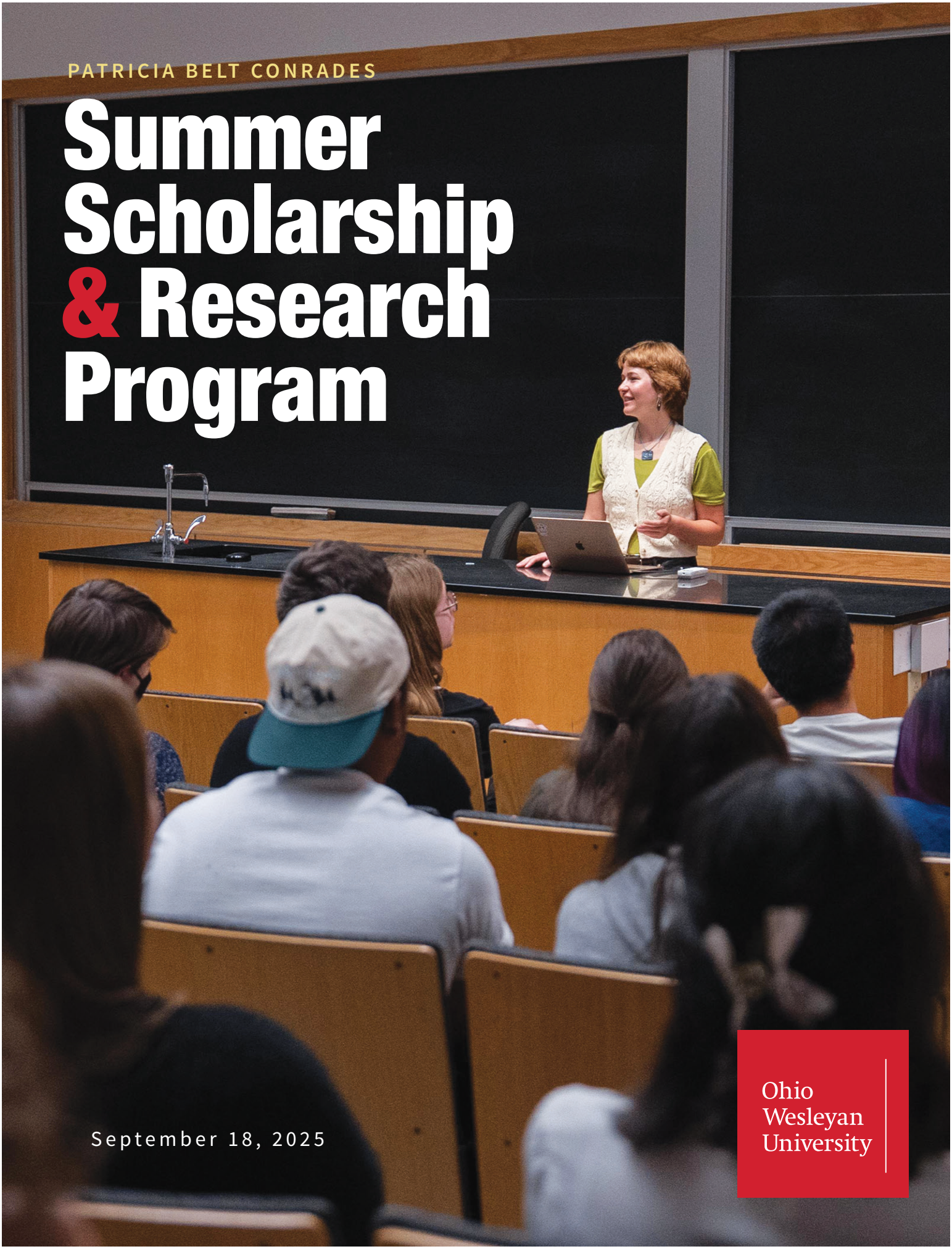
PATRICIA BELT CONRADES

Summer Scholarship & Research Program



September 18, 2025

Ohio Wesleyan University

LAN DO

OWU ’24 | POST BACCALAUREATE RESEARCHER | OHIO WESLEYAN UNIVERSITY

“Participating in the SSRP allowed me to fully immerse myself in research and confirmed my goal to pursue a career in research. The program was instrumental in building my confidence in experimental design and strengthening my ability to communicate my work to a wider audience.”

THE PATRICIA BELT CONRADES SUMMER SCHOLARSHIP AND RESEARCH PROGRAM

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

Now in its 33rd year, Ohio Wesleyan's Summer Scholarship and Research Program equips students to address complex issues by working side-by-side with accomplished mentors at OWU and other universities nationwide. At the Symposium, part of OWU's Fall Connection Conference, students will showcase their work and share why it matters. Following the event, research will be available at **owu.edu/ssrp2025**.

CONTENTS

September 18, 2025 | 1-3 p.m.

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

owu.edu/ssrp
owu.edu/ConnectionConference

THE MAKING OF A SCHOLAR

After 32 impactful years for scores of students and faculty, a big change came to SSRP in 2025. Now known as the OWU Summer Scholarship and Research Program, SSRP is open to faculty-mentored scholarship and research projects from every discipline on campus!

This summer, OWU students from many different disciplines had the opportunity to work with OWU faculty mentors here on campus making meaningful contributions to research and scholarship. Authentic research is quite different from classroom labs and work — 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 scholars, seeing them take command of a research project, and knowing that they are gaining the confidence to speak and act as experts in their field. To truly learn, students must actually do the cutting-edge work, not just read it from a book. At OWU, we encourage students to plunge in, preparing them to be successful researchers and scholars both at OWU and at other universities. Many first-year students are surprised to learn that they can contribute in substantive scholarship and 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 49 students who performed research at OWU mentored by OWU faculty members and 17 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 scholars 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 66 OWU students and 26 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 Scholarship and Research Program Director
Division Chair, Natural Sciences

THE PATRICIA BELT CONRADES SUMMER SCIENCE RESEARCH SYMPOSIUM ENDOWMENT

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

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

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

THE C. PATRICIA FERRY SUMMER SCIENCE RESEARCH PROGRAM ENDOWMENT

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

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

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

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

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




Board 1

ANNIKA DELONG
PAIGE NEAL
BAILEY WOODS

Research Mentor: Kayce Tomcho
Department of Chemistry

Most diseases or conditions, for example chronic pain, are linked to the malformation or malfunction of a protein; understanding the entire structure of a protein is necessary to understand its function and informs how therapeutics or treatments are designed. When the glycine receptor (GlyR) is not functioning or not formed properly, it leads to chronic pain, extreme startle disease, and other conditions. A particular piece of the receptor, the M3-M4 loop, has known functions but unknown structures. Our research aims to better understand its structure, particularly its interactions with a cell membrane. Three peptides within this loop, FRRKRRHHK, QHKELLR, and KIDKISR, were analyzed using a Langmuir trough, which measures surface pressure, to determine potential membrane interactions. This research, along with future studies, will lead to a better understanding of the structure of GlyR and the development of more effective targeted therapeutics.

