be governed, and ultimately how they govern themselves and others. We found no significant relationship between support and the regime of the target country, or number of violations committed, but found an interaction between personal authoritarianism and support for action. International audiences generally support action regardless of regime or repetition. However, as personal authoritarianism increases, support for action decreases especially with democratic leadership. The exception was peacekeeping action, where strong personal authoritarians were more likely to support peacekeeping in the presence of authoritarian leadership.

Board 18

MUZAFFAR YEZDAN

Research Mentor: Scott Linder
Department of Mathematics and Computer Science

Most clinical and industrial trials are subjected to a phenomenon known as censoring, which leads to the data collected from the trial to be incomplete. This missing data makes it difficult to infer information about the population based on the small-scale trial. We looked into methods of making more accurate statistical inferences from censored data which would allow researchers to more effectively utilize data collected from trials.

INFERENCE FOR REGRESSION MODEL COEFFICIENTS WHEN DATA HAS BEEN SUBJECTED TO CENSORING

Clinical and industrial trials offer crucial insights into how well drugs or electronic components perform. Data from these trials is sometimes subjected to censoring — clinicians stop the experiment at a certain time or after a predetermined number of observations has been made. When data have been subjected to censoring, the sampling distributions of certain statistics computed from the data are mathematically intractable, making statistical inference difficult. In this work we consider the sampling distribution of certain regression-associated sums of squares used to estimate variance. Using simulation, we demonstrate that the sampling distributions of these statistics are impacted by censoring, and differ from those one would use for full (uncensored) samples. We propose approximating these sampling distributions by Gamma distributions with parameters that are functions of the experimental conditions (sample size and degree of censoring). We then examine the performance of confidence intervals for population variances that arise from this approximation.

Board 19

CARLY SCHAFER

Research Mentor: Chris Wolverton
Department of Biological Sciences

Gravity is a downward force with which everything on Earth is influenced by, including plants. The shape and internal processes of plants are highly affected by the Earth's gravitational pull. This begs the question of how plants, and potentially agriculture as a whole, would be affected by a gravitational pull of a different magnitude, say on a different planet. By altering the genetic make-up of seedlings of a plant called *Arabidopsis thaliana*, and rotating the plants to change the direction of gravity, it can be determined exactly what segments of plant DNA are most affected by gravity, and how changes to those segments ultimately affect plant growth and development.

GRAVITROPISM OF ROOT TIP GROWTH IN *ARABIDOPSIS THALIANA*

Essential for the development of agriculture in space is an understanding of how plants grow in microgravity environments. Rather than inducing growth responses in space directly, gravitropism can be analyzed more accessibly on Earth via rotating surfaces that alter the direction of gravity. By altering the direction of gravity, starch-filled amyloplasts within root tip cells sediment to the bottom of cells, inducing signaling that leads to the downward growth of roots via the intracellular movement of auxin. Phenotyping of twenty-five mutants of *Arabidopsis thaliana* previously found to have altered genetic profiles after exposure to simulated microgravity environments was conducted using continuous rotation experiments, free rotation experiments, phototropism experiments, and RT-PCR. The goal of this study is to determine if any of the rotation experiments produce significantly altered root tip growth responses in the mutants with relation to wild-type strains. Those mutants with significantly altered responses would indicate genes that are responsible for some aspect of growth response to gravity. Additionally, closer examination of one mutant in particular, whose wild-type variant produces a protein containing an SPla/RYanodine receptor (SPRY) domain, will aim to predict, prior to further experimentation, the molecular basis of how this gene influences growth response. The results of this study have implications related to cultivating plants in space, which could ultimately expand on humanity's access to land and other agricultural resources, and a deeper knowledge of how the physiology and morphology of plants is impacted by gravity on Earth.

Board 20

MANGA BAUER, REGINA CAMPBELL, MO CARTNAL, ALE CORONEL-ZEGARRA, MARQUISE DOWNING, ABBY DOZA, ROSS EGGLESTON, CATIE HYATT, REAGAN JENNINGS, CARLY SCHAFER, MYLES STEED, SAI SURESH KANNAN, MAKAILA WEIR, AND ATHENA VAKALERIS

Research Mentor: Chris Wolverton
Department of Biological Sciences

By identifying genes that are involved in plant gravity response, we can better understand the processes that allow plants to grow properly, and further NASA's mission to successfully cultivate plants in space. In prior research, a list of 124 genes were identified as possibly being key players. We have chosen 25 of those genes to test this summer in order to determine which of them are involved in responses to gravity in Arabidopsis plants (Thale Cress.) In the future, our results could be applied to successfully grow food crops in lower- and zero-gravity environments.

SEARCHING FOR COMPONENTS OF THE GRAVITY SENSING SYSTEM IN PLANTS

Gravity is the predominant influence on plant growth and subsequent plant architecture. It has been discovered that a plant's primary response to gravity comes from the sedimentation of starch-filled structures called amyloplasts. Researchers have determined that mutant Arabidopsis plants without amyloplasts retain a significant response to gravity and have sought to identify additional molecular components for their contributions to the gravity response pathway. Over the past several years, research has led to the isolation of 124 Arabidopsis genes with the potential to affect plant response to gravity. Current research adds on to previous work where 30 genes were experimented on to isolate statistically significant differences between mutants and wild type plants. Gravitropism response in 25 confirmed Arabidopsis mutant genes were further tested using free rotation, continuous rotation and phototropism experimental analyses. Results of mutant comparative analysis are incomplete.

