September 28, 2023

Patricia Belt Conrades

Summer Science Research Symposium

Ohio Wesleyan University

MYLES STEED

OWU '23, SSRP '21 | CURRENTLY A PH.D. STUDENT AT UNIVERSITY OF PITTSBURGH

"This fall, I begin a Microbiology & Immunology Ph.D. program at the University of Pittsburgh with the ultimate goal of becoming a clinical virologist. This career choice would have not come to fruition without learning about what it means to be a scientist through the SSRP program. The SSRP program was my first introduction to research, showing me how to think critically, communicate effectively, and to be patient, all qualities that I will continue to carry with me throughout my scientific career."

THE PATRICIA BELT CONRADES SUMMER SCIENCE RESEARCH SYMPOSIUM

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

Now in its 31st 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/ssrp2023.

CONTENTS

September 28, 2023 | 1-3 p.m.

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

owu.edu/ssrp
owu.edu/ConnectionConference

THE MAKING OF A SCIENTIST

While so many things have changed recently, 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 mentor here on campus. 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 22 students who performed research at OWU mentored by OWU faculty members and 22 additional OWU students who performed research off campus at other universities. There is no doubt that the results presented here today are exciting and novel. However, equally exciting is the opportunity for you to speak with each of these young scientists about what discoveries they have made.

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

So on behalf of the 44 OWU students and 9 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.
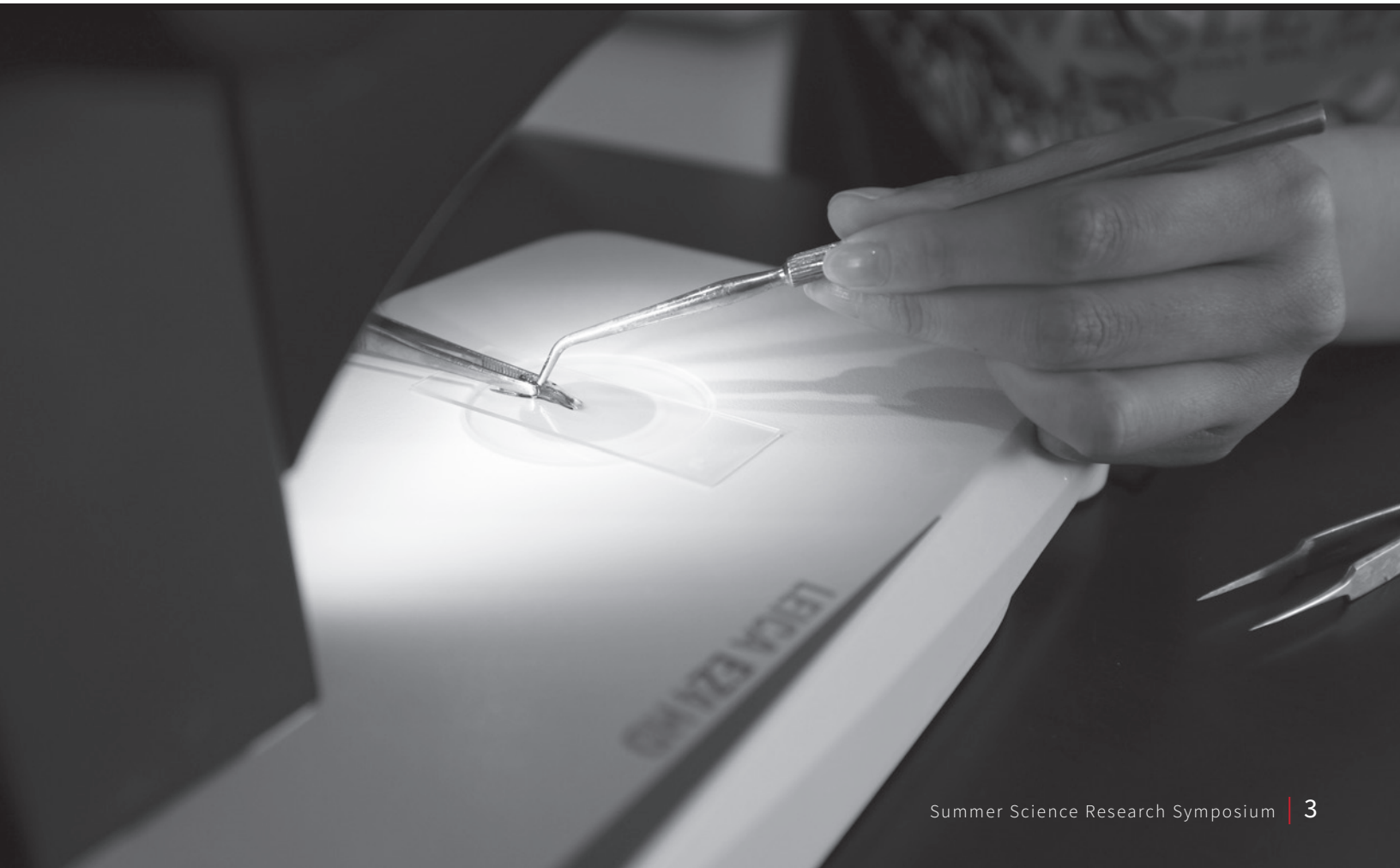
THE C. PATRICIA FERRY SUMMER SCIENCE RESEARCH PROGRAM ENDOWMENT

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

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

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

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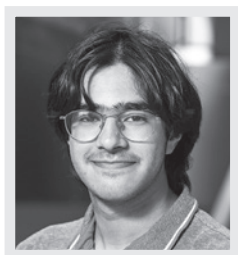
"I am pleased to have graduated from Ohio Wesleyan and to have been a part of doing something that might help the school in some way," Pat said. "It's just part of the giving back. I believe in this."

Abstracts

Board 1

HASSAN MUSHTAQ

Research Mentor: Hanliang Guo
Department of Mathematics and
Computer Science

Traffic modeling is creating a mathematical model to simulate real-world traffic conditions. We built a model to understand single-lane and multi-lane scenarios including intersections. Our work helps us understand how an individual's driving decision affects the overall traffic flow.

TRAFFIC MODELING: A COMPUTATIONAL MODEL FOR TRAFFIC JAMS

Traffic modeling is the process of creating a mathematical model to simulate real-world traffic conditions. Modeling the behavior of individual cars in a microscopic model can allow us to better understand traffic congestion, affect new traffic rules, and understand individual behavior. We built a numerical framework that connects the individual driver's habit with the overall traffic flow properties such as the flow rate which is the total velocity of every car. We used Python, Matplotlib, SymPy, NumPy, and other Python libraries to study the dynamics of different traffic scenarios such as single-lane traffic, multi-lane traffic with lane-changing, and intersections with traffic lights. In the single-lane scenario, we discovered that fewer cars do not necessarily mean a higher flow rate and that there is always a stable velocity that all cars move towards for a particular case. In a multi-lane model, we experimented with the lane-changing variable to visualize whether cars prefer to balance the load between two lanes and how different maximum velocity, minimum headway, and driver patience can cause any changes. In the case of intersections, we discovered that increasing the traffic light time decreases the average total velocity of cars.
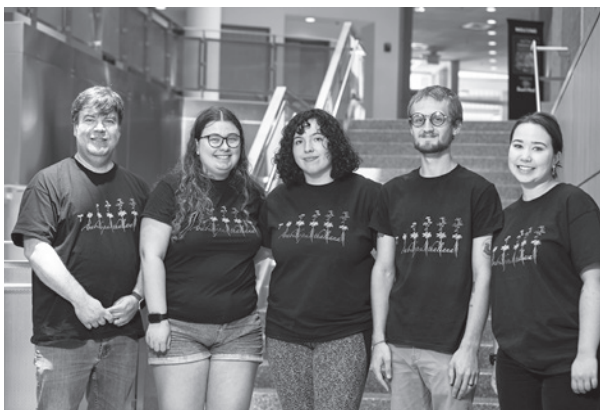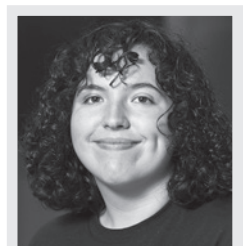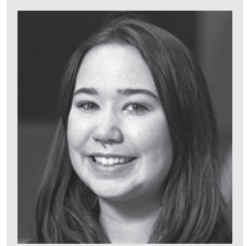
Board 2

PHOENIX BALL
CHANDLER CARR
MADISON COLEMAN
CHLOE SULLIVAN
JASMYN ZIMMERMAN

Research Mentor: Chris Wolverton
Department of Biological Sciences

Gravity plays a predominant role in the growth in development of the plant. It acts as a signal for the stem to grow upwards, against the gravity, and for the roots to grow downwards with it. This response allows the plant to optimize its ability to receive energy from the sun and nutrients from the soil, and understanding how plants sense and respond to gravity will allow humans to develop plants more tolerant of extreme environments. With 124 genes that have been shown to likely have a significant impact in a plant's response to gravity, we are testing to confirm if these findings are true.

UNCOVERING NEW MEMBERS OF THE PLANT GRAVITY SIGNALING PATHWAY

Gravity acts as a constant signal to direct the growth vectors and overall architecture of plant organs. One mechanism by which plants perceive gravity is through the sedimentation of dense, starch-filled plastids in specialized cells of roots and stems. Previous research in our lab used RNA-seq to identify genes with contrasting expression patterns between wild-type and starchless roots during the initial stages of the gravity response, most of which have not previously been implicated in gravity responses. Here we present the screening pipeline we have constructed and an update of work in progress to evaluate these genes' possible contributions to gravity perception, signaling, and/or growth regulation. We have completed one or more growth response assays on almost 80 mutant lines to date, the vast majority of which have been T-DNA insertion lines in the gene of interest. Each mutant was genotyped via gene-specific PCR to confirm the presence of the T-DNA in the gene of interest and tested for the presence of the gene's transcript via RT-PCR. Of the 80 mutant lines on hand, 43 have been confirmed to contain a homozygous T-DNA insertion, 12 have an ambiguous or heterozygous result, and 25 have not yet been tested. 43 of the 80 lines have been tested by RT-PCR to date, with confirmed knockdown or knockout in 14 lines. A series of phenotypic screening experiments was also carried out to elucidate the contribution of that gene to gravity signaling, with 18 mutants showing an altered response to gravity out of the 48 for which sufficient data has been collected. Discussion will focus on the design of phenotyping assays and the use of RNA-seq data as a means of discovering new genes involved in plant gravity responses.
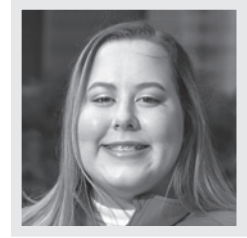
Board 3

GINNY FAETH

Research Mentor: Krystal Cashen
Department of Psychology

The recent wave of anti-LGBTQ+ legislation across the United States has increased discrimination and stigma against LGBTQ+ individuals, which may reduce their parenting desires and intentions. Practicing religion or spirituality within a group can provide the support needed to reduce stress caused by discrimination. With this in mind, we investigated whether religious coping could help reduce the negative impact of discrimination on parenting desires and intentions. Through an online survey, we asked a group of LGBTQ+ non-parents from the United States questions about their daily spiritual experiences, internalized stigma, experiences of discrimination, and their parenting desires and intentions. After regression analysis, it was shown that both forms of stigma did not predict parenting desires and intentions, so further research will be needed to understand the role of religion and spirituality in the parenting decisions of LGBTQ+ people.