CELL PENETRATING PEPTIDE (CPP) ACTIVITY OF PEPTIDES IN THE M3-M4 LOOP OF THE GLYCINE RECEPTOR (GLYR)

The glycine receptor (GlyR) is a pentameric ligand gated ion channel (pLGIC) protein that is responsible for cell hyperpolarization via facilitating chloride ion influx. Dysregulation of GlyR is linked to hereditary hyperekplexia and chronic pain. Treating these conditions requires full understanding of the structure of the receptor. Though high-resolution structures exist of GlyR, elucidated via Cryo-EM, the structure remains partially unresolved, particularly of note the characteristic M3-M4 loop. Previous studies using crosslinking mass spectrometry have helped to elucidate the loop's structure and dynamics, and have led to an interesting hypothesis that the M3-M4 loop may act as a cell penetrating peptide (CPP). This can be tested by using a model lipid membrane and various peptides within the M3-M4 loop. The interactions between the model lipid membrane dipalmitoylphosphatidylcholine (DPPC) and the peptides FRRKRRHHK, QHKELLR, and KIDKISR found in the M3-M4 loop were examined. Isotherms were obtained using a Langmuir trough using a subphase of a peptide of interest (FRRKRRHHK, KIDKISR, or QHKELLR) and DPPC to measure the surface pressure as the mean molecular area decreased. Preliminary results from KIDKISR isotherms show no difference from baseline water isotherms, indicating no interaction with the model lipid membrane. The isotherm data for the other peptides of interest showed a shift to the right, indicating elongation, and thus, interaction with the model membrane. These results indicate the potential for FRRKRRHHK and QHKELLR to act as CPPs. Further isotherm data is necessary, particularly for FRRKRRHHK, as there were reproducibility issues, potentially due to size of the peptide. Surface activity measurements were also taken of all three peptides, and FRRKRRHHK shows clear surface activity, with a surface tension of 75.656 mN/m, clearly surface active compared to water with 72.80 mN/m. To expand on the study, fluorescence microscopy and surface quenching with Proteinase K can be performed to help confirm if FRRKRRHHK is a CPP. To further understand the differences between KIDKISR and QHKELLR, simplified peptides LLLLSR and LLLLLR will be examined to observe the effect of having a polar residue versus a hydrophobic residue in the position next to the terminal R. Future work also includes examining additional peptides, SPEEMRK and KLFIQRAK found in the M3-M4 loop. Collectively, this novel information of peptide interactions with DPPC indicates the M3-M4 loop may function similarly to a cell penetrating peptide and improves our understanding of peptide and lipid interactions.

Board 2

TEODORA ILIC

Research Mentor: Krystal Cashen
Department of Psychology

Family socialization is critical to how people develop and often determines how families communicate. A quantitative study exploring how LGBTQ+ family socialization influences developmental outcomes in emerging adulthood, with one focus being body image development, is planned to launch in the fall. We expect the results to acknowledge and affirm previous research on how positive developmental outcomes are associated with LGBTQ+ family socialization practices.

THE RELATIONSHIP BETWEEN LGBTQ+ FAMILY SOCIALIZATION, FAMILY COMMUNICATION PATTERNS, & BODY IMAGE

LGBTQ+ parents use LGBTQ+ family socialization to inform their children of their diverse family identity and prepare them for potential stigmatization they may experience as a result (Oakley et al., 2017). Protective LGBTQ+ family socialization practices, such as proactive conversations, are associated with positive developmental outcomes (Farr et al., 2025), yet limited research exists on how it impacts these outcomes in emerging adults. Our research seeks to explore the relationship between LGBTQ+ family socialization, body image development, and family communication styles, as families who engage in open conversations are associated with positive body image in children (Story et al., 2022). Data will be collected in the early fall from a broader project examining LGBTQ+ family socialization in emerging adulthood. Participants will be 18-29-year-olds living in the United States with at least one LGBTQ+ parental figure. The Body Appreciation Scale-2 (BAS-2; Tykla & Wood-Barcalow, 2015) and conversation orientation section of the Revised Family Communication Pattern Instrument (RCFP; Koerner & Fitzpatrick, 2002) will be used to assess body appreciation and family communication. Based on the Family Communication Patterns Theory (Ritche & Fitzpatrick, 1990), we expect FCP and LGBTQ+ family socialization to each positively predict BAS-2. We also hypothesize that there will be an indirect effect of FCP on body image through LGBTQ+ family socialization. This study aims to garner a greater understanding of body image development and how LGBTQ+ family socialization may foster resilience in marginalized families.

Board 3

JOY GBADEBO
INESH TICKOO

Research Mentor: Kira Bailey
Department of Psychology,
Neuroscience Program

We're designing a fun, interactive video game that trains focus, memory, and decision-making skills. As players dive into the game, we use a brain stimulation technique called tDCS (transcranial direct current stimulation) to boost activity in the area that supports attention and self-control. This brain area, the dorsolateral prefrontal cortex (DLPFC), helps with staying focused, setting goals, and making smart choices. By combining gameplay and brain stimulation, we're making cognitive training more engaging and effective.

CAN BRAIN STIMULATION (TDCS) AND VIDEO GAMES MAKE YOUR BRAIN SHARPER?

Cognitive control refers to the ability to regulate, coordinate and sequence thoughts and actions in alignment with internally maintained goals (Braver, 2012). This capacity tends to decline with age, cognitive overload, and stress. Traditional cognitive training tools can help strengthen these skills but are often perceived as tedious and repetitive, limiting long-term engagement and benefits (Katz et al., 2014). Our project addresses this issue by combining an immersive video game environment with transcranial direct current stimulation (tDCS). While classic paradigms (e.g., N-back, go/no-go, Stroop, and flanker tasks) are used to measure core executive functions, our custom game is designed to also enhance motivation and immersion, offering a more user-centered training experience. tDCS is a safe, non-invasive brain stimulation technique that modulates cortical activity by delivering a low-intensity current (1–2 mA) (Nitsche & Paulus, 2000; Stagg & Nitsche, 2011), which can enhance brain function for up to an hour after stimulation. By stimulating the left dorsolateral prefrontal cortex (DLPFC), a region central to executive control and goal-directed behavior (Miller & Cohen, 2001; Ramnani & Owen, 2004), during gameplay, we expect to find greater improvements in performance and motivation compared to sham stimulation or gameplay with no stimulation. Combining brain stimulation with engaging cognitive training games may lead to more accessible, user-friendly approaches to maintaining or enhancing cognitive function.