A list of 124 genes was previously determined to be significant in the plant gravity response pathway with regards to *Arabidopsis thaliana*. 25 genes from the list of 124 previously identified genes were chosen for analysis. Each mutant was confirmed to be homozygous through PCR and gel electrophoresis. Each confirmed mutant was grown to the seedling stage and ran through a series of tests. The first test included attaching five seedlings to a motor that turned them exactly 90 degrees. The plants were grown at 90 degrees for 200 minutes, and a photograph was taken every 10 minutes. Angle measurements were recorded at determined intervals. The second test included the rotation of five seedlings 15 degrees per hour for 200 minutes. Photographs were taken every 10 minutes, and angle measurements were recorded at specific intervals. The third test included growing 20 seedlings vertically with a blue strip light shining on them at 90 degrees. The plants remained with the blue light at 90 degrees for 20-24 hours, and an image was taken of them at the end of the test.

The results of this research have not yet been determined.

This summer, 13 students contributed to a NASA-funded research project investigating the contribution of 25 genes to the gravity response pathway in plants. Students focused on confirming the identity of knockout mutants for these genes and collecting phenotypic data on the plants' growth responses. The work is part of a 3-year study aimed at testing the contributions of genes identified by transcriptomic analyses on plants grown on Earth and in space aboard the International Space Station.

Board 21

ANNA SCHILL

Research Mentors: Christine Miller and Michael Forthman
Department of Entomology at the University of Florida

Reproduction takes up a lot of an organism's energy via vigorous competition over mates, growing reproductive organs, and raising offspring. Our study used leaf footed bugs which invest a lot of energy in elaborate hind legs for competition. We examined the extent to which males and females had to shrink their gonads when the investment in their hind leg weapons was artificially increased by adding extra weight.

REPRODUCTIVE TRADE-OFFS BETWEEN COSTLY SEXUALLY SELECTED WEAPONS AND OTHER EXPENSIVE TISSUES IN THREE SPECIES OF COREOIDEA

Organisms generally have a finite pool of resources available for necessary functions such as survival, growth, and reproduction; they cannot always invest completely in each functional group, thus investing energy into one means having less for another. Within these functional groups, such as reproduction, further trade-offs are expected to exist, e.g., between costly primary sexual traits (testes or gametes) responsible for fertilization success and secondary sexual traits (ornaments or weapons) responsible for securing mating opportunities. Previous studies have shown that sexually selected weapons in males can be expensive to develop and maintain and trade off with testes size. One emerging model in these studies are leaf-footed bugs (Insecta: Hemiptera: Coreidae), which have elaborate, costly hind leg weapons that can be self-amputated when entrapped; losing these weapons are associated with increased investment in gonads. Furthermore, this relationship between hind leg mass and gonad mass is seen in weaponless females, adding a layer of complexity to the system. However, it is unknown if increasing the cost of the hind leg will result in decreased investment in the gonads. Using *Leptoglossus zonatus* (Dallas, 1852), we hypothesized that increasing the cost of a weapon during development would cause gonads of both sexes to be smaller because more resources would be required to develop and maintain a heavier weapon. In our experiment, we added weights to the hind legs of late stage juveniles and measured gonad, weapon, and body mass when they reached sexual maturity as adults. The results of this study will complement previous work investigating resource allocation decisions during development and will provide insights on competition for resources between costly sexual traits.

Board 22

CHASE REINERT

Research Mentor: Shala Hankison
Department of Biological Sciences

When wild animals become injured, South Florida Wildlife Center helps to rehabilitate and release them. During my summer internship, I had the opportunity to explore all aspects involved in wildlife rehabilitation. With the skills that I learned, I am able to supplement my educational goal of becoming a wildlife veterinarian.

ROTATIONAL INTERNSHIP AT SOUTH FLORIDA WILDLIFE CENTER

South Florida Wildlife Center admits more than 10,000 orphaned or injured wild animals every year with the goal of rehabilitation and release. In an effort to provide students with a glimpse of the work they do, the center offers a variety of internships. This summer I completed a three-month rotational internship. During the internship, I had the opportunity to rotate through all the different departments at the center. In the resource center, I learned how to communicate with members of the public that bring wildlife to the center as well as educating the public about how to coexist with wildlife. Next, I rotated through the veterinary clinic where I learned how to triage patients based on the severity of their injuries. I also learned how to access the injuries of a wide variety of species and how to administer medications and subcutaneous fluids. On rare occasions, I was able to observe the veterinarian during surgical procedures. After the vet clinic, I transitioned to the rehabilitation area. While learning to properly care for each species, I was also taught how to safely handle species ranging from birds of prey to mammals. Once the animals in care are completely rehabilitated, they are evaluated to ensure they can survive in the wild. Animals deemed fit for the wild are then released, which I had the opportunity to participate in. Lastly, I assisted with the raising of orphaned animals in the nursery, including birds, squirrels, raccoons, and opossums. When orphaned animals required more frequent feedings, I had the opportunity to take them home to care for them around the clock. Overall, I learned a variety of valuable skills on how to properly treat and rehabilitate many different species. These skills will be helpful in my future endeavors pursuing further education in veterinary medicine.

Board 23

DAVIS GRAHAM

Research Mentors: Bert O'Malley, David Lonard, and Yosi Gilad
Department of Molecular and Cellular Biology at Baylor College of Medicine

Cancer cells frequently utilize a variety of mechanisms to evade the immune system of their host and some cancer drugs can actually contribute to the activation of these mechanisms. Normal cells need to be able to use these mechanisms to avoid the immune system of their host. A gene of interest was validated in lung cancer cells as a gene involved in cancer cell's drug related immune evasion ability, but that is not involved in a normal cell's immune evasion ability.