THE ROLE OF STIGMA AND RELIGION/SPIRITUALITY IN PREDICTING PARENTING DESIRES AND INTENTIONS AMONG LGBTQ+ ADULTS

In recent years, many bills restricting the rights of LGBTQ+ people have been introduced in the United States, which has had major impacts on the parenting decisions made by LGBTQ+ families (Goldberg, 2023). Such legal discrimination can reduce a queer person's parenting desires and intentions (Carpenter & Nielsen, 2021). The Minority Stress Theory shows that social support buffers the negative effects of stress caused by stigma on queer individuals (Brooks, 1981; Meyer, 2003). Since many religions/spiritualities involve practicing with a group of people, religious coping can be a source of social support (Anderson & McGuire, 2022). Given this complicated intersection, the study aimed to establish a relationship between internalized and enacted stigma and the parenting desires and intentions of LGBTQ+ adults and determine whether religious coping, as measured by the Daily Spiritual Experiences Scale (DSES) (Underwood & Teresi, 2002), is a moderator of this relationship. To be eligible, participants had to be 18 years or older, live in the United States, identify as LGBTQ+, and not currently have any children. Participants (N= 431, M_{age}= 30.45) were recruited through snowball recruiting and CloudResearch and completed an online survey including the DSES, internalized and enacted stigma, parenting desires/intentions, and demographic information. Hierarchical regression analysis was used to determine whether internalized and enacted stigma predicted parenting desires/intentions. When controlling for confounding variables, like age and income, it was shown that internalized stigma did not have a significant impact on parenting desires (β= .024 , p= .393) or parenting intentions (β= .020, p= .494). Enacted stigma also showed similar results with both parenting desires (β= .000, p= .989) and parenting intentions (β= .005, p= .886) Due to a lack of relationship between these variables, DSES cannot be a moderator.

Board 4

LAN DO

Research Mentor: Shala Hankison
Department of Biological Sciences

Many animals mate with multiple individuals to increase the success of passing along their genes. In fishes such as guppies, males prefer to mate with unfamiliar females with which they have not yet had mating opportunities. We tested this in the US sailfin molly. We tested if males preferred to mate with familiar or unfamiliar females more by recording their mating behaviors. Initial results are inconclusive, with more tests yet to be conducted. This study will add information about the evolution and biodiversity of these animals.

MALE MATING PREFERENCES FOR FAMILIAR AND UNFAMILIAR FEMALES IN THE SAILFIN MOLLY FISH, *POECILIA LATIPINNA*

Evolution can favor individuals that maximize their mating opportunities to gain a fitness advantage. Previous studies have found male mating preferences for unfamiliar females in a variety of organisms, including in the guppy *(Poecilia reticulata)*, suggesting that males prefer new females for mating. However, there is less research done in this area for a related fish, the sailfin molly, *Poecilia latipinna*. Sailfin mollies are live-bearing fish native to coastal waters of the southeastern US. We tested whether sailfin molly males showed a preference for familiar or unfamiliar females. Males were observed for association times with familiar and unfamiliar females when separated and then the males were allowed to interact freely with both females. Mating behaviors that he exhibited were recorded. Our hypothesis was that males would prefer unfamiliar females to maximize their fitness (having already had the opportunity to mate with familiar females). Preliminary results are inconclusive as there is a small sample size. This study will add information about the evolution and biodiversity as well as sexual selection of these animals. Future work will test additional males to increase the sample size and investigate sperm allocation (relative number of sperm available for matings) respective to familiar and unfamiliar females.

Board 5

NICK CHURCH
MALCOLM HENDERSON

Research Mentor: Robert Harmon
Department of Physics and Astronomy
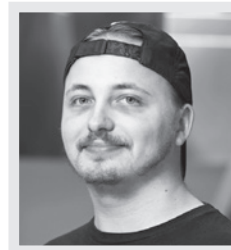
We took digital images of the star LO Pegasi through a 0.35m-aperture telescope at Perkins Observatory using a digital CCD camera on 7 nights in May, June, and July of 2023, and analyzed the images to measure how the star's brightness changes as it rotates. These changes in brightness are due to large dark so-called starspots on the surface being carried into and out of view by the star's rotation. We are interested in studying these starspots because they are caused by magnetic activity, so they can give us an insight into the physics of stellar magnetism. By applying the Lightcurve-Inversion (LI) program developed by Dr. Harmon, we obtained maps of the starspots on LO Pegasi and compared our results to those of previous students from 2014-2022.
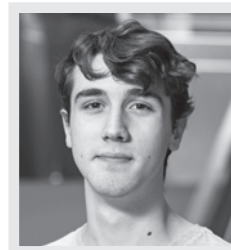
IMAGING THE STELLAR SURFACE OF LO PEGASI USING LIGHT-CURVE INVERSION

Stars with strong magnetic fields and convective upper layers can exhibit dark spots on their surface called starspots due to the magnetic suppression of convective heat transfer. We examine the star LO Pegasi, a K-type main sequence star located 81 light years from Earth. LO Pegasi has a short rotation period of 10.153 hours, which creates a strong magnetic field and starspots on the surface. The spots formed on the surface of LO Pegasi cause measurable changes in the brightness of the star as the star's rotation carries them in and out of view, which we can plot vs the time to create a light curve. We collected images of the surface on seven nights in May, June, and July of 2023 through visual (V), red (R), and infrared (I) standard Johnson-Cousins photometric filters using a CCD camera and 0.35-m telescope and performed differential aperture photometry on them using comparison stars in the star field to obtain light curves of LO Pegasi through these different wavelength passbands. Using the Light-curve inversion (LI) algorithm developed by one of us (Harmon), we created images of possible starspot configurations that would produce the light curves that we observe. By using data collected from 2014 to 2023, we used the surface maps to create visualizations of how the star spots have changed over time on the surface of LO Pegasi.

Board 6

AUBREY GERHARDT

Research Mentor: Danielle Hamill
Department of Biological Sciences

Nematodes, or microscopic roundworms, are a diverse and abundant class of organisms with important roles in agriculture, medicine, and the environment. We are investigating two types of nematodes that we believe are previously undescribed species. In support of this hypothesis, we found visible and DNA-level differences as well as an inability for the different worm types to mate. These results suggest we are studying previously undescribed species of nematodes, which furthers our understanding of this important group of organisms.

IDENTIFICATION AND CHARACTERIZATION OF NEW NEMATODES

Nematodes are an important class of organisms for agriculture, medicine, and the environment; however, many are uncharacterized due to their abundance and variety. In our study, two potentially new species of nematodes were investigated in comparison to a described species, *O. myriophila*, for reproductive, molecular, and morphological differences. Crosses between the different types of nematodes were scored for viable male progeny, an indicator that successful reproduction occurred. Male progeny were not observed in crosses between the three different worm types indicating reproductive isolation. To investigate why no viable out-cross progeny were produced, marked mating experiments were conducted. We stained the sperm of one type of worm and mated it into hermaphrodites of the same or different types to determine if there was copulation and subsequent fertilization and development. In crosses between worms of the same type, stained sperm was found in the uterus and often both spermathecae, and male progeny were produced. In crosses between two potentially different species, stained sperm were observed in the uterus of most hermaphrodites, however, it often did not reach the spermathecae and no male progeny were seen. This shows that sperm gets into the hermaphrodite, but can not fertilize the eggs to produce viable progeny. To further explore whether these worms are different species, we sequenced parts of two highly conserved genes. Specifically, we amplified and sequenced a nuclear gene (18s rRNA) and a mitochondrial gene (cox1). The sequences of these genes varied from 1-8% between the different types of worms. Finally, we carefully measured the worms and saw several morphological characteristics that appeared to differ. Taken together, these results suggest we are studying previously undescribed species of nematodes, which furthers our understanding of this important group of organisms.

Board 7

MADDIE COLEMAN

Research Mentor: Chris Wolverton
Department of Biological Sciences
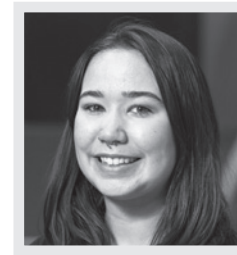
There is a much better understanding of hormones in animals, but their role is more unclear in plants. Within the last few decades, these hormones were found to contribute to plant development and growth as well as stress responses in plants, but what about gravity? Gravity is an important concept in plants and auxin transport plays an essential role in plants. By understanding the MSBP1 gene's connection to auxin transport, it will help scientists to get a better understanding of it's involvement in Arabidopsis Thaliana genome.

KNOCKING OUT MSBP1 GENE IN WILD TYPE PLANTS TO SEE HOW IT AFFECTS AUXIN TRANSPORT IN SEEDLINGS

There is a much clearer understanding on the effects of steroid hormones in animals, but still very little is known about it's extensive outcomes in plants. Scientists know that brassinosteroids contribute to vital plant development and help regulate abiotic/biotic stress responses in plants. However, there is still an unclear connection if there is a gravitropic aspect to these brassinosteroids in plants. In order to explore gravitropism with steroid hormones, an Arabidopsis Thaliana mutant line with the MSBP1 gene locus knocked out will be tested. MSBP1 gene also known as the Membrane Steroid Binding Protein is a vital part of plant regulation that binds brassinosteroids in vitro such as progesterone and brassinolide. Auxin transport is crucial to gravitropism in plants and important gravity-sensing statoliths act on this system in order to respond from gravity. With evidence pointing to a link between the MSBP1 gene locus and auxin transport, I hypothesis that the inhibitory effects of auxin would be suppressed in the MSBP1 absent plants than the wild type because of it unable to redistribute the auxin sufficiently. Any outcome will help scientists to immensely better understand the implications of the MSBP1 locus as well as lead to other conclusions surrounding its major implication in plants.

Board 8

ALYSSA HEAD
## CO-AUTHORS: LOGAN FRAIRE, EMMA FOSTER, MAYA MOORE & EMILY VIRGIN

Research Mentor: Eric Gangloff
Department of Biological Sciences

The way an animal uses its limbs and body in order to move through its environment can impact its ability to survive and travel, and in many species males and females have differently-shaped bodies. In the Common Wall Lizard, we hypothesized that males and females in different reproductive stages use their bodies differently while sprinting to achieve similar speeds despite their different proportions. To investigate this, we measured various body parts in both male and female lizards, then recorded high-speed videos of each individual sprinting on both curved and straight paths. We then analyzed the footage to determine the vertical and horizontal motions of limb segments.

"COME ON BABY, DO THE LOCOMOTION": THE DIFFERENCES BETWEEN MALE AND FEMALE RUNNING STRATEGIES IN THE COMMON WALL LIZARD

In many organisms, males and females have distinctly-shaped bodies and move through their environment differently. Despite these differences, our previous work has shown that male and female lizards maintain similar speeds while sprinting. The kinematics of lizard locomotion has been extensively studied; however, such research has been primarily based on males, leaving many unanswered questions about females. In the context of invasion biology, female organisms are essential to include in such studies because they are the limiting factor in reproduction and population establishment. Therefore, they experience selective pressures not only for survival but also for reproduction. As a successful global colonizer, the Common Wall Lizard *(Podarcis muralis)* has established populations and spread around Cincinnati, Ohio, USA. To address the knowledge gap within these introduced populations, we measured a complete suite of body dimensions in male and female lizards, including the dimensions of the head, limb segments, toes, tail, shoulder girdle, pelvic girdle, and trunk. We then sprinted male, non-gravid female, and gravid female lizards on a racetrack where they followed both straight and curved paths and recorded trials using high-speed video. We used multivariate statistical tools and computer software that implemented deep neural networks to analyze lateral and longitudinal limb movements, joint angles, and stride lengths to investigate the hypothesis that running strategies vary depending on sex and reproductive status. This study thus provides insights into how sexually dimorphic vertebrates may utilize their limbs differently between sexes in order to better survive in novel environments, as well as how females might compensate for increased size and mass during reproduction.