Board 4

JANIK DIXON

Research Mentor: Yunhua Ding
Department of Physics & Astronomy

General Relativity and the Standard Model of particle physics, despite being widely-accepted, concurrent physical theories, remain fundamentally incompatible. However, recent research suggests that extraordinarily small violations may occur in the spacetime symmetries integral to their formation, implying (should they be identified) such violations may appear as a feature of theories unifying GR and SM. As such, the goal of our work is to study the observable effects of symmetry violations by investigating the gyroscopic motion of a particle trapped in a storage ring. Beginning by conducting a theoretical analysis of the particle's behavior in the Storage Ring Experiment (SRE), we constructed a program to transform symmetry-breaking terms from an expanded theory—one that accounts for the possibility of symmetry violation—into a standardized measurement frame. Then, using current experimental data from the SRE, we determined the highest possible value of symmetry-violating contributions from each term.

TESTING LORENTZ AND CPT SYMMETRIES WITH STORAGE-RING EDM EXPERIMENTS

It has been shown that tiny violations may occur in Lorentz and CPT symmetries, both of which are integral to the formulation of General Relativity and the Standard Model of particle physics. Although these theories remain incompatible with one another as of yet, recent research suggests such violations may appear as a feature of theories unifying GR and SM. As such, the goal of our work is to study the effects of potential Lorentz and CPT symmetry violations in experiments looking to identify a non-zero Electric Dipole Moment (EDM) in charged particles in a storage ring. Beginning by conducting a theoretical analysis of symmetry-breaking terms found in the extended relativistic Bargmann-Michel-Telegdi (BMT) equation, we determined the contributions of symmetry-violating terms to the spin motion of the particle. Then, developing a Mathematica program to transform our laboratory-frame results into the standardized inertial frame, we used current experimental bounds on EDMs to set upper limits on the corresponding Lorentz- and CPT-violating coefficients.

Board 5

LAUREN DORSEL
CAMILLE PAYNE
ALANA WILSON

Research Mentor: Franchesca Nestor
Department of Politics & Government

We consider the ways in which disability might impact an individual's ability to run for and hold public office through the lens of food allergy. There are currently no known elected officials in the United States with a food allergy despite there being over 80 million people in the US who have food allergy. This creates a lack of representation for this population. To understand this phenomenon, we will be surveying both elected officials and the public to learn more about the connection between political office/candidacy and food allergy. We piloted our three surveys over the summer, and we are now preparing to put them in the field.

UNDERSTANDING THE CHALLENGES OF DISABILITY AND REPRESENTATION: THE CASE OF FOOD ALLERGY

Previous literature suggests that there are unique challenges associated with running for and holding political office for people with disabilities. These include a lack of accessibility and resources, stigma, and privacy concerns. We use the case of food allergy to investigate the connection between the lack of descriptive representation and disability: In the United States, over 80 million people have food allergy; despite this, there are no known elected officials with food allergy. Understanding potential barriers that stand in the way of people with food allergies becoming politicians will offer a blueprint for understanding the ways in which other chronic and invisible disabilities are represented in politics. We developed three projects to explore these concerns: two surveys of the public, one investigating how they would feel about individuals with food allergy holding public office, and one investigating the potential level of bias toward elected officials with food allergy; and one survey of state legislators investigating their comfort level with communicating about hypothetical food allergies. From these projects, we will gain a better understanding of the impact of disability on political candidacy and electability, both from the perspectives of voters and elected officials.

Board 6

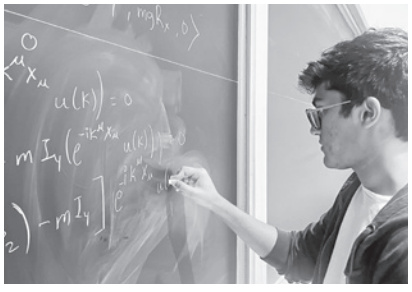
MUSA REHMATULLAH
PARTHEY VASANI

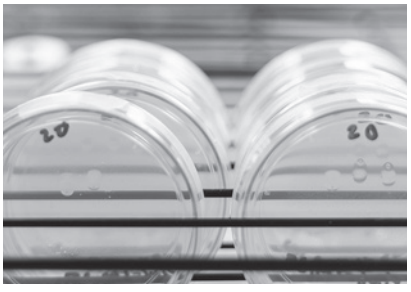
Research Mentor: Brad Trees
Department of Physics & Astronomy

SQUIDs are Superconducting Quantum Interference Devices, which are extremely sensitive to magnetic fields. These devices are used in MRI machines and as quantum bits among other applications. We are trying to predict the behavior of multiple SQUIDs attached in series and seeing if doing so increases their sensitivity, which can be helpful in having more accurate magnetic field measurements.

SYNCHRONIZATION OF DC SQUID ARRAYS

We study the behavior of multiple SQUIDs connected in series. We first solve the model equations that govern a single SQUID to understand its behavior. We then move to two SQUIDs connected in series, where we first come up with the set of equations that govern their behavior, and then solve them. We do so using both an analytical and a numerical approach. The analytical approach involves solving the equations using a form of perturbation theory to gain a solution that can predict the behavior of the SQUID, whereas the numerical approach involves writing code to solve the equations, which helps us verify the solution found by the analytical approach. Using the solution, we will attempt to determine the boundary conditions, i.e. the combinations of characteristics of the SQUIDs that lead to the two SQUIDs synchronizing, meaning that they have equal time-averaged voltage values.





Board 7

OYINDOUBRA AKIKA
ALLY GERTY
ARIANNA MORRIS

Research Mentor: Mary Anne Lewis Cusato
Department of World Languages & Cultures

"French for the Future... At OWU and Beyond!" was designed to put students at the heart of co-curricular development, meet the needs of the Gen Z student, and help spread the word about French as a global language that is growing in number of speakers and cultural relevance alike. This project allowed professor-and-students to shape a curricular and co-curricular model in tandem that is practical, experiential, professionalizing, and that raises awareness and competence to address some of the most pressing social issues the world is facing. Although French was the disciplinary lens, the curricular and co-curricular structures created can be used as models for other disciplines, too.

FRENCH FOR THE FUTURE... AT OWU AND BEYOND!

"But what are you going to DO with French?" This question almost always follows a student's proud declaration that they are studying French in college. People wonder where this major or minor could possibly lead. This question, it turns out, is typical of the Gen Z student, born between 1997 and 2012, who values practical application of what they learn; a personalized approach to learning; and an emphasis on social justice. And it is with this student in mind that we have worked on our respective prongs for this SSRP, "French for the Future… at OWU and Beyond!"