DRUG RELATED INDUCTION OF PD-L1 IN CANCER CELLS

Programmed death-ligand 1 (PD-L1) and programmed cell death protein 1 (PD1) comprise the PD-L1 immune checkpoint ligand-receptor axis. PD-L1 ligand binding to its receptor (PD1) restrains the immunogenic response and under normal conditions the PD-L1 axis is responsible for maintaining immune homeostasis and preventing autoimmunity. Cancer cells can upregulate the expression of PD-L1 due to drug treatment, supposably as an escape program triggered by pharmacological pressure. Interferon-gamma (IFN-γ) is a physiological inducer of PD-L1, which can act to balance an immune response.

The PD-L1 axis is targeted for treating cancer to unleash the immune system so it can resume its anticancer activity. Targeting immune checkpoints in cancer can result in severe autoimmune-like effects in patients. We explored whether inhibition of specific molecular targets will suppress the induction of PD-L1 under drug pressure while preserving its IFN-γ induced expression.

The Cancer Genome Atlas (TCGA) was used to identify *AXL*, *FOSL1*, and *NT5E* as genes that correlated with *CD274* (PD-L1) mRNA expression without major links to IFN-γ related pathways. We hypothesize these genes might be involved in a non-canonical pathway of PD-L1 induction. Due to the availability of a small molecule AXL inhibitor, we chose this gene to test our hypothesis.

To test drug-related induction of PD-L1 we used Paclitaxel (PTX) and Gemcitabine (GEM) — known PD-L1 inducing chemotherapies. The inducibility of PD-L1 under physiological-like and pharmacological conditions was confirmed via qPCR and Western blot. Next, we subjected the cells to AXL inhibiton, followed by IFN-γ or PTX treatments. PD-L1 expression was then tracked by qPCR.

AXL inhibition reduced drug-related PD-L1 induction while keeping IFN-γ induced expression intact. The data indicated *AXL* is involved in a non-canonical pathway of PD-L1 induction and combinations of a PD-L1 inhibitor and other agents may provide future therapeutic benefit.




Board 24

EMMA BLACKBURN

Research Mentor: Xiaorong Lin
Department of Microbiology University of Georgia

Quorum sensing a major mechanism of cellular communication regulates the expression of genes in response to cell density. This communication is facilitated by various proteins that act as signals. We hypothesized two potential quorum sensing proteins, specifically transcription factors to be responsible for this communication. We found that artificially producing these proteins caused the cell morphology of *Cryptococcus neoformans* to change.

OVEREXPRESSION OF QUORUM SENSING TRANSCRIPTION FACTORS *NRG1* AND *CQS2* AFFECTS FILAMENTATION IN *CRYPTOCOCCUS NEOFORMANS*

Cryptococcus neoformans is an opportunistic fungal pathogen responsible for cryptococcal meningitis, a lethal infection most prominent in immunocompromised individuals. The disease kills over 180,000 people annually. *C. neoformans* utilizes quorum sensing, an essential form of communication that enables the organism to regulate gene expression in response to changes in cell density. Quorum sensing is involved in cryptococcal progression within the host. Quorum sensing relies on autoinducers, which are chemical signals released that increase proportionally with cell density. Qsp1, a quorum sensing peptide, of *C. Neoformans*, activates the transcription factors Nrg1 and Cqs2. I discovered that overexpression of these transcription factors results in phenotypic changes in filamentation and the growth rate, both essential components of virulence.

Board 25

HIEN NGOC MAI

Research Mentors: Zhude Tu and Hao Jiang
Mallinckrodt Institute of Radiology,
Washington University School of Medicine

PET radioligand images is a promising application for diagnosing early-stage disorders and assessing disease progression.

CHARACTERIZATION OF S1PR2 SPECIFIC RADIOLIGAND [^{11}C]TZ34-125 IN STREPTOZOTOCIN INDUCED DIABETIC MODEL

Sphingosine 1-phosphate (S1P) and its receptor S1PR2 play essential roles in many physiological and pathophysiological processes such as diabetes. Studying the role of S1P and its receptor S1PR2 in the process of diabetes would provide novel ideas for the prevention and treatment of diabetes. Radioligand is a promising application for quantifying receptors, and the PET images taken from radioligand can help diagnose early-stage disorders and assess disease progression. Our lab has designed and successfully synthesized the S1PR2 specific radioligand [^{11}C] TZ34-125 compound. We hypothesized that the expression of S1PR2 be increased in streptozotocin (STZ) induced diabetic mice, and the increase of S1PR2 in diabetic mice can be detected by our S1PR2 specific radioligand [^{11}C]TZ34-125. To have induced diabetic models, we injected a single high dose of streptozotocin (STZ) to 10 weeks old mice. We measured the mice's glucose level and weight level on Day 1, Day 3, and Day 6 after streptozotocin (STZ) injection. Our collected data on the mice's glucose level and weight level confirmed a successful induced diabetic model. On Day 7, after streptozotocin (STZ) injection, we injected the radioligands [^{11}C]TZ34-125 to the mice, and after 30 minutes, we had biodistribution and tissue collection. We noticed that in the spleen and pancreas of streptozotocin (STZ) treated mice, the uptake level of [^{11}C]TZ34-125 was significantly higher than in the spleen and pancreas of control mice. This data validates our hypothesis that the uptake of radioligand [^{11}C]TZ34-125 is higher in diabetic mice. We performed Immunohistochemistry staining in the pancreases of the streptozotocin (STZ) injected mice and the control mice. The collected data confirmed our hypothesis that S1PR2 had higher expression in diabetic mice, and the increase of S1PR2 in diabetic mice can be detected by our S1PR2 specific radioligand [^{11}C]TZ34-125.