Board 9

LOGAN FRAIRE
CO-AUTHORS: SIERRA SPEARS, ALYSSA HEAD, MAYA MOORE & EMMA FOSTER

Research Mentor: Eric Gangloff
Department of Biological Sciences
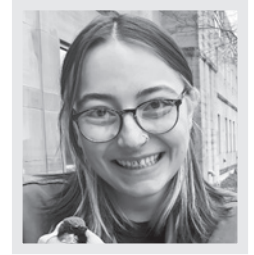
Maintaining our bodies at a steady temperature throughout the day allows us to do tasks like eating and working with ease. As humans, our bodies can keep us from being too cool or warm without the need for any outside help. Animals such as lizards, however, cannot maintain their bodies at a functional temperature by themselves; they are dependent on their surroundings. Our research is focused on the active choice lizards must make when managing their body temperature. By recording data from the environment and establishing preferred lizard body temperatures for daily tasks, we can deepen our understanding of which factors impact temperature regulation.

WHAT FACTORS AFFECT THERMOREGULATORY DECISIONS IN WALL LIZARDS?

In many organisms, males and females have distinctly-shaped bodies and move through their environment differently. Despite these Ectothermic organisms do not internally produce body heat, so effective thermoregulation is necessary to perform essential bodily functions such as feeding, digesting, avoiding predators, and reproducing. While thermoregulatory behaviors have been extensively studied in ectotherms, most research has been performed in captive settings, leaving little known about how conditions in natural environments affect thermoregulatory decisions. Further, little is known about how an ectothermic organism's activity patterns are affected by temperature and other environmental factors across an entire day. We conducted extensive field observations to understand what factors affect activity and thermoregulatory decision-making in introduced populations of the Common Wall Lizard *(Podarcis muralis)* in Cincinnati, Ohio, USA. To do this, we conducted standardized surveys every 30 minutes across the entire daily activity period (8:00 to 20:00) to observe lizard behaviors and record body temperatures using infrared thermography. In addition, we used 3-D printed operative temperature models to measure available temperatures throughout the entire day. We collected data on air temperature, humidity, solar radiation, UV radiation, and wind speed at the start of each survey. We conducted these surveys at three unique sites, including parks and a Wal-Mart parking lot. By combining repeated-measures data on activity and body temperature of individual lizards *in situ* with a suite of environmental data, we can identify the factors that affect lizard thermoregulation. This has important consequences for understanding how these animals can respond to urban environments and rapidly-changing climates.

Board 10

GABRIELLE MAGID

Research Mentor: Nick Dietrich
Department of Mathematics and
Computer Science

Monitoring agencies produce human rights reports that describe the conditions of human rights in each country by year. We use the language in these reports to identify words associated with certain kinds of human rights violations. We then use these word lists to create automated scores for each of these reports. Once these reports have scores, we test the validity of the scores by comparing them to scores produced by expert coders over the last few decades.

SPECIALIZED SENTIMENT DICTIONARIES FOR HUMAN RIGHTS TEXTS

Human rights reports are released yearly by monitoring organizations, describing the details of human rights violations in a country within a specific year (country-year). Our project uses the text within these reports to develop specialized human rights sentiment dictionaries using GloVe, an unsupervised learning algorithm for text analysis, looking at individual words and how often they appear together. These words are converted to word vectors, which we use to calculate word similarities. We use the language in these reports to identify seed words associated with certain human rights, which allows us to tune our dictionaries to specific kinds of rights violations. These dictionaries allow us to develop sentiment scores for particular country-years and compare them to scores provided by well-known coding scales, such as the Political Terror Scale (PTS) and the Cingranelli-Richards (CIRI) Human Rights database. This sentiment method could prove useful for working with all sorts of textual data, as it allows for automated coding that is quick, accurate, and incorporates knowledge from subject area experts.

Board 11

RONALD NETAWAT

Research Mentor: Matthew McCurdy
Department of Mathematics and
Computer Science

Thermal convection is the movement of heat through fluids due to temperature differences. We use Partial Differential Equations (PDEs) to understand it, as PDEs handle changes over multiple variables. Solving PDEs for heat transfer is complex but important for applications like groundwater flow and designing cooling systems. We establish governing equations, define boundary conditions, and use numerical methods to approximate and analyze thermal convection in enclosed porous media.

INVESTIGATING THERMAL CONVECTION IN AN ENCLOSED POROUS MEDIUM

Thermal convection is the process of heat transfer through the movement of fluid caused by temperature differences. The use of thermal convection is vast and dynamic, ranging from ocean currents to designing electronic cooling systems et cetera. Our aim here is to analyze and study the effects, nature, and flow of heat, i.e., convection in porous media with confinements. The holy grail in studying thermal convection is a tool in mathematics called partial differential equations (PDEs). When we are dealing with quantities that change in more than one variable over time, we use PDEs. Since heat transfer varies in both space and time, PDEs are of great essence to our study. PDEs also offer a better way to analyze fluid flow and heat transfer; however, most PDEs do not have analytical solutions that we can solve for. Solving these PDEs, or approximating their solutions, requires us to use some differential equations like the Darcy's equation, Continuity equation, etc. (for our case). We use these equations and manipulate them to fit our needs and research goal. We change the initial and boundary conditions accordingly, and after this is done we feed these factors and variables into a computer that approximates a solution to the PDEs. Our aim is to study thermal convection in an enclosed porous medium particularly because of its vast usage and applications in fields like groundwater flow, oil recovery, filtration, and designing cooling systems for computers. For our project, we first establish the governing equations, use numerical methods to approximate solutions to our system, and then analyze our results.
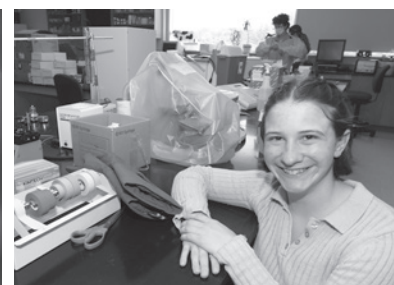
Board 12

AUDREY PROPP
MATT REASE

Research Mentor: Kira Bailey
Department of Psychology, Neuroscience Program
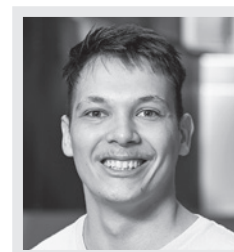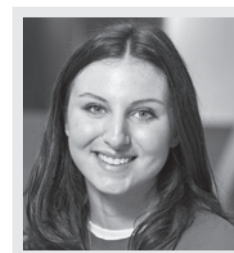
This study examined how video game experience is related to our ability to regulate, coordinate, and sequence thoughts and actions for goal-driven behavior, a set of skills known as cognitive control. High and low gamers completed a task to measure their cognitive control and brain activity, as measured by event-related potentials (ERPs). Low gamers were invited back to be exposed to a first-person shooter or strategy video game while completing the same tasks with ERPs. Based on past research, we expected that the high gamers would struggle with some aspects of cognitive control, and that this would also be the case for the low gamers exposed to a first-person shooter video game.

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

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

Board 13

CHLOE SULLIVAN

Research Mentor: Chris Wolverton
Department of Biological Sciences

A plant's ability to sense changes in its orientation and how gravity is affecting it is an essential and necessary ability for its survival. Starch-filled organelles fall to the new bottom of the cell, which communicates with the plant to release the hormone auxin and encourage growth that follows the "new" gravity. However, when this interaction is inhibited, there is an inability of the plant to readjust. Reactive oxygen species (ROS) are one of the molecules that stops auxin from being transported so that the plant can't readjust. We can predict if the plant has a significantly lower gravity response by utilizing 2′,7′-Dichlorodihydrofluorescein (DCF) — which glows when it reacts with ROS — to see if there is a high concentration of ROS and therefore a lower ability of the plant to readjust.

UTILIZING 2′,7′-DICHLORODIHYDROFLUORESCEIN AS AN AGENT TO PREDICT ABNORMALITIES IN GRAVITY RESPONSE

The ability for plants to respond and adapt to their environment as they grow and develop is necessary for their ability to survive and thrive. Gravity is initially perceived through the relocalization of amyloplasts — starch-filled plastids — when the plant is reoriented. The relocalization of the amyloplasts in root cells serve as a trigger for the release of the hormone auxin in the direction of gravity, further encouraging the gravity response. However, when there is a disruption between the amyloplasts interacting to trigger the auxin, the gravity response is expressed differently. Reactive oxygen species (ROS) is one of the modulators of auxin; when there is an abnormally high concentration of ROS, the auxin is unable to be transported and therefore the gravity response is reduced. By utilizing 2′,7′-Dichlorodihydrofluorescein — a molecule that fluoresces when it is oxidized — the concentration and distribution of ROS can be measured and the level of expression for the gravity response can be predicted. This method can be implemented as a pre-screen in order to prioritize mutant lines that are highly likely to have an abnormally high concentration of ROS (and therefore a reduction in expression) and begin ruling out those that are unlikely to be effected. Discussion will focus on the implementation of this assay and the efficacy of it.

Board 14

CLAIRE HAMMOND
KAYLA SAIKALY

Research Mentor: Chelsea Vadnie
Department of Psychology,
Neuroscience Program
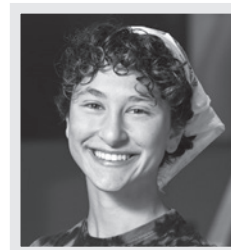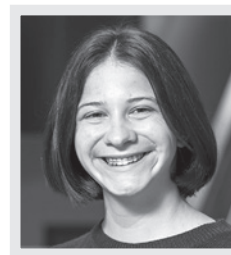
Our project looks at the effects of stress early in life on adult brains using mice as a model system. We have seen an increase in anxiety-like behavior because of early life stress and we are currently examining changes to a chemical system in the brain that is connected to anxiety. If there are changes to this system because of early life stress, it could change our understanding of anxiety treatment and adolescent stress.