Since Dr. Lewis Cusato has been building professionalization and career exploration into the heart of French at OWU, six records have been set in French at OWU in the last five years for majors and minors declared, student retention from course to course, and overall percentage of student enrollment in French. This is great news! At the same time, especially with more courses offered at the upper levels in English, there is a demand for co-curricular opportunities for students to engage with one another, practice their French, and create community. Enter the SSRP dream team, aka the "Three Musketeers of French!" We have been working to continue to build out French at OWU, this time focusing on co-curricular structures such as the Cercle français (now tied directly to the curriculum); a fully formed PR plan to foster understanding and enthusiasm; and a summary of resources, internships, and curricular / co-curricular strategies implemented with particular success around the country. This summer, we have been answering the following question, "What happens when students, alongside their professor, shape the very curricular and co-curricular opportunities of their chosen discipline, all with the Gen Z student in mind?"

"French for the Future... At OWU and Beyond!" was designed to put students at the heart of co-curricular development, meet the needs of the Gen Z student, and help spread the word about French as a global language that is growing in number of speakers and cultural relevance alike. This project allowed professor-and-students to shape a curricular and co-curricular model in tandem that is practical, experiential, professionalizing, and that raises awareness and competence to address some of the most pressing social issues the world is facing.

Board 8

JULIEN DEFELICE
SOPHIA ROHR

Research Mentor: Andrea Suria
Department of Biological Sciences

A symbiotic community of bacteria in the eggs of Hawaiian bobtail squid provide protection against fungal infections. Our lab is using a synthetic squid egg model to grow these bacteria so we can examine their interactions within the community and with fungi. Further understanding of these interactions may contribute to the development of new antifungal treatments.

A BIOMIMETIC HYDROGEL SYSTEM FOR STUDYING COMPETITION OF SQUID REPRODUCTIVE SYMBIONTS

Diverse seawater bacteria compete to colonize the reproductive accessory nidamental gland (ANG) of female Hawaiian bobtail squid (Euprymna scolopes). These symbiotic bacteria are deposited into the squid's eggs where they protect the embryo from environmental fungal pathogens. It is unknown if this antifungal activity comes from a few strains or is a result of many strains interacting with one another. In order to study specific strains in vitro, we used a biomimetic hydrogel spheroid 'egg' model. The alginate-calcium chloride hydrogel system consisted of a yolk sac-like core, an intermediate layer with bacteria to mimic the jelly coat, and an outer layer that simulated the egg's capsule. Both monocultures and cocultures were tested in the 'jelly coat' layer. Cocultures contained a target strain and an inhibitor strain. Colony forming units (CFUs) were quantified from the 'eggs' to assess bacterial viability and competition. Imaging via fluorescence microscopy was used to qualitatively assess growth and competition. We found that bacteria are able to replicate inside of the hydrogel model up to 8.00 x 108 CFU/mL. In coculture 'eggs', significant inhibition of target strains was not observed, differing from previous experiments that showed successful inhibition of target strains in liquid culture and on agar plates. Fusarium keratoplasticum, a common marine fungal pathogen, was successfully grown on our model in an incubated well. Future research will explore fungal quantification methods in order to study possible inhibition of fungal growth by bacteria within the hydrogel 'egg' model.

Board 9

SUNAINA PANDEY

Research Mentor: Miranda Horn
Department of Biological Sciences,
Neuroscience Program

We're studying how brain cells change with age and how those changes differ when someone has an infection. We're focusing on astrocytes, a type of brain cell that helps maintain the health and function of the brain. By understanding how infection affects the way astrocytes change with age, we hope to find better ways to protect the brain and reduce the risk of age-related diseases.

COMBINED ANTIRETROVIRAL THERAPY REVERSES SIV-INDUCED ASTROCYTE MORPHOLOGICAL ALTERATIONS

HIV remains a significant global health issue with many individuals now living longer due to combined antiretroviral therapy (cART). However, despite the improvement in lifespan, cognitive decline in people living with HIV continues to occur earlier than in the uninfected population. The effect of long-term cART on the brain, and especially on astrocytes, remains poorly understood. In this study, we aimed to determine how cART affects astrocyte morphology in the brain. We hypothesized that the treatment of SIV-infected rhesus macaques with cART would reduce astrocyte morphological changes associated with SIV infection. To test this, we used fluorescence microscopy to analyze archival brain tissue from three groups of rhesus macaques: SIV-naive controls (Naive), SIV-positive animals without treatment (SIV), and SIV-positive animals receiving cART (SIV-cART). We then used Neurolucida® to trace astrocyte cell bodies and branches to assess changes in astrocyte morphology across these groups. Our findings demonstrate that relative to the SIV group, the SIV-cART group had branch points appear more gradually, at larger radii (20 - 40 µm). We also found that SIV-cART animals had an increased cell body area compared to that seen in the SIV animals. Together, these data demonstrate that cART treatment alters astrocyte morphology from that seen in SIV infection, which may suggest a healing or protective effect.

Board 10

ABIGAIL KALLAY
ANNIKA PARDEE

Research Mentor: Bona Kang
Department of Education

Third places offer regular, informal gatherings among community members beyond the home and school/work, allowing individuals to establish relationships with those around them and experience benefits that come with increased social capital. This multiple case study aimed to examine child-centered spaces previously excluded from the literature by investigating what third places are available to Delaware K-12 students, how these spaces are used, and what other places could be created. Site observations and interview responses highlight that successful third places in Delaware give children ownership, and the community desires for more spaces for children that are free, fun, and educational. The findings from this research will support OWU's Education Department in preparing culturally responsive teacher candidates for Delaware schools.

LIBRARIES AND LATTES: A CASE STUDY OF K-12 STUDENTS' ACCESS TO THIRD PLACES IN DELAWARE, OHIO

Third places are the public spaces that offer regular, informal gatherings among individuals in the community beyond the realms of home and work or school, often acting as the mediation between an individual and larger society. They promote civil participation, positive mental health, and increased social capital. However, third-place dialogue has not considered child-centered, post-covid spaces. This multiple case study investigated what third places are available to Delaware K-12 students, how these spaces are being used, and what other places could be created. We spoke to Delaware community members at the farmer's market, interviewed individuals who own businesses and run community-based programs within these spaces, and completed site observations around Delaware. We compared interview responses to look for common and unique patterns between individual cases. Additionally, we created a layered map that looks at accessibility in regards to cost, physical accessibility, and location. Our findings indicate that successful third places give children ownership of the space, such as the Delaware Public Library, Mingo Park, and the YMCA. However, there is a lack of third places for children in Delaware despite there being a high demand for free, fun, and educational spaces. We also found that accessibility to third places was affected by limited parking or due to not being within walking distance. Future work will include interviewing K-12 students to inform the design of third places for Delaware children. Continuing this research will support OWU's Education Department to prepare culturally responsive teacher candidates for Delaware schools.

Board 11

CLAIRE HAMMOND
JAN KUBACEK

Research Mentor: Chelsea Vadnie
Department of Psychology

Here we determined the effects of stress early in life on behavior in adulthood using mice as a model system. We specifically looked at rodent behaviors related to symptoms present in individuals with psychiatric disorders to help us better understand how adolescent stress may contribute to the development of those disorders in adulthood. We are currently exploring how the length of stress experienced impacts the severity of changes to behavior later in life.