Board 26

ISABEL JOHNSON

Research Mentor: Fay-Wei Li
Boyce Thompson Institute, Department of Plant Science,
Cornell University

Hornworts are important in understanding plant evolution from algea but more genetic studies need to be done. This study focused on a strain of hornworts that had a gene that glows under fluorescent light inserted into it's DNA. Though,this specific strain only glowed in the rhizoids; little root-like structures that hornworts have. To investigate this, we looked closer at the DNA, specifically where the genes that we inserted landed in the DNA. We then compared the genes around this insert to the genes in other hornwort species to try and understand why only the rhizoids were glowing.

THE INVESTIGATION OF A HORNWORT INSERTION LINE WITH RHIZOIDS SPECIFIC GFP EXPRESSION

Hornworts share an ancestor with vascular plants around 500 million years ago and serves as the keystone for understanding the evolution of all vascular plants known today from their algal ancestors. Hornworts also have a symbiotic relationship with cyanobacteria and contain pyrenoid structures that sequester more carbon than chloroplasts of vascular plants. Doing more research on hornwort genomes will therefore aid in our understanding of these characteristics so that they might be implemented in crop plants to increase agricultural yield. There is not much coverage of hornworts in the literature, so preliminary investigation of these hornwort genomes is needed. This investigation looks at the rhizoids of the model species *Anthoceros agrestis* after it was bombarded with a plasmid containing the fluorescent gene GFP via a gene gun. Though the plasmid containing GFP was bombarded in all tissue, only the rhizoids of this specific strain fluoresced under UV light. To try and understand this, RT-PCR was performed on rhizoid tissue on the genes surrounding the insert to see if they are being expressed and acting as a promoter for GFP. This test showed the genes present and expressed in rhizoid tissue. The DNA of the strain was also sequenced using Nanopore and Readfish Selective Sequencing to gain longer reads and more depth on our target insertion site. The DNA sequence showed multiple inserts of the GFP gene as well as its promoters. A pairwise comparison of the syntenic relationship of the genes surrounding the GFP insert showed the genes belonging to a very large syntenic block conserved in all the genomes of hornworts. GO enrichment factors of this syntenic block were examined and showed an enrichment of DNA-transcription factors. This leads us to believe that the genes surrounding the GFP insert are epigenetically controlled (i.e., methylation or histone acetylation) which is consistent with these gene's large synteny and enrichment factors.

Board 27

ISABEL SOLOWIEJ AND REBECCA HÖLZEL

Research Mentors: Christopher Hadad, Ryan Yoder, and Joseph Fernandez
Department of Chemistry and Biochemistry,
The Ohio State Univesity

Chemical nerve agents are a lethal branch of weaponry that lack a widely effective and available treatment, resulting in thousands of exposures and deaths each year. The FDA approved treatment for nerve agent exposure is lacking, as the treatment cannot access all damage caused. This project explores a new approach to nerve agent treatment with a new molecule component, a diketopiperazine (DKP), allowing therapeutics to easily access all nerve agent damage in the body.

DKP DEVELOPMENT AS TREATMENT FOR OP NERVE AGENT POISONING

Exposure to organophosphorus (OP) nerve agents and pesticides presents a threat to health, safety, and national security. OP nerve agents inhibit acetylcholinesterase (AChE), an enzyme found in the nervous system, neuromuscular junctions, and red blood cells designed to hydrolyze the neurotransmitter, acetylcholine (ACh). OP compounds phosphylate the catalytically active serine residue of AChE, inhibiting the enzyme from performing hydrolysis. Certain nucleophilic oximes have been identified as a treatment in the event of OP nerve agent exposure, reactivating the inhibited serine residue. These therapeutics are limited in effectiveness because of challenges in crossing the blood brain barrier (BBB), limiting access to the inhibited AChE in the brain.

In response to this problem, we proposed the use of diketopiperazines (DKPs) as transport agents to create a shuttle that allows the oxime reactivator to cross the BBB. The initial shuttle design included a peptoid BBB shuttle component, linker component, and therapeutic component. Combinations of side chains, DKP linkers, and oxime reactivators were examined through Epik protonation prediction, Gaussian quantum mechanical optimization, AutoDockFR docking, and SwissADME drug efficacy prediction for VX and sarin nerve agents. Compounds with no net charge or masked charges, likelihood to exist at physiological pH, and shortest oxime-phosphorous reactive distances were identified as lead compounds. Straight chain linker components and arginine or tBu protected glutamate side chains were generally preferred for reactivation potential. No difference was apparent between therapeutic oxime reactivators. A set of four DKP compounds with overall greatest potential to be effective treatments for VX and sarin inhibited AChE were selected to move forward for synthesis, *in vitro* testing, and *in vivo* testing.

Board 28

ISAIAH BRANT

Research Mentors: Patrick Brennan, Samuel Franklin, Ben Kelly, and Alejandro Otero-Bravo
The Institute of Genomic Medicine

The current file type that is actively being used for storage at the Institute of Genomic Medicine is annually costing them $100,000. To effectively resolve this issue we researched a new file type that will reduce file size and ultimately save the Institute of Genomic Medicine over $50,000. While analyzing these new files for a loss of data to insure that it will not hinder with the Institute of Genomic Medicines workflow.