DETERMINING THE EFFECTS OF EARLY ADOLESCENT STRESS ON PSYCHIATRIC-RELATED BEHAVIORS OF C57BL/6J ADULT MICE

Anxiety and mood disorders are highly prevalent and often diagnosed in late adolescence or early adulthood, with stress as a major risk factor. Limited studies have focused on long-term neurological and behavioral effects of juvenile stress in mice, which are a powerful model for basic neuroscience research. In this study, male and female C57BL/6J mice were split into stressed and unstressed groups (n=7-8). The stressed mice experienced 3 days of stressors from postnatal day (PND) 25-27. Non-stressed mice remained undisturbed in the animal facility. The stressors used were forced swim, restraint, and elevated platform stress. We hypothesized that stress during early adolescence would cause anxiety and depressive-like behaviors, as well as cognitive deficits in adults. Behavioral testing started at PND 60. We used the open field (OF) and elevated plus maze (EPM) as measures of anxiety-like behavior, the sucrose-preference test (SPT) and tail-suspension test (TST) as measures of depressive-like behavior, and the Y-maze (YM) to test spatial working memory. Results so far show early adolescent stress increases avoidance behavior in adult mice in the OF as measured by a decrease in center entries and time ($*p$ <0.05). However, stress had no impact on behaviors in the EPM, SPT, TST, and YM. Thus, similar to previous findings, we observed that stress during early adolescence increases some anxiety-like behaviors in adult C57BL/6J mice. Early life stress has been shown to affect the expression of subunits of the $GABA_A$ receptor in rodents but results have been inconsistent. Therefore, we are currently determining the effects of early adolescent stress on the expression of $GABA_A$ receptor subunits in brain regions known to play an important role in regulating psychiatric-related behaviors. We hope that our work in combination with previous studies will contribute to the understanding of the long-term impacts of early life stress on adult behavior and neurobiology.

Board 15

MAYA M. MOORE, EMMA FOSTER
CO-AUTHORS: ALI AMER, LOGAN FRAIRE, ALYSSA HEAD, ANNELISE BLANCHETTE & ALEX R. GUNDERSON

Research Mentor: Eric J. Gangloff
Department of Biological Sciences

Lead, a byproduct of human industrial processes, is a toxic heavy metal that has serious health consequences; and while this has been established for humans, such as impaired cognition and reduced oxygen transported throughout the body, little is known about the effects of lead in reptiles. To test the hypothesis that higher levels of lead in the blood negatively affect lizards' abilities to perform tasks necessary to their survival, we captured Common Wall Lizards from various locations across Cincinnati, Ohio, USA, measured lead in blood samples, and assessed endurance and balance abilities. Understanding how these lizards cope with lead toxicity could help us better respond to public health and environmental concerns.
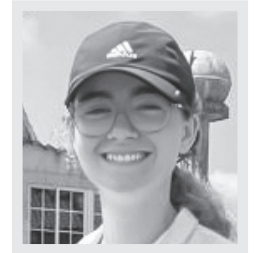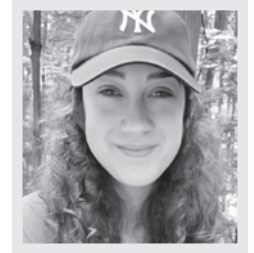
EFFECTS OF LEAD ON PERFORMANCE MEASURES IN THE COMMON WALL LIZARD

Living in urban environments presents many challenges to wildlife, including exposure to potentially toxic pollutants. For example, the heavy metal lead introduces many health problems to various urban organisms, including humans. It is commonly known that lead exposure causes many adverse health effects in humans such as impaired cognition and reduced oxygen-carrying capacity in blood, but little is known about lead toxicity in reptiles. The little work that has been conducted on lead toxicity in reptiles suggests that lizards are extraordinarily resilient to very high levels of lead pollution, by either avoiding or mitigating the toxicity. To assess the impact of lead exposure on urban animals, we evaluated levels of lead in the blood of adult male common wall lizards (*Podarcis muralis,* N = 41) — a small reptile particularly capable of thriving in urban environments. We captured lizards from various locations across Cincinnati, Ohio, USA, collected blood samples, and quantified the concentration of lead in the blood. We then tested balance and endurance abilities, two aspects of lizard performance important for survival. To test balance, we ran lizards on a balance beam and quantified the distance run before falling and the number of slips. Balance is a cognitively-demanding task, therefore this protocol assesses the effect of lead to impair cognition. To test endurance, we ran lizards on a small treadmill and measured the amount of time it took for individuals to become exhausted. Since running endurance is a type of aerobic exercise dependent on oxygen, this protocol assesses the impact of lead on the oxygen-carrying capacity of blood. We then used correlation analyses to quantify the relationship between lead levels and these ecologically-important performance measures. Understanding the effects of lead levels in a particularly resistant animal could help us better respond to public health and environmental concerns.

Board 16

BEN BUROKER

Research Mentor: Nathan Rowley
Department of Environment and
Sustainability

Our goal is to identify different species of plants, identify the number of plants, and even the amount of carbon stored within specific natural areas without ever stepping foot in the research area. We are able to do this remote sensing with drones and complex sensors. This summer, we conducted the theoretical setup for this research by reading scientific papers, understanding other scientists' methods, and then practicing and developing our own methods with data we collected from around campus and Ohio.

USING MULTISPECTRAL REMOTE SENSING FOR HIGH-RESOLUTION ENVIRONMENTAL MAPPING IN COASTAL COSTA RICA

Remote Sensing (RS) relies on technology to gather information about the environment without direct contact with it. Remote sensors utilize the principle that all energy travels in waves of different frequencies in order to learn about the environment. New drones and sensors are quickly and drastically changing the RS field and allowing researchers to ask bigger and more complex questions and discover fascinating and useful answers. Included in these new technologies are the Micasense Dual-Rededge camera system and the DJI Zenmuse L1 LiDAR sensor that we have been conducting research with this summer. These groundbreaking technologies are the premise of the vegetation landscape analysis that we worked on, and require theoretical and practical setup in order to utilize. The multispectral Dual-Rededge camera system with its ten bands of EM wavelengths is designed to allow fine spectral resolution of the red-edge (a swath of the EM spectrum) which can provide insight to crop health and species identification. The LiDAR sensor emits a laser pulse which is transmitted, absorbed, and reflected by the target area before returning to the sensor, generating a 3D point cloud used to create digital surface models, 3D imagery, and more. Our work has allowed us to confidently design research questions, conduct flights, process data, and generate useful outputs using computer software. Further related work includes research partners at MTSO and vegetation landscape analysis in Bahia Ballena, Costa Rica.

Board 17

KEEGAN FLOYD

Research Mentor: David Johnson
Department of Biological Sciences
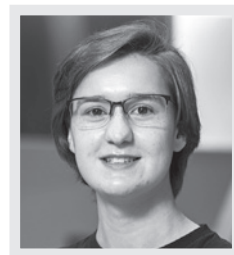
Phylogenetics is the study of relationships between organisms. Researchers compare DNA from groups of related organisms to paint a picture of the Earth's history: the evolution and movement of all organisms on Earth, from animals to plants to single-celled bacteria. Our study focuses on a group of tropical trees called *Xylopia*, chosen as a model to better understand how plants in Africa moved from wet to dry habitats and their subsequent path to spreading across the world.

ASSEMBLING THE TROPICAL TREE GENUS *XYLOPIA*: ANALYSIS OF NUCLEAR DNA SEQUENCES TO DETERMINE EVOLUTIONARY HISTORY

Building on prior studies, we aimed to determine ancestral dispersal patterns of *Xylopia* and understand how some species transitioned from wet to dry environments. We chose *Stenoxylopia* as our study group, a section of *Xylopia* with extant species found in Africa, Madagascar, and the Asia-Pacific, because it contains most of the dry-habitat members of the genus. We hypothesized that most dry-habitat species transitioned from wet habitats recently enough that few species have had enough evolutionary time or selective pressure to reverse the transition and return to wet habitats. The first step was to extract DNA from 271 genes from the dried leaf tissue of herbarium specimens. The DNA data was then processed into a manageable size with the help of the preparation software HybPiper. This processing allowed us to run our data through two tree estimation programs, IQTree and ASTRAL, to produce phylogenetic reconstructions of the *Stenoxylopia* section. We then used the TreePL software to date the tree generated with IQTree, giving us an estimate of the time frame of species divergence within the section. Finally, we used the BioGeoBears program to reconstruct the environment in which the ancestors of these species lived. Results show that the 71 species of *Stenoxylopia* included in the study formed a monophyletic group in both the IQTree and ASTRAL analyses and diverged from the rest of the genus about 26 million years ago. About 16 million years ago, the ancestor of these species diverged into three separate groups: two in Africa and Madagascar and one in Asia and the Pacific. The analysis showed that dry-habitat species evolved multiple times in both Africa+Madagascar lineages within the last 8 million years.

Board 18

JOSEPHINE STARK
BRANDON EDWARDS

Research Mentor: Amy Downing
Department of Biology

The purpose of our experiment is to see if freshwater plankton have the ability to adapt a tolerance to rising salt levels in their environment. We want to study this because human urbanization activities (such as salting our roads in the winter and agriculture) are causing saltier freshwater environments and zooplankton are very important to the food chain and the success of freshwater habitats. We took plankton from three ponds, each with different natural salt levels and moved them to our testing site. We then added varying amounts of salt along the gradient and would sample the tanks periodically and count the amount of plankton still living with a microscope. This allowed us to measure if communities have gained a tolerance based on their natural habitat. We found that communities from the saltier pond showed a higher resistance to salt exposure, meaning previous exposure might cause species to gain higher tolerances.

SALINIZATION EFFECTS ON FRESHWATER ZOOPLANKTON COMMUNITIES

Freshwater ecosystems are increasingly vulnerable to increased salinization in areas where anthropogenic activities, such as applying road salt, occur. Freshwater organisms, including zooplankton, are generally negatively affected by increasing salinity but have been shown to vary in salt tolerance both within and between species. Here, we explore if variation in salt tolerance may be in part due to evolutionary adaptation in areas with historically higher salt exposure. We conducted an experiment in 300 liter freshwater mesocosms where we established replicated plankton communities from 3 different ponds that experienced historically low (1.23-1.33 mg Cl-/L), medium (49.91-244.5 mg Cl-/L) and high (505-1479 mg Cl-/L) salinity. We experimentally exposed each community to salinity gradient ranging from 0 to 1800 mg Cl$^-$ per liter for 6 weeks. Preliminary LC50 values for zooplankton abundance in week 3 ranged from 265 - 657 mg Cl-/L for the zooplankton communities in order of lowest to highest historical salt concentrations, indicating that variation in salt tolerance may be partially explained by previous exposure to salt. Tolerance to salt also varied by species. Finally, phytoplankton biomass increased as zooplankton abundance declined. Our results show freshwater communities with historically more salt exposure are better able to resist higher salinity concentrations, indicating that zooplankton may be able to adapt to increasing salt concentrations.

Board 19

CHANDLER CARR

Research Mentor: Chris Wolverton
Department of Biological Sciences
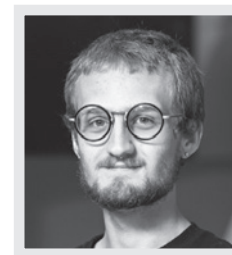
Our lab has discovered 124 genes that may play a role in a nontraditional model of a plant's gravity response, however many of these genes' functions are unknown. One way we are attempting to decipher the functions of these genes is through a guilt-by-association analysis. By understanding which genes are interacting within and between certain treatments, we can estimate their functions from their relationships.

DISCOVERING RELATIONSHIPS BETWEEN GRAVITY-REGULATED GENES THROUGH CO-EXPRESSION ANALYSIS

We previously used RNA-seq to identify 124 genes showing contrasting expression during the early gravity response between roots of wildtype and pgm-1 mutants. Many of these genes are novel and their functions remain unclear, particularly as it pertains to the gravity response. To estimate the functions and behaviors of these genes, we ran them through the public database ATTED-II for known co-expression relationships. Of the 124 genes, 49 showed strong connectivity with each other, aligning themselves within five main groups. We compared the connectivity of our 49 contrast genes to the 63 unique gravity-regulated genes discovered by Kimbrough (XXXX) and the 20 hypothesized gravity-response genes proposed by Kruse (XXXX), as well as 249 genes with known functions from auxin biosynthesis to sterol transportation. We found a large amount of connectivity in this model with 298 unique nodes and 1024 unique edges. To further tease apart the relationships important for the gravity response, we are working on re-examining the RNA-seq data for differential co-expression networks between genotypes and under gravity stimulation.