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

Anxiety and mood disorders are highly prevalent and often diagnosed in late adolescence or early adulthood, with stress as a major risk factor. Studies support that adolescent stress can have long-lasting effects in adulthood, but the specific effects are unknown. Here we adapted a stress paradigm used in rats to determine the effects of early adolescent physical stress in male and female C57BL/6J mice. Three days of physical stress from postnatal day (PND) 25-27 (n= 7-8 of each sex) increased anxiety-like behavior in the open field (OF), as measured by decreased center entries and center time ($p<0.05$). There was no effect of sex. To explore the effects of a longer period of adolescent stress on psychiatric-related behaviors in adulthood, male and female mice were separated into stressed and unstressed groups (n = 7-8 of each sex). Stressed mice experienced six days of stressors (forced swim, restraint, elevated platform in an unpredictable order), one type per day, from PND 25-30 during the light phase. Control mice remained undisturbed. We then determined the effects of early adolescent stress on psychiatric-related behaviors in adulthood using a battery of behavioral assays starting at PND 60. We hypothesized that early adolescent stress would increase anxiety- and depressive-like behaviors and would decrease measures of cognitive function in adult mice. Results thus far show that adolescent stress increased anxiety-like behavior in the OF ($p<0.05$) with sex having no effect. Further results will be presented. Overall, we hope that our work will contribute to the understanding of the long-term impacts of early life stress on adult behavior and neurobiology.

Board 12

AVA PETTEY

Research Mentor: Sean McCulloch
Department of Math & Computer Science

The board game Scotland Yard pits two teams against each other—London's most-wanted criminal Mr. X and a group of five detectives. The objective of the detectives is to catch Mr. X as he traverses the board. I wrote a computer program to intelligently move the detectives in response to the user's decisions as Mr. X. In my program, I enforced the rules of the game and designed a graphical user interface.

AN INTELLIGENT AGENT OF THE BOARD GAME SCOTLAND YARD

The board game Scotland Yard invites players to a tactical manhunt on the streets of London. Players can choose to be the ever-elusive Mr. X or one of five detectives who must work together to catch him. Detectives traverse the map with their limited taxi, bus, and underground tickets. As Mr. X's location is usually hidden, the detectives must rely on the criminal's selected mode of transport to deduce his possible locations. I wrote a computer program in Java to simulate the role of the detectives in Scotland Yard. The computer, given the rules and objectives of the game, moves detectives to prune the tree of Mr. X's possible locations, restricting his future movement options. The movement algorithm uses breadth first search to calculate the shortest path from a detective's current station to one of Mr. X's possible locations. Before Mr. X's position is first revealed, I implemented an algorithm to intelligently place the detectives at central locations. The detectives play on a level to defeat human opponents, and they do so quickly—the program implements a memory efficient HashMap to store the map. Furthermore, I designed a graphical user interface to display the map, the pawns, the current round, and Mr. X's inventory.

Board 13

JOSIAH GROSS

Research Mentor: Dustin Reichard
Department of Biological Sciences

Mate switching or "divorce" is a behavior that is commonly observed in some Northern House Wrens in between their first and second clutch of the season. We predicted that this behavior takes place when one parent cares for the nestlings more than the other parent. The mate pairs were tested for two major parental behaviors, nestling feeding and antipredator behavior. Our data will be analyzed to determine if unequal parental care contributes to mate switching in these tiny birds.

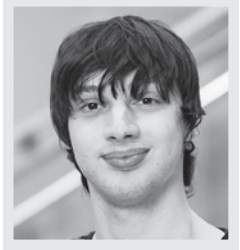
IS PARENTAL INVESTMENT RELATED TO MATE SWITCHING IN NORTHERN HOUSE WRENS?

In monogamous species, mate quality is an important factor that determines reproductive success. Individuals that switch mates between breeding attempts may improve their chances, but little is known about the causes of mate switching behavior. We studied within-season mate switching in three populations of Northern House Wrens (Troglodytes aedon). We predicted that mated pairs with unequal investment in offspring provisioning and defense would more likely result in mate switching, and the individual that invested more would be more likely to switch, leaving their territory to find a new mate. Northern House Wrens reproduce from late April to early September, typically raising 2-3 broods per season, which allows us to identify mate switching behavior. We measured provisioning behavior for each pair when the nestlings were 9-13 days of age for two 60 minute intervals 24 hours apart. We also used a decoy eastern rat snake (Pantherophis alleghaniensis) placed on top of the nest box to measure antipredator behavior for five minutes on two consecutive days when the nestlings were between 4-8 days of age. Our results will provide insights into whether unequal parental investment contributes to mate switching behavior in Northern House Wrens.

Board 14

DEVON HALEY
HAYDEN KELNER
BRITTNEY PARKS
TYLER WILLIARD

Research Mentors: Eric Gangloff, Bryan Juarez
Department of Biological Sciences



Common wall lizards (Podarcis muralis) are native to Europe but have been introduced in Ohio. Studying these lizards provides important insight into invasive species and their impact on the local ecosystems. In Cincinnati, Ohio, this species mainly occupies human-built environments, but some are also found in more natural forest habitats. In this study, we compared the sprinting and climbing speeds of lizards from both habitat types at five different temperatures and on two different surfaces, stone and tree bark. Comparing these speeds allows us to see if lizards from these two habitats differ in their ability to perform in different habitats.

HOMEFIELD ADVANTAGE IN ACTION: CLIMBING AND SPRINTING PERFORMANCE IN PODARCIS MURALIS

How organisms adjust their traits to different environments is a central and compelling question in biology, particularly relevant in the context of introduced species where rapid phenotypic shifts can influence ecological impact and spread. Common wall lizards (Podarcis muralis) are urban specialists native to Europe but invasive in North America. In Cincinnati, Ohio, USA, these lizards are found in both urban and forested habitats, bringing up the question of how they may thrive in either habitat and impact native wildlife. Here, we test the 'homefield advantage' hypothesis—that traits match the environments in which they live. We predicted that lizards sprint and climb faster on substrates and at temperatures that match their home environment. To test our predictions, we measured sprinting and climbing speeds at five temperatures (spanning the range of active temperatures) on bark and stone tracks in animals from both wall habitats (N = 18) and forest habitats (N = 20).. Our findings may have important implications for understanding how phenotypes are matched to the environment in which organisms live, which is important to further understanding their spread around southern Ohio and beyond.

Board 15

CORD PODOLAN
MACK FINCHAM

Research Mentors: Hanliang Guo, Kyle Pellegrin
Department of Math & Computer Science

Many bacteria swim by spinning their helical tails called flagella. Flagella come with a wide variety of geometric parameters for different bacteria. In this work we study how the different geometries affect the swimming of bacteria via computer simulations and benchtop experiments.