REDUCING CLOUD COMPUTING COSTS THROUGH COMPRESSION OF GENOME SEQUENCING DATA

The Institute of Genomic Medicine (IGM) spends over $100,000 annually on storing BAM files. BAM files are essentially the sequenced raw genetic data of an individual or in our case patients and IGM generates an abundance of BAM files which are eventually archived. BAM files are quite large and our motivation is to resolve the issue of file size with the use of SAMtools CRAM compression. SAMtools CRAM guaranteed that CRAM files are 40% smaller than BAM files but we tested different CRAM commands to observe the compression on our own BAM files, allowing us to access if there truly is a 40% difference in file size and also to obverse the quality of CRAM files considering that there may be a loss of data during compression. We observed a 55% difference in file size with the archive SAMtools CRAM command which progressed our research to enhance this command with the use of multithreading. SAMtools CRAM runs on mono-threading which can cause that single thread to become backed up during compression and negatively affect the compression of the file. To accommodate this we did a series of tests using different amounts of threads and observed that 8 threads was the most optimal during CRAM compression, resulting in a 62% difference in file size when multithreading is partnered with the archive SAMtools CRAM command. As a result of our research we will yield an estimated cost saving over $50,000 but we did observe a loss of data during compression. SAMtools CRAM resulted in the removal of the NM and the MD tags within read data: the NM tag is the edit distance to the reference and the MD tag is string encoding that is mismatched and deleted within reference bases. We consulted with the analysis team that work very closely with these BAM files and they verified that the removal of these tags alone will not hinder their analysis. As our next step we intend to use SAMtools CRAM compression on a cohort of BAM files to observe how the SAMtools CRAM command fares with a larger data set, with intent of fully implementing SAMtools CRAM.

Board 29

JOSH PLETCHER
ALAN COHN

Research Mentors: Lisa Tabak and Dustin Reichard
Department of Biological Sciences

Climate change is a global phenomenon most noticeably expressed by the melting of polar ice caps and glaciers. Alaska is the northernmost state in the Union and is home to more glaciers and sea ice than any other state, making the effects of climate change much more drastic. Museums, zoos, and national parks are an important aspect of communicating the science behind climate change to the general public. We went to Alaska for two weeks to examine how museums and other institutions present climate change to the general public in places such as Seward, Anchorage, Denali, and Fairbanks.

DEFROSTING SEWARD'S ICEBOX: CLIMATE CHANGE AND MUSEUMS IN ALASKA

Climate change is an emerging threat to ecosystems and communities worldwide. The effects of climate change are most striking in the polar and subpolar regions, such as the State of Alaska, where melting glaciers and sea ice directly impact local landscapes, wildlife, and human settlements. We travelled to Alaska to see how zoos, museums, and national parks are reacting to climate change and how they are presenting it to the general public. We visited Seward, Anchorage, Denali, and Fairbanks. Seward is the coastal terminus of the Alaska Railroad and headquarters of Kenai Fjords National Park. Anchorage is Alaska's largest city and home to the Anchorage Museum and the Alaska Zoo, and within a short drive of the Portage Glacier and the Alaska Wildlife Conservation Center. Denali National Park encompasses 6 million acres including North America's tallest peak Mount Denali and is inhabited by black and grizzly bears, moose, Dall's sheep, and herds of caribou. Fairbanks is Alaska's second largest city and the location of the University of Alaska Fairbanks Museum of the North and the Large Animal Research Station. Also nearby is the United States Army Corps of Engineers Permafrost Tunnel.

Counter to our expectations (as of August 8 at least), climate change was not as prominently discussed in museums or zoos. And while the visitor's centers of the national parks may have discussed it more in depth, these were unfortunately closed due to the COVID-19 pandemic. From what we did manage to find, some of the more relevant effects of climate change in Alaska included thawing permafrost creating "rollercoaster roads", glacial retreat, and shifting native species such as caribou farther north and allowing invasive species like the spruce bark beetle to expand northwards.

Board 30

JOY BURAIMA

Research Mentors: Marcelo Febo and Marjory Pompilus
Department of Psychiatry, McKnight Brain Institute, College of Medicine, University of Florida, Gainesville, Florida

Aging has several implications including deteriorating physical health and an increased risk for dementia, neuropsychiatric disorders and conditions that contribute to cognitive decline. That being said, aging is also associated with an increased incidence of mood disorders, which have been identified as a risk factor for the development of dementia. The goal of this pilot study was to establish a baseline model of normal aging in mice to identify what behavioral differences naturally occur in an aging population using behavioral tests and functional magnetic resonance.

REWARD, SOCIABILITY, AFFECTIVE BEHAVIORAL AND FUNCTIONAL NEUROIMAGING DIFFERENCES IN YOUNG, MIDDLE, AND AGED C57BL/6J MALE AND FEMALE MICE