Board 20

ELISABETH MADORE

Research Mentor: Krystal Cashen
Department of Psychology

Recent discriminatory legislation and changes in abortion access have affected the LGBTQ+ community, which may impact how LGBTQ+ individuals are thinking about future family-building. Participants report an impact of these legislations; for example, we found a variance in the impact of abortion access between the West and Midwest. Still, there is not as much variance across geographic contexts as hypothesized. This study provides initial information to further investigate the impacts of restrictive legislation within geographic contexts for LGBTQ+ individuals.

IMPACT OF LEGISLATIVE CONTEXT ON FAMILY FORMATION DECISION MAKING AMONG LGBTQ+ INDIVIDUALS

This study examines whether LGBTQ+ individuals are adjusting their decisions about parenting based on recent changes in abortion access and discriminatory legislation targeting LGBTQ+ people. Specifically, we tested whether the impact of legislation and the gap between parenting desires and intentions differs between geographic regions. We also examined potential differences between participants who live in urban versus rural area. LGBTQ+ individuals in rural areas report disparities in access to healthcare, safe community spaces, and other affirming resources compared to those living in or close to urban areas (Eisenberg et al., 2019; Hubach et al., 2019; Rosenkrantz et al., 2017). Participants ($N = 434$, $M_{age} = 30.44$) resided in the U.S., identified as LGBTQ+, and did not have children. Participants completed an online survey asking about the perceived impact of legislation and future parenthood plans (e.g., intentions, desires). The gap between LGBTQ+ parenting desires and intentions was calculated using the difference in parenting desires and intentions. State of residence was used to code geographic region (e.g., Midwest, Northeast), and participants' zip codes were used to code urbanicity. Preliminary results showed few differences across contexts. However, there is a significant difference by geographic region for the impact of abortion access, $F(4,427) = 3.85$, $p = .004$. We also found significant differences by geographic region in whether participants considered moving because of anti-LGBTQ+ legislation, $X^2(8) = 47.191$, $p < .001$, and changes in abortion access, $X^2(8) = 36.132$, $p < .001$. Anti-LGBTQ+ legislation has influenced 204 (47%) participants to answer maybe or yes to moving, while 153 (35%) participants reported considering moving because of changes in abortion access. These initial findings suggest that anti-LGBTQ+ legislation impact extends beyond geographic regions. Directions for future research will be discussed.

Board 21

JACK GENSLER

Research Mentor: Peter Kourtev
Department of Biology at Central Michigan University

Purple pitcher plants are a species of carnivorous plant that obtain nitrogen from insect prey which is digested by the microbial community within the pitcher. The investigation uncovered nitrifying microorganisms within the pitcher fluid for the first time which gives insights to how nutrients is cycled in the fluid. These microbes oxidize the products released from digested exoskeletons into nitrate, a key form of nitrogen that can be utilized by not only the microbes in the pitcher but also by the pitcher plant itself. More data is needed to conclude any relationship between the activity of digestion enzymes and the presence of microorganisms that preform nitrification over time.

ENZYMATIC ACTIVITY & DETECTION OF NITRIFYING MICROORGANISMS IN PURPLE PITCHER PLANTS ON BEAVER ISLAND, MICHIGAN

Purple pitcher plants *(Sarracenia purpurea)* are a species of plants that use carnivory to obtain essential nutrients in environments of scarcity. Insect prey, which acts as a major source of nitrogen, are digested by microorganisms within the pitcher fluid. Previous literature has not investigated nitrification and the microbes who participate in the conversion of ammonium to nitrate, a key form of nitrogen that can be utilized by the host plant and other microbes. During five weeks of sampling, fluid samples were measured for chitinase activity and DNA extractions, PCR, and gel electrophoresis were done to detect for nitrifying microbes. The investigation uncovered ammonia-oxidizing bacteria (AOB), ammonia-oxidizing archaea (AOA), and nitrite-oxidizing bacteria (NOB) within the pitcher fluid for the first time which gives insights into an unstudied aspect of nitrogen cycling within pitcher plants. More evidence is needed to determine the relationship between digestion enzyme activity that releases nitrogen into the system, and the presence of nitrifying microbes that convert its products into nitrate. Future sequencing of DNA samples needs to be conducted to confirm results and to identify the detected microorganisms.

Board 22

ANNIE MARAZITA

Research Mentor: Chengcheng Huang
Department of Mathematics, Department of Neuroscience at the University of Pittsburgh

Brain activity is highly variable. How the brain processes incoming information depends on whether you're aroused or drowsy, moving or still, wakeful or asleep, attentive or inattentive. We studied different types of neurons in a region of the mouse brain that combines a variety of information about the external environment to influence behavior. We found that the neurons respond to auditory input and increases in running speed on their own, but interestingly, the auditory-driven response changes depending on the mouse's current running speed.

AUDITORY-DRIVEN ACTIVITY IN CELL TYPE-SPECIFIC POPULATIONS OF MOUSE POSTERIOR PARIETAL CORTEX

Neural responses are highly variable and are modulated by behavioral state. Brain/behavioral states are distinct patterns of brain activity related to changes in levels of arousal, motor activity, and attention. The posterior parietal cortex (PPC) is an association-level region where feedforward inputs from multiple sensory areas, including auditory cortex (AC), converge, and responses in PPC are modulated by behavioral state to allow for flexible integration of these multisensory inputs. Inhibitory interneurons are key to mediating the state dependence of cortical processing and consist of multiple cell classes with specialized gene expression, local circuitry, and functional roles. Parvalbumin- (PV) and somatostatin- (SOM) expressing inhibitory neurons are two such cell types that influence local response properties depending on brain state. To examine how feedforward projections coming from the AC contribute to cell type-specific activity in PPC, putative pyramidal (Pyr), PV, and SOM neurons were labeled within mouse PPC. Activity in the three populations in response to AC axon photostimulation was recorded using two-photon calcium imaging while mice ran voluntarily on a spherical treadmill. Photostimulation resulted in both activation and suppression in all cell types. On average, a greater proportion of SOM cells were modulated relative to Pyr and PV. PPC also had heterogeneous responses to changes in running speed, and the PV cell population was especially modulated. Cells modulated by photostimulation were mostly distinct from cells modulated by running, and there was a weak dependence between cells' responses to stimulation and running. Principal component analysis revealed running speed also influenced the population response to photostimulation, with higher speeds prior to stimulation increasing the response's magnitude. These findings support the importance of inhibitory neurons for flexible processing in association cortex.

Board 23

SPENCER YATES

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

Antibiotic-resistant bacteria are a problem that is becoming more commonplace due to the overuse of antibiotics. Many antibiotics are derived from bacteria products. Our research focuses on finding new antibiotics by culturing and testing soil bacteria for antibiotic properties. By doing this, we can find new ways to treat antibiotic-resistant bacteria.

ANTIBIOTIC PROPERTIES OF ENVIRONMENTAL *BACILLI* AND *ACTINOMYCETES*

The discovery of antibiotics played a crucial role in the development of modern medicine. Since the discovery of penicillin in the 1920s, mortality rates have dropped, and life expectancy has increased worldwide. However, antibiotic-resistant bacterial infections are becoming more common due to overuse. Solutions need to be found before this issue gets out of control. One potential solution to the antibiotic-resistance crisis is finding new antibiotics. Over ⅔ of all antibiotics are derived from bacteria, and 70% come from actinomyces, a soil bacterium. This study focuses on collected soil bacteria, with an emphasis on Bacilli and Actinobacteria, to discover new antibiotics. This is done by culturing each soil sample after two different treatments, boiling and drying, and isolating pure cultures. These pure cultures are then tested against E. coli with and without IPTG to see if there are any antimicrobial effects against gram-negative bacteria. The strains that show antimicrobial properties are prepared for 16s rRNA gene sequencing, which allows for identifying each strain. At the end of the experiment, four strains showed effectiveness as antimicrobial agents. They were all identified as bacillus, peribacillus, or paenibacillus, which is in order with what is known. While no new antibiotics were identified, not all strains have been tested, and there are still potential antibiotic properties regarding Gram-positive bacteria. There is a large capacity for further research to produce promising results and help with the growing antibiotic resistance crisis.

Board 24

KATIE CHITTUM

Research Mentor: Jennifer Lundine
Department of Speech & Hearing Science,
The Ohio State University

Homeless youth experience a multitude of challenges, and these challenges are amplified after an individual sustains a brain injury. For example, one may struggle to complete tasks by themselves, forget instructions easily, or act more impulsively post-injury. By better understanding how brain injury affects an individual, we can more effectively develop strategies to meet these individuals' needs.

EXECUTIVE FUNCTIONING SKILL DIFFERENCES IN HOMELESS YOUTH BASED ON ACQUIRED BRAIN INJURY STATUS

This project examines the executive functioning (EF) skills of homeless youth (ages 18-24) recruited from a local drop-in center. As of this writing, 22 youth have been recruited for this study – 16 with a history of acquired brain injury (ABI) and 6 with no ABI. Participants answer questions and complete multiple cognitive assessments. These data focus specifically on the results of the BRIEF-Adult, Dimensional Change Card Sort (DCCS), and Flanker Task, assessments of general executive function, cognitive flexibility, and inhibition, respectively. It was hypothesized that homeless youth with ABI would have poorer EF than those without a history of ABI, as evidenced by longer completion time and lower accuracy on the Flanker Task and DCCS and more negative symptoms reported on the BRIEF. Preliminary results show, on average, youth with ABI score 7.8 points higher than youth with no ABI on the Global Executive Composite scale of the BRIEF, indicating more difficulty in one or more areas of EF. On the DCCS, youth with ABI demonstrated similar response times but lower accuracy (93.3% vs. 96.7%) than the no ABI group. On the Flanker Task, non-ABI participants had slower response times than those with ABI (1.25 sec vs. 0.82 sec), yet almost identical accuracy. These results show preliminary evidence, as hypothesized, that homeless youth with ABI demonstrate heightened EF deficits. Homeless youth are likely to struggle to find appropriate supports for these deficits after ABI. This research begins to identify areas of difficulty so interventions can support these vulnerable youth.

Board 25

NATALIE RYAN

Research Mentor: Kevin Schmidt
Air Force Research Laboratory

How much of the world do you actually perceive? The capacity of human consciousness has been long debated: is it quite large or incredibly small? While in the Air Force, a pilot must be conscious of many things while in the air. This includes their machinery, that machinery's condition, the possibility of enemy fighters in the area, etc. Determining the limits of consciousness is key to concluding where support is needed to enhance the performance of humans. A change blindness task was developed to determine this capacity. It was hypothesized that the capacity of consciousness would be relatively small, not allowing multiple different things to be perceived at once. Data will be presented defining the limits of conscious experience along with conclusions relevant to Air Force and Space Force applications.