FLAGELLAR GEOMETRY AND ITS EFFECTS ON RUN AND TUMBLE—A NUMERICAL AND EXPERIMENTAL STUDY

Flagellated bacteria navigate the environment using the method "run-and-tumble". Specifically, the helical flagella bundle together when spinning counterclockwise and drive the bacteria to move in a near-straight line (run); the flagella unbundle when spinning clockwise and cause the bacteria to change their direction (tumble) randomly. In this work, we study how the different helical geometries of the flagella affect the bundle/unbundle rate via their attractive/repulsive velocities from each other. We explored a wide range of helical geometries pertinent to bacterial locomotion numerically using the method of regularized stokeslet and experimentally with a benchtop setup motivated by Zang et al., 2025. Our results show that flagellar geometry has significant effects on bacterial run-and-tumble.

Board 16

CHASE ELLIS

Research Mentor: Dustin Reichard
Department of Biological Sciences

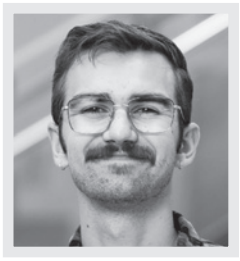
Bird nests often have more than just birds living inside them such as mites, ants, spiders, and other small invertebrates. My study investigates where parasitic mites are located in the nests of Northern House Wrens. These mites draw blood from nestlings, so by learning about the mite's behavior we can gain insight into how some diseases spread between nests.

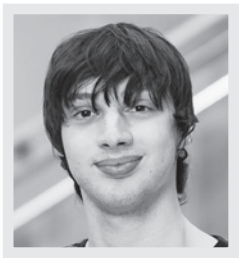
MITE LOAD DIFFERENTIATION IN THE NESTS OF NORTHERN HOUSE WRENS (TROGLODYTES AEDON)

Mites are commonly found in bird nests, including nests of cavity nesting species that reuse the same cavities within and between years. The nest environment provides a suitable ecosystem for mites to thrive where they are able to feed on debris brought into the nest, parasitize the nestlings, or feed on other invertebrates. We examined nests of Northern House Wrens (Troglodytes aedon) and quantified three categories of mites that live there: commensal, predatory and parasitic. Parasitic mites were the major focus due to their direct influence on nestling health. Because the mites feed on blood, they play an important role in the transmission of disease, and learning about their behavior may help us better understand avian epidemiology. Using the Tullgren funnel method, we collected and identified mites from the nest cup, where the nestlings live, and the stick platform, which provides structural support for the cup. This procedure uses a heat source to direct the mites into a collection tube containing ethanol for preservation, and the mites are later cleared using lactic acid before identification. By comparing the differences in mite load within the nest of each category, we will learn about how the mites move within the nest and what implications that may have for the health of nestlings and spread of disease within a community.

Board 17

BRITTNEY C. PARKS
DEVON X. HALEY
HAYDEN KELNER
TYLER WILLIARD





Research Mentors: Eric Gangloff, Bryan Juarez
Department of Biological Sciences

Monitoring introduced species, like the common wall lizard (Podarcis muralis), is important for mitigating impacts on native wildlife. In this study we monitored lizards by conducting a capture-mark-recapture study to estimate population sizes and characteristics at both walls and in forests. We also extracted DNA from their feces to compare the gut microbiome between sites and unexpectedly found results counter to our predictions: their gut microbiomes do not differ. Finally, we studied digestive physiology efficiency between sites in lab trials, where we found that lizards at cool forest temperatures ate less and digested slower than lizards at warm wall temperatures. By combining field and lab studies, we can better understand what factors contribute to the spread of introduced species.

CAN WALL LIZARDS LIVE IN THE FOREST? A COMPARISON OF POPULATION DEMOGRAPHY, GUT MICROBIOME, AND DIGESTIVE PHYSIOLOGY IN INTRODUCED LIZARDS (PODARCIS MURALIS)

Understanding the potential harm caused by introduced species on native biodiversity is crucial. The common wall lizard (Podarcis muralis), introduced from Europe in 1951, now thrives in urban areas with stone walls in Cincinnati, Ohio. We seek to understand why wall lizards have flourished in Ohio by learning about their population structure, gut microbiome, and potential physiological (digestive) plasticity in both the anthropogenic areas where they flourish and in forested habitats. Specifically, we used capture-mark-recapture techniques to estimate population size and demography between wall and forested sites, where we expected more lizards at the wall than in the forest. We tested our prediction that lizards from the forest will have a more diverse gut microbiome than lizards from the wall due to differences in prey diversity across environments by measuring microbiome diversity using 16S rRNA gene sequencing. Finally, we conducted a lab experiment testing the hypothesis that lizards kept at the warmer wall temperatures would consume more food and digest food more efficiently than lizards kept at cooler forest temperatures. Preliminary results indicate that lizards are relatively less abundant in forests, lizards from both environments exhibited similar gut microbiomes, and that lizards at cooler forest temperatures eat less and digest slower, thereby assimilating less energy, compared to lizards at warmer wall temperatures. By studying the population density and physiological ecology of common wall lizards among habitats, we show how integrative approaches to studying invasive ecology can reveal the potential future establishment and spread of introduced species.

Board 18

ZOE WARD
TAYLOR NOSZKA
AYLISH O'HARRA

Research Mentor: Grant Walby
Department of Chemistry

Drazepinone is a naturally occurring compound found in mushrooms. This compound is particularly important due to its ability to shut off different biological pathways in the body. Our research this summer into the compound has taken us through several successful reactions that has allowed us to synthesize some of the steppingstones needed to make Drazepinone and compounds similar to it. Our research in the future looks to see how the compounds similar to Drazepinone once made successfully affect the bodies on off switches for different biological pathways.

TOTAL SYNTHESIS OF DRAZEPINONE AND DERIVATIVES FOR PTP INHABITION

Drazepinone is a natural product, meaning it can be isolated from sources within the natural world, and it has recently garnered interest for its demonstrated selectivity towards two specific protein tyrosine phosphatases (PTPs). PTPs are enzymes whose function is to remove phosphate groups from proteins, initiating many significant biological pathways. However, it is typically difficult to target only certain PTPs due to their similar structures. In our lab, we are interested in Drazepinone due to its affinity for two PTPs, PTP1B and T-cell PTP (TCPTP), which are involved in pathways relating to insulin, inflammation, and cancer, making this selectivity all the more compelling. To date, a full synthesis of drazepinone has not been developed, but our lab has begun work on the early steps of the synthesis and has already optimized the first two reactions. Additionally, our lab has theorized pathways towards the synthesis of key derivatives to develop a more comprehensive understanding of the binding elements of drazepinone, using computational data to support the designs.