According to the WHO, mental health conditions affect 15% of adults ages 60 and older and accounts for 6.6% of total disability. These conditions are often underdiagnosed because they occur along with other primary systemic and neurological conditions. More research on the neurobiological regulation of mood and affective states in aging subjects is thus needed. We investigated reward preferences, sociability, and anxiety-like behavior in male and female C57BL/6J mice tested after arrival at 10, 30, and 60 weeks of age. Mice were behavioral assessed using protocols for sucrose preference, social interaction/recognition, open field activity, and contextual fear condition (CFC). Mice were then imaged at 4.7 Tesla under combined dexmedetomidine/isoflurane anesthesia to measure resting state functional connectivity across cortical, striatal, hippocampal, and amygdala nodes. Initial analyses of general locomotor activity in an open field environment indicates that 10-week-old mice had higher levels of horizontal activity than 30- and 60-week-old mice. The total distance moved during testing showed a similar difference, however, stereotyped activity was not different between the 3 age groups. Interestingly, 10-week-old mice ambulated at much higher levels in the center of the test arena than 30- and 60-week-old mice. We used a 3-day CFC protocol that included a conditioning day, a retrieval day, and a 2nd retrieval day with changes to context. Mice in all age groups acquired tone-shock paired freezing behavior at the same rate and extent on day 1. All mice showed robust conditioned fear to tone alone on day 2, with 60-week-old mice trending towards higher levels of conditioned freezing relative to 10- and 30-week-old mice. On day 3, 10-week-old mice had lowest levels of conditioned freezing in a modified context. Our data suggest that aged (60-week-old) C57BL/6J mice are less active, exhibit anxiety-like behavior in an open field, and express higher levels of fear conditioning and more difficulty in suppressing conditioning in a modified context when compared to younger 10-week-old mice. Ongoing analyses will investigate reward preferences, sociability, and functional connectivity in these mice. The present preliminary results show initial evidence of differential expression of affective and cognitive behaviors in aged C57BL/6J mice.



Board 31

JUSTICE CLARK

Research Mentor: Tasha Posid
Department of Urology at Ohio State University

COVID-19 has impacted medical education, which resulted in the cancelation of clinical rotations, which affects the educational progress of 4th-year medical students. In this study, researchers have created a virtual curriculum, consisting of nine lectures, which provide supplemental education on core Urology topics, which originally would be taught in-person. Nine lectures were created and distributed either "live" or as recordings to these medical students as well.

MEDICAL EDUCATION IN THE TIME OF COVID-19: A DIDACTIC CURRICULUM FOR RISING UROLOGY ROTATORS

COVID19 has profoundly impacted the world, with critical changes to Medical Education both immediately following the peak onset of the pandemic and in months to follow. In particular, all in-person away rotations were canceled in late spring and summer of 2020, meaning that rising third-year medical students would not have the opportunity to rotate with Urology prior to their sub-internships, and away rotators joined departments virtually as well. In summer 2020, our Education Leadership designed and implemented a virtual didactic curriculum to minimize lost learning and provide rising 4th-year medical students or virtual urology rotators with core urology education to supplement what they would have typically received in person.

Nine lectures covering foundational urology topics were created and delivered by faculty via Zoom; either "live" for our institution's medical students (n=9), or as recordings for virtual rotating sub-interns (n=9). A post-curriculum survey evaluated gains in content knowledge, curriculum satisfaction, and usefulness to education.

18 students participated, and 38.4% of lectures were viewed 'live' with 61.6% as recordings. Students demonstrated significant pre- to post-curriculum gains and this was also true for each individual topic presented (all ps<0.001). Both live and recorded formats resulted in significant gains in content knowledge overall, with greater gains for those participating live. More than 90% of participants 'Agreed' or 'Strongly Agreed' that the curriculum better prepared them to rotate with Urology, increased their knowledge of the subject matter, and said they would recommend it to a peer.

In conclusion, Virtual Sessions led by expert Urologic educators can make a significant impact on trainee learning, despite the limitations imposed by remote education. These advantages can be leveraged for future learning as we transition back to more traditional models.

Board 32

KADEN HUBLY

Research Mentors: Thomas Weiss and Ivan Rajkovic
SLAC National Accelerator Laboratory, Stanford University

It is important for a research lab to operate efficiently in order to save time and money. Doing so leads to more discoveries that can benefit humankind in a shorter period of time. In order to improve the efficiency of a lab at Stanford's SLAC research facility, I wrote a computer program using the python programming language that reduces the amount of biological material needed for them to run their experiments. This improves efficiency as obtaining biological materials is time consuming and expensive.

OPTICAL DETECTION OF FLUIDS

Solution small angle X-ray scattering (SAXS) is one of the few experimental techniques in structural biology that is capable of depicting the structure of proteins that have been in solution. To begin the experiment, the sample solution is inserted into a capillary tube where it interacts with an X-ray beam. In the current sample delivery process, a higher volume of protein is used than necessary to ensure that the X-ray beam hits the sample within its boundaries. This is problematic as obtaining the protein is a tedious and expensive process, so reducing the volume of protein needed is crucial to improving experimental efficiency. To do so, a computer program using the python programming language was written to automatically detect where the sample is in relation to the x-ray position using camera images. Furthermore, if the x-ray is not hitting within sample boundaries, it indicates how far and in what direction the sample needs to be moved.

Board 33

LYDIA ARNOLD

Research Mentors: Yitao Dai and Alessandra S. Eustaquio
Department of Pharmaceutical Sciences and Center for Biomolecular Sciences, College of Pharmacy, University of Illinois at Chicago

A specific genus of bacteria is found to colonize on healthy marine sponges. These bacteria produce a natural product that allows the bacteria to survive on the sponge more easily. We studied the production of this natural product and its benefit to the bacteria.