THE CONFINES OF HUMAN CONSCIOUSNESS AND INTEGRATION OF AI

Human perception of the world and its workings are controlled by how much our consciousness can hold and understand in one moment. Consciously perceiving the world seems simple, yet the limit and capacity of consciousness has been debated in the scientific community for years. Arguments have been made that humans are conscious of many things, while some say that consciousness is limited and we are not very perceptive of the ongoings of the world around us. Understanding this capacity is crucial, especially for active Air Force pilots. In the air, pilots are tasked with multiple jobs: maintaining speed, staying aware of both the locations of enemy and friendly aircrafts, and more. One person can only hold so much in their mind at one time, so how can we enhance consciousness to provide our pilots with the tools they need for success? While there are no true tests to measure consciousness levels on a commonly known scale, some methods have been developed in order to give a rough understanding about consciousness and its capacity. One specific method is using a change blindness task to determine this limit. In a change blindness test, an individual is shown a circular array of eight objects surrounding one focal point for 500 ms. This screen is then followed by a blank screen for 1500 ms and then another circular array of eight objects for 800 ms. After showing these images, participants are then questioned if any of the objects had changed between the first and the second image. During this experiment, one item of the array changes about 50% of the time. We hypothesized that out of the shown eight items, individuals would only detect a change in a few of the photos displayed in the circular array, thus beginning to quantify the limited capacity of consciousness. Further research into consciousness may help the Air Force and Space Force determine where artificial intelligence support may be necessary in aircrafts and other vehicles, to supplement any conscious limits and maximize Airman effectiveness.

Board 26

NICHOLAS MANKOWSKI

Research Mentor: Steven Davies
3E Company

This summer, while interning at 3E Company on the Notify team, I rebuilt a part of the data broker used to upload chemical compliance information from 3E Generate to 3E Notify. Completing this project proved to be a large undertaking due to the complex nature of industrial chemicals and their representation in software. This task was of utmost importance due to the effect on business, as clients of 3E were facing rejection from some countries after using 3E Notify to notify ECHA, a government agency dealing with chemical safety in the EU, of their chemical usage.

BRIDGING SOFTWARE FOR ACCURATE CHEMICAL COMPLIANCE

When representing the regulatory information of industrial chemicals in software, there are many intricacies to deal with. This is further complicated when attempting to communicate between two different pieces of software and thus two different representations of the same chemicals. While working on the Notify team at 3E Company this summer, I was tasked with rebuilding a portion of the data broker that was responsible for reading in chemical regulatory data from 3E Generate and mapping it to the data format used by 3E Notify. Using a recursive solution, I built code that correctly categorizes chemical mixtures with all types of ingredients supported by 3E Notify and 3E Generate, including MiMs (Mixture-in-Mixtures), substances, and trade secrets. The solution developed was required to categorize and summarize components of the mixture in 3E Notify based on the criteria given in 3E Generate. Due to the complexity and severity of this issue, I was also tasked with build a robust test case that incorporated both test chemicals designed by the engineering team and chemicals used in client instances of 3E Generate. This solution has a large business impact for 3E, as it is addressing an issue found by a client while reporting chemical usage in the European Union that resulted in their chemical notification being rejected by a government body.

Board 27

SPENCER G. AMACHER

Research Mentors: Alvaro Rojas-Pena, Robert H Bartlett
ECLS Laboratory, Department of Surgery, University of Michigan

The heart is the most challenging organ to keep alive and viable outside of the body. Since around the 1960s, donor hearts have been placed on ice before transplant. However, a patient donating a heart in California would not be able to match with a recipient in Maine due to the length of time for transport. My lab uses ECMO (extra corporeal membrane oxygenation) technology to pump a blood derived solution through procured pig hearts, allowing them to be maintained outside of the body for longer periods of time. In this study, we tested cardiac performance using both the right and left side of the heart, which is important in determining proper function before transplant.

PROLONGED HEART PRESERVATION: ASSESSMENT OF CARDIAC FUNCTION WITH INTERMITTENT LEFT ATRIAL PERFUSION

The demand for donor organs is higher than the number of organs available for transplant. The current clinical method to preserve hearts is cold storage (5°C) for a maximum of six hours prior to transplantation. Longer cold ischemia times are associated with post-transplant complications due to tissue injury. Recently, normothermic ex vivo heart perfusion (NEHP) has been used to as a way to preserve hearts from hours to days with the option of assessing organ viability and function before transplant. In addition, this technique can increase the donor pool, improve immunologic organ optimization, and lead to better recipient matching. The purpose of this study is to assess cardiac function using intermittent left atrial (iLA) perfusion during NEHP for 24 hours at coronary flow. Five consecutive porcine hearts (n=5, 45±5 kg) were procured following anesthetic induction, sternotomy, cardioplegia administration, explantation, and back table instrumentation. NEHP was initiated in Langendorff mode for 24 hours. After the first hour, the heart was transitioned into iLA perfusion for 30 minutes, baseline parameters were documented, and the heart was placed back into resting mode. iLA perfusion was repeated and assessed every four to six hours. Data for left atrial pressure (LAP), aortic pressure (AO), coronary resistance (CR), and lactate levels (L) were measured. All hearts were successfully preserved for 24 hours during NEHP. Cardiac function data while on iLA perfusion was: LAP= 8.2±7.5 mmHg; AO= 22.8±7.7 mmHg; CR= 0.15±0.05 mmHg/L/min; and L= 2.7±0.6 mmol/L. This data demonstrates effective preservation and assessment of heart function during NEHP with iLA perfusion at coronary flow.

Board 28

ANINDITHA NAIR

Research Mentor: Melissa Allen-Dumas
Oak Ridge National Laboratory Department of Project

More than 40% of Maine's population depends on groundwater as their primary source of water. Arrowsic, an island in southern Maine is especially dependent on bedrock aquifers for freshwaters. Bedrock aquifers are aquifers in which groundwater is stored in the fractures between rocks and water is pumped out by drilling wells into them. Aquifers are constantly at the risk of being intruded by saltwater leading to water contamination. With this project we aimed to evaluate how vulnerable the aquifers in Arrowsic are to saltwater intrusion and what the stress is on the water resources in Arrowsic by examining three factors driven by climate change.

ASSESSING THE VULNERABILITY OF COASTAL AQUIFERS TO SALTWATER INTRUSION IN ARROWSIC, ME

More than 40% of Maine's citizens depend on groundwater for their main source of water, with Arrowsic Island largely dependent on bedrock aquifers for freshwater. This project evaluates the vulnerability of coastal aquifers to saltwater intrusion in Arrowsic and the town's capability to meet the water demands of the future. We examine three components of projected water quality and quantity for the island: changes in precipitation patterns, sea level rise and increases in population. Data for the project includes measured, historical and projected precipitation and temperature, historical and projected population scenarios based on potential affordable housing unit development on the island, and three sea level rise scenarios: no change, 3 ft rise and 6 ft rise. By validating historical data and generating plausible future projections, we will develop a portfolio of analyses to help Arrowsic's residents make best management decisions for the island's aquifer water resources.

Board 29

HANNAH GREEN

Research Mentors: Dmitry Kondratyev, Mia Liu
Department of Physics and Astronomy, Purdue University

The Large Hadron Collider (LHC) is the most powerful particle accelerator in the world and produces a peak of 40 million particle collisions per second. This number will be even larger after the LHC's upgrade to the High Luminosity LHC (HL-LHC), which is planned to create about 10 times the data as the LHC. This increase in data will require more computing resources and processing power for analysis work. In this project, we explore the effectiveness of outsourcing parts of particle analysis workflows to GPUs using a specialized workflow called SONIC and the Kubernetes software to better understand methods of speeding up HL-LHC data processing.

GPU ACCELERATION OF MACHINE LEARNING INFERENCE AT THE LARGE HADRON COLLIDER CMS EXPERIMENT

After the Large Hadron Collider (LHC) completes its data collection, it will undergo a substantial upgrade to the High-Luminosity Large Hadron Collider (HL-LHC), which is planned to record about 10 times more data as compared to the LHC. The projected increase in CERN's computing resources over the same time period is expected to only narrowly accommodate the increased requirements for data processing. Currently, the bulk of computations at the LHC experiments is performed by CPUs via the Worldwide LHC Computing Grid (WLCG). One way to accelerate these computations is to outsource the neural network inference, used in many of the data processing sequences, to dedicated co-processors, such as GPUs, FPGAs, and ASICs. The CMS collaboration is currently developing a prototype implementation of this approach, referred to as SONIC (Services for Optimized Network Inference on Coprocessor), in which the neural network inference is performed by one or multiple NVIDIA Triton servers connected to GPUs. In this project, we explore and compare various SONIC configurations, in which the Triton servers are launched either in Singularity containers at a traditional Linux cluster, or in Docker containers via a scalable and customizable Kubernetes Deployment.

Board 30

SHLOK MUNDHRA

Corporate IT Intern
Worthington Industries

Imagine having to manually adjust settings on hundreds of devices daily. My project at Worthington Industries involved creating a software that turns this complex task into a few simple clicks. By developing an application that allows users to easily manage RFID readers, I provided a solution akin to a universal remote control for all devices in a warehouse, making daily operations more efficient.

RFID CONTROL AND MANAGEMENT MANIPULATOR

Radio Frequency Identification (RFID) technology is essential for tracking goods and smart-factory automation. However, managing individual RFID readers is cumbersome and time-consuming. To address this, I developed a web application using Jython 2.0, enabling users to add and remove readers via IP Addresses. Once a reader is verified, the user inputs the location once, and it remains stored. The application allows manipulation of controls and settings, offers predefined settings, and displays a live feed of printed tags. All communications are made in standard JSON format, streamlining RFID management.

Board 31

KAITLYN QUINN

Research Mentor: Doo- Sup Choi
Mayo Clinic Department of Molecular Pharmacology and
Experimental Therapeutics

The relationship between moderate alcohol use and Alzheimer's disease is understudied. We know that alcohol misuse is implicated in the development of Alzheimer's disease but what about moderate alcohol use? Moderate alcohol use has been shown to have some beneficial effects on cognitive function; so, our study aims to better understand the cellular differences across multiple brain regions when mice are exposed to moderate amounts of ethanol.

MODERATE ETHANOL EXPOSURE ENHANCES HIPPOCAMPUS NEURONAL ACTIVITY IN A MOUSE MODEL OF ALZHEIMER'S DISEASE

- Alcohol misuse is a key risk factor for development of Alzheimer's Disease (Tyas, 2001), and excessive alcohol use is associated with hippocampal pathology (Sullivan and Marsh, 2003).

- It remains unclear how moderate ethanol intake impacts the activity of hippocampus and cortical ensembles, and some literature suggests that moderate drinking may have neuroprotective effects (Koch, 2019).

- Here we aimed to characterize the effects of a moderate ethanol exposure (4h/d x 4d/w x 12 w) on the activity of cortical and hippocampal neurons in APP/PS1 mice, a model of early onset Alzheimer's disease (AD).

- We analyzed data through spike sorting in principal component analysis. This allowed us to identify the presence of neurons in the hippocampus or cortex as well as calculate the frequency that the neurons fired.

Board 32

NILADRI DEB

Research Mentors: Matthew Swann, Roland Kawakami
Department of Physics, The Ohio State University

We live in a world where the usage of technology and AI is increasing and we need our computers to develop to meet these requirements. In order to improve computers, we can develop the smaller parts of the computer, including the Field Effect Transistors (FETs), which is the cornerstone of modern electronics. We investigated a special type of FET and tried to investigate if the current model can be improved by choosing a different combination of metal and semiconductor. We successfully built our first device and were able to collect data on it, however, we have a couple more devices ready for data collection.