Board 19

EMILY KOCEL
SHANNON O'MALLEY

Research Mentor: James C. Franklin
Department of Politics & Government, International Studies Program

Researchers have created scales to measure human rights abuses, but these scales do not indicate whether abuses are political, targeting opposition groups, or are apolitical, targeting people who are not politically active, such as people from minority ethnic groups. We have used human rights reports from Amnesty International and the U.S. State Department to create scales of political abuses and apolitical abuses for over 150 countries for the years 2000-2004. This will allow a better understanding of why human rights violations occur.

ANALYZING OPPRESSION AND POLITICAL REPRESSION WITH NEW GLOBAL INDICATORS OF HUMAN RIGHTS VIOLATIONS

Social scientists have typically seen human rights abuses as a means for governments to maintain power against threats posed by domestic opposition. This especially applies to the subset of human rights known as physical integrity rights that protect against arbitrary imprisonment, torture, disappearances, and extrajudicial killing. In other words, these violations are seen as political repression. However, several recent publications have argued that there is a significant number of physical integrity rights abuses that do not appear to target political opposition, instead focusing on criminal suspects and people from marginalized social groups. This type of coercion is often called oppression, to contrast with political repression.

A broader understanding of these divergent motivations requires consideration of the targets of human rights abuses. Building on a previous study by one of the authors (Franklin 2020), this project develops new global indicators of human rights, adapting the prominent Political Terror Scale (PTS) methodology to code (1) political abuses that target politically active individuals and (2) apolitical abuses that target people who are not politically active. The three researchers coded scales on the severity of political and apolitical abuses for most countries of the world over a five-year period (2000-2004) using annual human rights reports from Amnesty International and the U.S. State Department. Each report was coded by at least two raters, and the resulting indicators show high inter-rater agreement. In the future, the researchers will use these indicators to analyze global trends and factors in political repression versus oppression.

Board 20

ELLIE ABSHIRE

Research Mentors: Shala Hankison, Tamara Panhuis
Department of Biological Sciences

Species can change over time and develop specific behaviors due to sexual selection favoring the inheritance of traits that enhance reproduction. In the fish, sailfin mollies males will display specific courting behaviors to gain female attention. Our research examines courtship behaviors in male sailfin mollies, in order to determine the relationship between male courting behavior and paternity success. Our findings will provide valuable insight into the traits shaped by sexual selection in sailfin mollies.

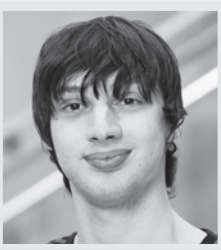
MULTIPLE PATERNITY & COURTSHIP BEHAVIORS IN THE SAILFIN MOLLY (P. LATIPINNA)

Sexual selection favors the inheritance of traits that enhance reproduction. In order for a trait to be selected for, the reproductive benefit of a trait must outweigh any costs. Along with this, different forms of sexual selection acting within a species, such as intrasexual selection and female choice, can lead to the inheritance of different traits.

The sailfin molly, Poecilia latipinna, is a highly promiscuous species of live-bearing fish where females produce broods that often exhibit multiple paternity. In this species, both male size and male courtship behaviors play a role in reproductive success. However, the relationship between male courtship behaviors and paternity success in multiply mated females is unknown. Our research aims to determine the relationship between male courtship behaviors and paternity success in P. latipinna. To do this our research combines methods from animal behavior, life-history evolution, and genetics. Males were placed into pairs based on similar size and total body area. Once a female became receptive she would be assigned a pair. Each male would then spend 24 hours with the female, during which behavior was filmed. After collecting the footage, male behaviors are scored based on the frequency and duration of behaviors expressed. By using DNA collections from the parents and offspring as well as microsatellite analysis of 11 different loci, we are able to determine paternity. Ongoing research will allow us to better understand the direct relationship between male courtship behavior, female preference and reproductive success.

Board 21

TYLER WILLIARD



Research Mentors: Bryan Juarez, Eric Gangloff
Department of Biological Sciences

The European common wall lizard (Podarcis muralis), introduced to North America by humans around 75 years ago, has caused concerns over its potential to expand its range and disturb native ecosystems. Using a methodology known as ecological niche modeling, we used geographical data, climate data, and machine learning to determine the suitability of locations across North America for the common wall lizard. Knowing this information, we are able to better understand what creates good habitat for the common wall lizard and where they could expand to next.

USING ECOLOGICAL NICHE MODELING TO DETERMINE THE POTENTIAL SPREAD OF PODARCIS MURALIS ACROSS NORTH AMERICA

Understanding how invasive species expand their range from introduced locations is necessary for learning how ecosystems change over time. The common wall lizard (Podarcis muralis) was introduced to multiple locations across North America from Europe and is a generalist carnivore, typically found living in fissured man-made habitats. P. muralis notably thrives in urban environments, making this species an important model for both invasion and urban biology. In this study, we combine occurrence, climate, and geographical data in an ecological niche modeling (ENM) framework to map habitat suitability across North America. Specifically, we analyze N = 354,019 occurrences and 20 climatic and geographical variables using a machine learning model ("MaxEnt") to determine habitat suitability for P. muralis at the continental and country levels, providing information on how P. muralis might spread and establish in new areas. Of the variables used in the model, human population density is of particular interest and we are testing its importance in an ecological niche model for the first time for any species in the genus Podarcis. We predict the most suitable habitats have warm winters, mild summers, high food availability, and are found near areas with high human population densities and human-built structures made from limestone. Overall, this research highlights the benefits of using integrative approaches combining climate and geography to investigate the spread and establishment of ectotherm animals, with a focus on urban areas.

Board 22

ISABELA RODRIGUEZ ORTIZ

Research Mentors: Robert Harmon[1], Rachael Roettenbacher[2]
[1]Department of Physics & Astronomy
[2]University of Michigan

Starspots, like sunspots, are darker and cooler regions on a star's surface that are due to increased magnetic activity, which suppresses the flow of heat from the hotter layers below the spot. Starspots cause a star's brightness to vary due to them being carried in and out of view as the star rotates. Using data from the Kepler Space Telescope, which detected planets orbiting other stars by measuring the decrease in brightness when the planets pass in front of them, we can also detect starspots because of the decrease in brightness they cause when they are facing us. With this, it is possible to learn about the behavior of starspots and their relationships to various stellar properties, such as mass and rotation rate. By studying starspots, we can learn about the magnetic behavior of stars and, therefore, better understand the Sun's magnetic field behavior. Using a program written by Dr. Harmon, we are able to create an image of the stellar surface based on the data gathered by the telescope. Because of noise in the brightness measurements, if the map produced by the program does too good a job of matching the data, the stellar surface image ends up being covered in noise artifacts that makes it hard to identify the starspots. For each rotation of the star, we have to choose from different options of stellar surfaces and pick the ones in which the starspots are easily identifiable. I have created a machine learning program that automates and speeds up this selection process. This process can dramatically save time and now allows us to track how the starspots change and move over time, so we can then learn more about their behavior.