REVERSE GENETICS TO INVESTIGATE THE ROLES OF TWO GENES IN THE BIOSYNTHESIS AND EXPORT OF NONRIBOSOMAL PEPTIDE NATURAL PRODUCTS

Microbial secondary metabolites (natural products) play important roles in organismal behavior and in microbe-host interactions. Genomes of *Pseudovibrio* marine bacteria isolated from healthy marine sponges contain a nonribosomal peptide synthetase, polyketide synthase gene cluster shown to encode the biosynthesis of pseudovibriamides which were shown to affect swarming motility and biofilm formation. The goal of this project was to use reverse genetics methods for *Pseudovibrio brasiliensis* strain Ab134 to study two flanking genes, open reading frame (ORF) 1 and 2. Based on sequence similarity, we hypothesized ORF1 encodes a major facilitator superfamily transporter potentially involved in pseudovibriamide export, and ORF2, a GCN5-related N-acetyltransferase (GNAT) potentially involved in pseudovibriamide propionylation. Gene deletion mutants for ORF2 were obtained via homologous recombination and confirmed by Polymerase Chain Reaction. Comparative metabolite analysis of ORF2 mutant and wild-type strains using matrix-assisted laser desorption/ionization-time of flight (MALDI-ToF) mass spectrometry suggest that ORF2 is not involved in the production of pseudovibriamides. Moreover, the ORF2 mutant's swarming motility was comparable to the wild-type strain. Deletion of ORF1 is still ongoing. Once mutants are obtained, we will perform comparative swarming assays and metabolite analysis of supernatant and cell pellet extracts to test the hypothesis that ORF1 is a pseudovibriamide transporter.

Board 34

SYED SHARIQUE AHMED

Research Mentor: John M. Herbert
Department of Chemistry and Biochemistry, Ohio State University

Computational quantum chemistry (that's a mouthful!) is expensive business. Calculating different properties of large molecules (bunch of atoms — you know the building blocks of matter) can take a long time on the supercomputer (extremely high performing computer on steroids). Fragmentation is like breaking up a big task into small pieces and different people can do the task simultaneously making it faster and easier to do. My project was to help develop a software that can do fragmentation and has other cool features that can help research in the field and eventually help students study as well

FRAGMENTATION IN COMPUTATIONAL QUANTUM CHEMISTRY: DEVELOPING PYFRAGMENT

Computational quantum chemistry calculations scale nonlinearly and to get an accuracy of 1 kcal/mol the time cost is $O(N^7)$. To put this in perspective, doubling the system size from one molecule to two molecules leads to a 2^7 increase in computational time (calculations take 128 times longer). Additionally, there is a storage cost of $O(N^4)$ associated with the same methods. A possible solution to calculating properties of large molecules and systems like protein chains is fragmentation. Fragmentation involves breaking down large molecules into smaller subunits. Computational can be parallelized and each fragments property like energy can be calculated on s different node reducing wall time. Different levels of theory can be applied in layers to achieve a tradeoff between accuracy and computational time. Over the summer, the software developed by the Herbert group — PyFragment was interfaced with MOPAC, a quantum chemistry package for semiempirical methods. Additionally, distance-based screening was implemented. The tasks involved coding in Python, Yaml, and knowledge of regular expressions, GitLab (collaborative development with version control), SQLite to navigate the new database implementation, and command line prompts. Upcoming tasks include energy screening, extracting matrices-based properties from text files and eventually gradients and dependency trees.

Board 35

LAUREN BARNES

Research Mentor: Elizabeth Kantor
Department of Biostatistics and Epidemiology,
Memorial Sloan Kettering Cancer Center

Per- and polyfluoroalkyl substances (PFAS) are a class of pollutants associated with various health concerns. One of the most common sources of PFAS in our bodies is seafood consumption — PFAS enter waterways, the fish living in those waters, and finally the humans who eat the fish. Our study used survey data to examine whether or not regular use of fish oil supplements made from those same fish also contributed to PFAS levels in Americans.

ASSOCIATION BETWEEN FISH OIL SUPPLEMENTS AND PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

Per- and polyfluoroalkyl substances (PFAS) are widespread pollutants and associated with a variety of potential health concerns such as decreased immune response. Although fish consumption has been associated with increased PFAS levels, little is known about the association between fish oil and PFAS. For this study, we examined associations between fish oil supplement use and serum PFAS levels. This analysis includes 4,672 U.S. adults, ages 25 and older, surveyed from 2007-2014 as part of the National Health and Nutrition Examinations Survey (NHANES). Fish oil supplement use over the prior 30 days was assessed during an in-home interview, and defined as follows: no use, low use (<1 serving/day), and high use (1+ serving/day). Outcomes include four serum PFAS compounds: PFOS, PFOA, PFNA, and PFDE. To determine the association between fish oil use and log-transformed PFAS levels, survey-weighted linear regression was used to evaluate the multivariate-adjusted ratios between supplement-users' and non-users' geometric mean PFAS concentrations. Compared to no use of fish oil supplements, high use was inversely associated with PFOS levels (ratio = 0.88; 95% CI = 0.77, 0.997), with no association observed for PFOA, PFNA, and PFDE. Associations pertaining to PFOA varied by survey cycle (p-interaction = 0.048), but fish oil use was not significantly associated with PFOA levels in any survey cycle. Results did not vary significantly by age or sex. However, fish oil supplement use was significantly associated with lower PFOS levels in female participants (p-trend=0.03), but not male participants. Fish oil supplements were inversely associated with PFOS levels- an association driven by female participants. Fish oil use was not associated with the other PFAS examined. Future work is needed to determine if this pattern of association reflects a true association, residual confounding, or chance.