CONTACT RESISTANCE OF METALS WITH TUNGSTEN DISELENIDE

The usage of technology and artificial intelligence is increasing. Therefore, our computer parts need to develop in order to meet these requirements. As a result, we investigated Ferroelectric Field Effect Transistors (FeFETs) — specifically Metal Oxide Semiconductor Field Effect Transistors (MOSFETs) — as they have fast operating speeds, low power requirements and have non-destructive read capabilities. The most used semiconductor in MOSFETs is Silicon, which is a 3-D material and has many dangling bonds. Tungsten Diselenide (WSe_2) is an excellent option as a semiconductor as it has intrinsically lower number of dangling bonds, high on-off ratios, acceptable subthreshold voltages, and it is ambipolar in nature. Hence, we wanted to grow more WSe_2 using Molecular Beam Epitaxy (MBE). Furthermore, we wanted to study the contact resistance of metals with WSe_2. WSe_2 has the potential to be the next generation of transistors because of its characteristics. Additionally, by determining the contact resistance between WSe_2 and metals will help us determine which metals have a low contact resistance with WSe_2. We wanted to study Bismuth (Bi) because it is said to have a low contact resistance with WSe_2 and has a lower work function when compared to Gold (Au). We exfoliated some thin flakes of WSe_2 on Si/SiO_2 substrates. Following that, we spin coated the substrate with methyl methacrylate (MMA) and poly methyl methacrylate (PMMA). Next, we patterned the electrodes using Electron Beam Lithography and deposited the metals using the Capping Chamber. Finally, we determined the overall resistance of the device by measuring the current through the device for a given potential difference and then determining the inverse of the slope of the current against the potential difference plot. We successfully made our first device and it had a high resistance. Thus, we concluded that the device is of poor quality and needs improvement.

Board 33

LILY HAMBRIC

Columbus Zoo and Ohio Wildlife Center

INTERNSHIPS AT THE COLUMBUS ZOO AND OHIO WILDLIFE CENTER

Over the summer, I worked as a North America Region intern at the Columbus Zoo. I assisted full-time keepers with daily animal husbandry, which involves cleaning and maintaining enclosures, prepping diets, and creating enrichment for animals. I was able to work closely with a variety of species such as goats and sheep, polar bears, grizzly bears, moose, Mexican wolves, river otters, and lynx. At the Ohio Wildlife Center, I was the Animal Husbandry and Interpretation intern in the Education Department. Again, I helped full-time staff with daily animal husbandry; however, each day, we had to care for over 60 ambassador animals. Although some days were hectic, I enjoyed providing the animals with the best possible care, and I also learned how to handle animals during education programs.

Board 34

HANNAH COX

Research Mentor: John Krygier
Department of Environmental Science and Sustainability

In the Adirondack Park region of New York resides a variety of plants that were introduced to water bodies and have since overpopulated this environment, pushing out native plants in the process. Variable and Eurasian watermilfoil are labeled as "Aquatic Invasive Species" (AIS) in many waterbodies throughout upstate NY and the greater New England area. To control their populations, scuba divers like myself are trained to hand remove these plants from infected waterbodies to manage their population size. We obtain data on patch location and density to help lake associations create future management plans and hopefully remove watermilfoil completely.

FIGHTING AQUATIC INVASIVE PLANTS

Within the Adirondack Park region of New York lies waterbodies infested with Aquatic Invasive Species (AIS). AIS grow and reproduce rapidly, taking over large portions of waterbodies while threatening native plant species and causing habitat loss. They can reproduce through the fragmentation of mature plants, settle into a new location, and grow into a new plant. Fragments are typically produced through human activities: for example, AIS can get entangled in boats, anchors, trailers, fishing equipment, and spread quickly. Aqualogic Inc. set out to equip interns like myself with the tools and resources to fight back against the spread of AIS. As certified PADI Open Water and Weed Control divers, we harvest the two main AIS in the Adirondacks, Variable watermilfoil and Eurasian watermilfoil, to prevent further dispersal and manage existing infestations. We work alongside lake associations to collect data on patch locations and density so the associations understand the infestation level of the lake and what further management options are available to them (ex: herbicides). Although our efforts may not eradicate the Adirondack lakes of AIS, we are developing a significant control method to fight aquatic invasive plants.

Board 35

DHRUV SEKHAWAT

Supervisor: Anthony Rodriguez
Organization: Open Gov Hub

Imagine walking into a building and being greeted by a virtual assistant that guides you effortlessly. My summer project at Open Gov Hub involved creating such a digital experience. By designing a chatbot and revamping the website, I made information more accessible and interactions more engaging, much like having a personal guide in a digital world.

ENHANCING DIGITAL EXPERIENCE AND EFFICIENCY AT OPEN GOV HUB

During my internship at Open Gov Hub, I designed an intelligent chatbot, revamped the website, managed organizational databases, and coordinated event schedules. Utilizing Python, HTML, CSS, and JS, I improved user interactions and organizational efficiency. Collaboration with professionals provided insights into IT operations within a non-profit organization.

Supervisor: Audrey Duhaime
Company: Cialfo

Imagine a world where education is tailored to each student's dreams and potentials. My work with Cialfo, a global edtech company, focused on using data to understand students' needs and create personalized pathways. By analyzing data and crafting business strategies, I contributed to making education more personalized and accessible, like a GPS for students' futures.

DATA-DRIVEN DECISION-MAKING AND OUTREACH AT CIALFO

My remote internship with Cialfo involved learning data management principles, working with predictive models, integrating data across platforms, and developing a business plan for student engagement. I conducted market research, participated in client meetings, and received professional training, enhancing collaboration and communication skills in a global environment.

Board 36

GIA D. HAILU

Research Mentor: Jeffrey J. Wing
Department of College of Public Health,
The Ohio State University

Racism plays a significant role in health disparities among racial groups and can operate through different mechanisms, such as segregation and redlining. From a public health standpoint, in addition to biological factors, social and physical factors such as segregation need to be understood to promote the well-being of every individual.

HISTORICAL REDLINING AND PRESENT-DAY HEALTH OUTCOMES IN OHIO

Historical redlining denied people of color the opportunity for fair housing and long-term investment by creating racialized graded housing maps of neighborhoods based on desirability for lending. There is substantial evidence suggesting an association between redlining and present-day health outcomes. The purpose of this study was to review the literature and create a visual representation of the association between redlining and present-day neurological health outcomes in Ohio. Articles were retrieved from The Ohio State University libraries using the terms residential segregation, redlining, stroke, Alzheimer, dementia, cognition, and cardiovascular. Articles within the project's scope were analyzed and thematically coded with NVivo. Segregation in Ohio was mapped using Meier's historical redlining scores created from Home Owners Loan Corporation (HOLC) grades of the 1930s, and stroke prevalence in Ohio was mapped using the Centers for Disease Control and Prevention PLACES 2022 data set. In the literature, HOLC scores, Getis and Ord local Gi* statistics, percent of noncardiovascular health and disease. HOLC scores, isolation index, and index of concentration at the extremes — Hispanic Blacks and non-Hispanic Whites, and Isolation index were associated with were associated with stroke prevalence. Interaction, isolation, and dissimilarity index were associated with dementia and cognitive domains of memory and language. Self-reported racial identity was associated with Alzheimer's dementia. The maps showed concordance between historical redlining scores and stroke prevalence in racially and ethnically diverse cities such as Cleveland and Columbus, Ohio. Segregation is indeed associated with present-day neurological health outcomes. Although the literature provides comprehensive knowledge, it is not without limitations. Restricted generalizability, selection bias, and lack of adequate evidence to establish a causal association between segregation and health outcomes call for more work.

Board 37

SOPHIA HOLUPKA

Research Mentor: Kevin Hart
Stone Laboratory, The Ohio State University

During the Summer of 2023, I spent eight weeks taking two courses, being a student worker, and volunteering as a Research Assistant at The Ohio State University's Stone Laboratory on Gibraltar Island within Lake Erie. During my time there, I was able to learn in an environment that provided a mix of hands on, in the field, and classroom learning. I was also able to have experiences and opportunities that will help me in my future field of study.

SUMMER AT THE OHIO STATE UNIVERSITY'S STONE LABORATORY

During the Summer of 2023, I spent eight weeks taking two courses, being a student worker, and volunteering as a Research Assistant at The Ohio State University's Stone Laboratory on Gibraltar Island within Lake Erie. During my time there, I was able to learn in an environment that provided a mix of hands on, in the field, and classroom learning. I took Environmental and Natural Resources Policy in June and Taxonomy and Behavior of Fishes in July. For each course, it was eight hours, three days a week that we would spend either in the classroom or on fieldtrips. In Environmental Policy, we learned about the political and social contexts of environmental and natural resources policy making and how this is applied to modern environmental problems. In Taxonomy and Behavior of Fishes, we explored the diversity of fishes (mainly the freshwater fishes of Ohio), how fish interact with and respond to their environment, and how environmental changes caused by humans influence fish populations. Being a student worker at Stone Laboratory entails shifts helping in the dining hall, providing outreach and education at the Aquatic Visitors Center (AVC), and performing general maintenance tasks around Gibraltar Island. In my free time, I was able to volunteer as a research assistant for a master's student in The Gray Lab on South Bass Island. F There, I was able to help set up experimental tanks, take daily measurements such as turbidity and temperature, and anything else that needed to be done in the lab. Overall, the eight weeks I spent on Gibraltar Island provided many different opportunities and experiences that will help me in my future field of study.

Board 38

CHASE ELLIS

Supervisor: Marc Kibbey
Ohio State University Museum of Biological Diversity,
Fish Division

My internship at the Ohio State University Museum of Biological Diversity focused on the function and use of museums. During my time at the museum I worked in the fish division and assisted with processing new collections and organizing previous ones. I was also able to help with a research project on the Spottail Shiner where I learned about how museums participate in research and how they can collaborate to achieve a common goal. The project compares different populations of Spottail Shiner to see if there is a significant enough difference to declare the populations separate subspecies.

INTERNSHIP AT THE OHIO STATE UNIVERSITY MUSEUM OF BIOLOGICAL DIVERSITY

During my time at the OSUMBD (Ohio State University Museum of Biological Diversity), my focus was on learning about how museums function and how they can be useful for current and future scientific research. Specifically my focus was in the fish division with the director, Marc Kibbey. I was able to help with the process of entering new collections into the museum database, updating information on past collections, learning and assisting with the organization of samples in the museum, going into the field and collecting new specimens, as well as participating in active research on the Spottail Shiner *(Notropis hudsonius)*. This research project was the primary focus of my internship. Using samples from the OSUMBD collection, I measured certain properties of each shiner and compiled the information into a spreadsheet. On each fish I would measure the body length, body depth, scale counts, fin/ray counts, and similar measurements. Using past information on each sample, I would be able to compare different populations based on location and body of water. This project focused on comparing Spottail Shiner from Southwest waterways such as the Mississippi river to Northeast waterways such as the Great Lakes and the North Atlantic slope drainage. Previous studies showed that there was a wide variation between samples but there was not a significant enough difference to declare the different populations as separate subspecies. The study I was assisting with hopes to expand on the previous study by collecting updated data of more specimens, using a wider range of Spottail Shiner, and using different methods of comparing populations. My time during the internship limited me to only observing collections at the OSUMBD but I was able to learn more about the loan process between museums and how that can further advance research and cooperation on specific projects. After my internship the project with the Spottail Shiner will continue using a range between the Chowan River in North Carolina to the Great Slave Lake in the Northwestern Territories of Canada.

Board 39

MINDI KLAUS

Research Mentor: Katrin Karbstein
Department of Integrative Structural and Computational Biology, The Herbert Wertheim University of Florida Scripps Institute for Biomedical Research Innovation and Technology

Rps26 is a ribosomal protein that is taken off the ribosome during times of cellular stress, such as high salt, by chaperone protein Tsr2. These Rps26-deficient ribosomes can accumulate in the cell and have a different function than normal, Rps26-enriched ribosomes. In this study, the role of Rps26-deficient ribosomes in sugar metabolism was explored through a series of growth curves of yeast cells grown in glucose- a fermentable carbon source- and ethanol and glycerol- non-fermentable carbon sources. It was found that Rps26-deficient ribosomes have a significant growth recovery on non-fermentable carbon sources, indicating that they optimize this process, but the mechanistic specifics of this phenomenon are not yet known.

THE ROLE OF RPS26-DEFICIENT RIBOSOMES IN SUGAR METABOLISM

Ribosomes are complex macromolecules composed of seventeen ribosomal proteins. One of these proteins is Rps26, which has been shown to be paired with chaperone protein Tsr2 and taken off the ribosome during cellular stress, particularly high salt. The accumulation of Rps26-deficient ribosomes leads to an entirely new set of mRNAs being preferentially bound to the ribosome, indicating an alternate function for these ribosomes. This led to the question of whether or not Rps26-deficient ribosomes play a role in sugar metabolism. To test this, a series of growth curves on yeast cells were conducted in which cells were grown on a fermentable carbon source- dextrose- or non-fermentable carbon sources- glycerol or ethanol- to test the optimization of non-fermentable carbon source metabolism in Rps26-normal cells and Rps2-deficient cells. Rps26-deficient ribosomes were found to have a significant growth recovery on non-fermentable carbon sources compared to their counterparts, indicating a direct role in sugar metabolism! A list of mRNAs preferentially bound to Rps26-deficient ribosomes was compared to a list of genes that when deleted, make the yeast sensitive to growth on glycerol or ethanol to generate a list of nine genes- five of which relate to metabolism. These genes are five potential targets for the growth recovery on non-fermentable carbon sources in Rps26-deficient ribosomes and are a topic for future study.

Board 40

GRACE LUXON
OHIO WESLEYAN UNIVERSITY

MYRHISSA ORTEGA
ST. EDWARDS UNIVERSITY

Research Mentor: Kassie Dudek
The School for Field Studies, Center for Marine Resource Studies

We aimed to examine the difference between two types of areas in a harbor and how well they protect the species that reside there. We did this by focusing on one species and measuring different aspects of them. We then compared the results from the two different areas. By understanding what this difference is or could be, we can expand our knowledge on the effectiveness of protected areas.

ASSESSING DIFFERENCES IN *ALIGER GIGAS* POPULATIONS INSIDE AND OUTSIDE OF THE EAST HARBOR CONCH AND LOBSTER RESERVE

The Turks and Caicos Islands (TCI) largely depend on Queen Conch fisheries, as they bring in more than $3.5 million US dollars each year, as well as local business. However, overfishing in these areas has led to a decline in Queen Conch, *Aliger gigas*, populations in the TCI. The East Harbor Conch and Lobster Reserve (EHCLR), a no-take marine protected area, was established in 1993 as a way to combat this decline. This study aimed to assess the effectiveness of marine protected areas at combating the effects of overfishing and other stressors by looking at differences in *A. gigas* populations inside and outside the MPA. An MPA is a marine protected area. Similar research found that there was a higher density of adults inside the MPA versus outside the MPA (Tewfik and Bene, 2000). We hypothesize that there will be a slight difference between the MPA and the non MPA but will not be significant enough to credit the MPA with this result. Our experimental design attempts to asses this MPA by surveying different sites using transects, depth, habitat type, and specific measurements on the live conch specimens. Assessing this MPA in depth may lead to the implementation of MPA's in other vulnerable areas.

Board 41

NANDINI ARORA

Research Mentor: Kristy Murray
Department of Human Immunobiology at Texas
Children's Hospital

The project I worked on this summer pertained to the epidemiology of dengue virus infections in Belize, which is a central American country that borders Mexico, Guatemala, and the Caribbean. Dengue virus spreads through mosquitoes and is especially prevalent in tropical and subtropical regions; the climate in Belize is conducive to high transmission of the virus. Epidemiological data collected and analyzed over time can provide useful insights on how the virus spreads in the population and the risk factors for severe infection.

ACUTE FEBRILE ILLNESS SURVEILLANCE FOR THE EPIDEMIOLOGICAL INVESTIGATION OF DENGUE VIRAL INFECTIONS

Dengue virus (DENV) is a mosquito-borne pathogen transmitted mainly through *Aedes aegypti* and *Aedes albopictus*. DENV is prominent in tropical and subtropical climates. The double-stranded positive-sense RNA virus exhibits 4 distinct serotypes. Approximately 1 in 4 infected patients are symptomatic, with severe infections resulting in hemorrhagic fever, shock syndrome, and even death. Belize, a low-to-middle income country in Central America has a climate prone to high transmission of DENV. Economic factors compound the impact, making it an important public health issue. A nationwide Acute Febrile illness (AFI) study was launched in 2020 in Belize with ~6,000 patients enrolled. The goal for my project was to understand the epidemiology of DENV infections in Belize. I conducted qPCR multiplex DENV serotype testing on whole-blood extracted samples collected from febrile, non-respiratory patients in 2020. Singleplex qPCR was performed on the samples that tested positive to confirm DENV serotype. The goal was to understand epidemiological trends by comparing data over three years of surveillance. In 2020, ~70 patients tested positive for DENV, with the majority of cases identified in the first 4 months of the year. All 4 serotypes were detected, with the majority (63%) of co-infections exhibiting DENV4. No positive cases were identified in 2021. DENV re-emerged in 2022 with 20 cases identified, with the majority (75%) being DENV4. Across all 3 years of surveillance, a higher percentage of cases were found in the northern half of the country, closer to the Mexico border. The clinical and epidemiological information collected from the surveillance can provide critical insight into the endemicity of DENV in the tropics.
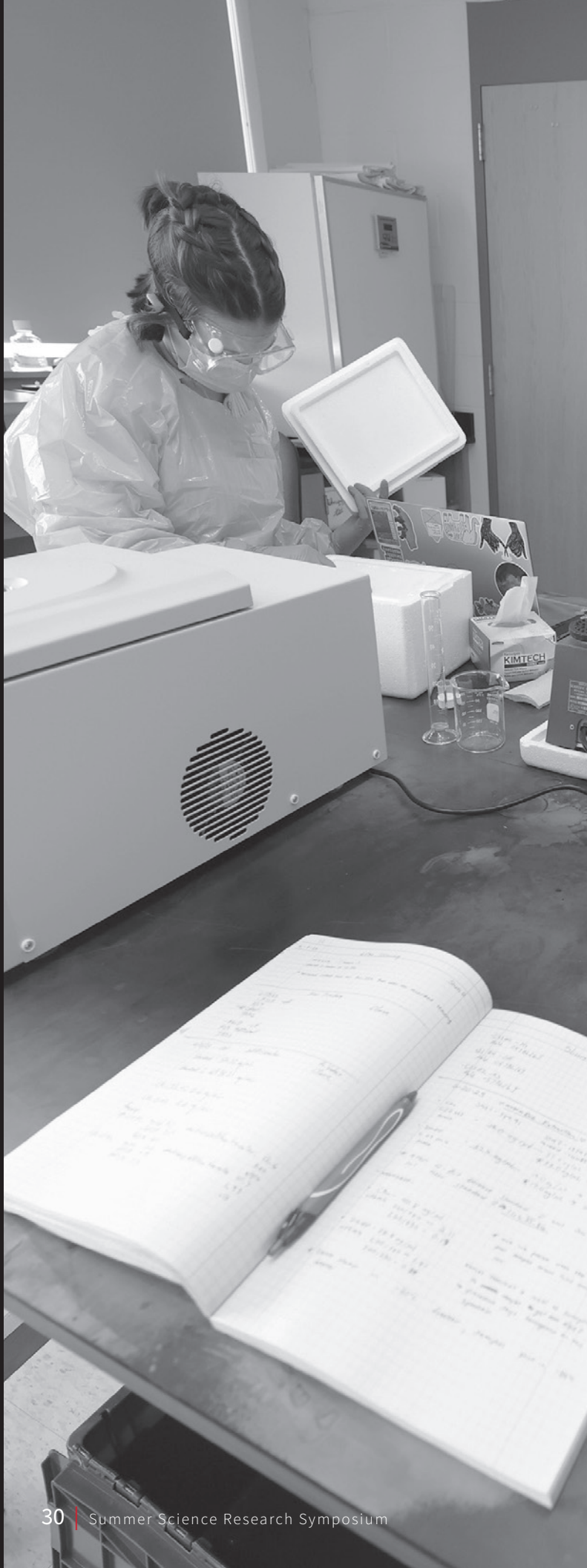
HERE ARE SOME OF THE THINGS PAST SSRP PARTICIPANTS ARE DOING NOW.

SSRP 2022

Makenna Juergens – Graduate school at Colorado State University, Ph.D. program studying the reproductive

physiology of deer mice, *Peromyscus manticulatus*

Abby Biddle – Research assistant at The Ohio State University Behavioral Neuroscience Department and applying for graduate school

Aadarsha Gopala Reddy – Graduate school in Fall 2023

Kyleigh Beck – Summer study at Yonsei University in South Korea and Fall 2023 study at Kansi Gaidai University in Japan

Zoë Swanson – Summer job as a vet assistant at Delaware Northwest Veterinary Clinic and Fall 2023 continued research at Ohio Wesleyan University with Dr. Reichard

Bryan Benavente – Summer work as an investments intern for T. Rowe Price in Baltimore using software and methods learned during SSRP project

Audrey Calvin – Pharmacy school at University of North Carolina Chapel Hill

SSRP 2021

Ciara Pettit – Pursuing work as a Zoology lab assistant

Myles Steed – Graduate school at University of Pittsburgh, Microbiology and Immunology Ph.D. program

Josie Fornara – Summer work as a seasonal naturalist at Canal Way Nature Center in Cleveland and Fall 2023 graduate studies at Indiana University, Evolution, Ecology, & Behavior Ph.D. program with Dr. Kimberly Rosvall

Brianna DeMuth – Graduate school at University of Notre Dame, Political Science Ph.D. program and studying international relations and quantitative research methods looking at human rights in authoritarian regimes and international security

Emma Zajac – Behavioral Technician for BY YOUR SIDE Autism Therapy Services in Morton Grove, Illinois

SPECIAL ACKNOWLEDGEMENTS

Researchers

Special Thanks

Matt vandenBerg
Karlyn A. Crowley
Dale J. Brugh
Elaine Chun
Lindsay Mauter
Barb Wiehe
Marilyn Stephens
David Markwardt
Megan Ellis
Ohio Wesleyan University Buildings and Grounds Staff
OWU/ABM Housekeeping Staff
Generous donors to the SSRP
Office of University Communications
Faculty supervisors and student volunteers
Parents and guardians of student researchers

Summer Science
Research Program