Board 36

MAYUKHA DYTA

Research Mentor: Harpreet Singh
Department of Physiology and Cell Biology at
The Ohio State University

Exosomes, extracellular vesicles, are important to cells because they help communication, transfer DNA, and deliver cargo from one cell to another. In order to deal with different environments in the body throughout its journey, we hypothesized that exosomes contain a large channel called Ca^{2+}- gated K^+ channels (BK_{Ca} channels) to regulate K^+ (Potassium). By using the planar lipid bilayer system to replicate the cell wall environment, we were able to record BK_{Ca} channel activity in exosomes.

NOVEL ROLE OF BK_{CA} CHANNELS IN EXOSOMES

Exosomes are extracellular vesicles packaged within the cells and are important in intercellular communication, transferring genetic information, deliver the cargo to the target cells, and can be markers of diseases. During their journey from one cell to the other cell, they face differential ionic gradients. The mechanism of handling different ionic environments throughout the circulation is unknown. We predict that exosomes possess an ion-exchange mechanism and we hypothesize that exosomes contain large conductance voltage- and Ca^{2+}- gated K^+ channels (BK_{Ca} channels) to counter intracellular vs. extracellular potassium gradient. Hence to validate the hypothesis, we incorporated the lysed exosomal membranes in a planar lipid bilayer system to record the channel activity of BK_{Ca} channels. Exosomes showed voltage-dependent activity and were sensitive to Ca^{2+} ions in a dose-dependent manner. The channel activity of the exosomal BK_{Ca} channel was blocked by paxilline, a specific blocker for BK_{Ca} channels. Furthermore, we incorporated a novel Near Field Electrophysiology (NFE) method to show the presence of K^+ currents mediated through the BK_{Ca} channel in intact exosomes. NFE result suggests K^+ currents mediated through BK_{Ca} were sensitive to iberiotoxin, a specific inhibitor of the BK_{Ca} channel. The localization of BK_{Ca} channels in exosomes was established through immunocytochemical analysis. Exosomes isolated from plasma of wild type and BK_{Ca} knockout (KO) mice revealed a lesser number of circulating exosomes in KO mice and were smaller in size compared to the exosomes from BK_{Ca} WT. Overall, the study elucidates the novel role of BKCa channels in exosome survival and structural integrity.

Graduation with Honors in Scholarship requires an independent project, an oral exam on the project, and a comprehensive exam in the student's major department during the senior year. The program is open to students who have attained cumulative grade point averages of 3.5 in their majors after fall semester of the junior year, as well as overall grade point averages of 3.0 or the support of their academic major departments, and have successfully petitioned the Ohio Wesleyan Academic Policy Committee.

Student Name	Mentor	Department	Title
Emma Hall	Suren Ambegaokar	Neuroscience	Optimized Protocol for Robust Differentiation of SH-SY5Y Cells into Neuronal-like Cells
Margaret Kriebel	Anne Sokolsky	Comparative Literature	Kami, Esir, and the Liminal Space between Dichotomies: Gender in Japanese and Old Norse Myth
Apoorva Puranik	Suren Ambegaokar	Neuroscience	The Practice of Ayurveda and African Traditional Healing
Richard Sammartino	Lee Fratantuono	Classics	An Analysis of the Use and Critique of Classical Philosophy in Augustine's *De Cicitate Dei Contra Paganos*
Hannah Treadway	Glenda Nieto-Cuebas	Modern Foreign Languages	"Medieval Ballads in Miniature: Shadow of Myself": A Review of the Modernization of the Medieval Spanish Romance Genre Through Adaptation

SPECIAL ACKNOWLEDGEMENTS

Sources of Support for the 2021 Summer Science Research Program

American Electric Power Foundation
Harry Phillip Bahrick Summer Research Fund
Joseph H. ’30 and Elizabeth Brant Collaborative Research Fund
Eleanor Brown Summer of Science Research Endowment
Jack E. ’52 and Joyce A. Cornett Summer Science Research Fund
Anne E. Donnelly ’75
Herbert L. ’61 and Margaret Wright ’61 DuPont Collaborative Summer Research Fund
Ferry Family Foundation
Dr. James B. Hoy ’57 Endowment
Robert V. and Alice C. Kail Summer Science Research Internship
Marcia Kunstel ’69
The Frank McKinney P ’71 and Donalda McKinney P ’71 Endowed Fund
Albert A. Mills Jr. Summer Science Research Program Fund
National Science Foundation
Bruce R. Roberts Research Endowment for The OWU Connection
The David O. and Janice S. Robbins Summer Science Research Endowment
David H. Smith ’53 Fund for the Sciences
The Student-Faculty Endowed Research Fund in Chemistry
Ohio Wesleyan University Provost and Academic Affairs Office

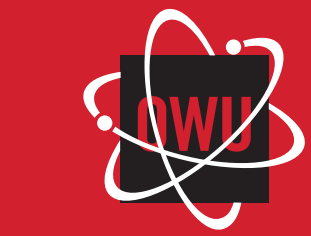
Support for the Patricia Belt Conrades Summer Science Research Symposium

Dr. Nancy Reynolds Schneider ’64

Researchers

Special Thanks

Rock Jones
Karlyn A. Crowley
Dale J. Brugh
Sue Haidle
Chuck Della Lana
Elaine Chun
Lindsay Mauter
Barb Wiehe
Jill Kerins
Ohio Wesleyan University Buildings and Grounds Staff
AVI Fresh
OWU/ABM Housekeeping Staff
Office of University Communications
Faculty supervisors and student volunteers
Parents and guardians of student researchers



Summer Science
Research Program

Ohio Wesleyan University

61 S. Sandusky Street · Delaware, Ohio 43015 • owu.edu/ssrp