AUTOMATED STARSPOT DETECTION WITH CONVOLUTIONAL NEURAL NETWORKS AND KEPLER SPACE TELESCOPE LIGHT CURVES

Starspots, like sunspots, are darker and cooler regions on a star's surface caused by increased magnetic activity, which suppresses the flow of heat from the hotter layers below. As the star rotates, these spots move in and out of view, causing the star's brightness to vary. The Kepler Space Telescope, which detected planets orbiting other stars by measuring dips in brightness when planets pass in front of them, also detected starspots through the decreases in brightness they cause when they face us. With the data from the telescope, we can learn about the behavior of starspots and how they relate to various stellar properties, such as mass and rotation rate. By studying starspots, we can better understand the magnetic behavior of stars and gain insight into the Sun's magnetic field as well. Using a light curve inversion (LI) program developed by Dr. Harmon, we can create images of stellar surfaces based on the light curves, which are plots of brightness versus time, collected by the telescope. However, because of noise in the brightness measurements, if the program matches the data too well, the resulting image will be filled with noise, making the real starspots hard to identify. With tens of thousands of stars and hundreds to over thousands of rotations per star to analyze, we must select the best surface reconstruction for clearly identifying and tracking starspots for each rotation. This used to be done by humans, but it becomes very tedious and impractical to go through a large dataset like ours. Using the open-source machine learning library and toolkits, TensorFlow, I developed a Convolutional Neural Network (CNN), a machine learning program that automates and speeds up the selection process. The CNN can tell the difference between surface reconstruction images and sort them into good ones, where starspots are clear, and bad ones, where they are obscured by noise artifacts. This approach greatly reduces processing time and makes it possible to track starspot positions and other properties more efficiently and effectively.

Board 23

SHELBY BAY
MADDIE HOYT
MARIA THIBODEAUX

Research Mentors: Elizabeth Nix, Elizabeth Starns
Department of Health & Human Kinetics

The pilot study of the Whole Athlete Program aims to evaluate the effectiveness of the program with youth swimmers (ages 11-18) who participate in summer club teams. The swimmers were taught lessons on various exercises including bodyweight and resistance band, hydration, snack intake, goal setting, and time management. They took surveys at the beginning and end of the program that measured their levels of activity, motivation, and dietary habits. We found there was an increase in water consumption, minutes spent exercising, and a decrease in amotivation.

THE EVALUATION OF THE WHOLE ATHLETE PROGRAM

Background: This study assesses the effectiveness of the Whole Athlete Program, which teaches young athletes the importance of strength training, nutrition, and mental aspects of sport to fill the gaps that may be lacking from coaches.

Methods: This study utilizes a single-arm pre/post intervention design. Participants completed surveys at week 1 and 6 and were taught lessons for the middle four weeks. The lessons focused on varying exercises including resistance band and bodyweight, hydration, proper fueling, and goal-setting. Surveys used to gauge the effectiveness of the program measured motivation, caloric and non-caloric beverage intake, carbohydrate consumption, number of minutes per week of exercises such as resistance band and body weight.

Results: Thirty-seven young swimmers (M=10, F=27) from the Delaware Darts swim team (N=27, M=14.22 1.97) and Westerville Piranhas swim team (N=10, M=13.7 2.16). Participants demonstrated a significant increase in minutes spent per week completing bodyweight exercises (pre = 1.91 1.52, post = 2.77 2.04, p = 0.035) and resistance band exercises (pre = 1.63 1.66, post = 2.37 1.93, p = 0.022), a significant decrease in amotivation (pre = 9.78 6.16, post = 8.21 5.23, p = 0.008), and an increase in number of water bottles consumed per day (pre = 3.44 1.41, post = 3.95 1.58, p = 0.022). Two-sided t-tests were performed to analyze significance between variables.

Conclusion: Limitations throughout the study included response bias and high attrition. Future research is encouraged to explore associations with other sports teams and varying levels of competition.

Board 24

EMILY HOLT
EMMA FOSTER

Research Mentors: Eric Gangloff, Miranda Horn, Chelsea Vadnie
Department of Biological Sciences, Department of Psychology

For this study, we observed how lead pollution affects the brains of common wall lizards from Cincinnati, Ohio. These lizards are interesting to use because their brains have neuroregenerative properties, unlike many other animal species. By giving these lizards different amounts of lead and examining their brain cells, we hope to find evidence that their brains can respond to damage caused by lead by making new cells. This research can be helpful in understanding how brains can recover from toxins, which can be applied to both humans and animals alike.

LIZARD NEUROGENESIS IN RESPONSE TO LEAD TOXICITY

Lead (Pb) is a prevalent contaminant that is a serious threat to humans and other animals, with effects including the disruption of neurological function. Lead pollution is particularly prominent in urban environments, affecting organisms such as common wall lizards (Podarcis muralis), an invasive and abundant species in Cincinnati, Ohio, USA. Previously we found that lead does not impact lizards' balance In this study, we aimed to determine the effects of lead toxicity on the brain at the cellular level. Lizards possess a widespread capacity for adult neurogenesis, which has the potential to reverse neurotoxin-induced damage. We hypothesized that after ingesting lead, wall lizards would show increased neurogenesis in the medial cortex—a homolog to the mammalian hippocampus—as a means to compensate for lead-induced neuronal damage. To test our prediction, we divided lizards (N = 36) into nine treatment groups based on the doses they would receive orally (distilled water control, 10 mg Pb/kg body weight, and 50 mg Pb/kg body weight) as well as sacrifice date following the last dosage (5 days, 15 days, and 30 days). We found that wall lizards can tolerate lead levels ten times greater than what we observed in the field previously. By employing immunohistochemistry and fluorescent microscopy with NeuN, BrdU, and TUNEL stains, we will assess correlations between lead blood levels in the lizards and neurogenesis and neuronal death. Understanding the mechanisms underlying neurological resilience to lead toxicity in a lizard species will provide valuable insight into variations in regenerative properties across taxa, with implications for both wildlife and human health.

Board 25

AESTELLE DONDERO

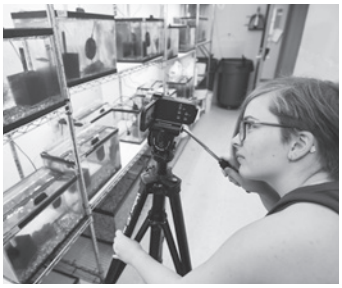
Research Mentor: Robert Harmon
Department of Physics & Astronomy

Cooler, and thus darker patches of heightened magnetic activity known as starspots are found on many stars, including our own Sun. As a star rotates, these patches are carried into and out of view, causing a variation in the measured brightness of the star over time. Using brightness variations due to starspots measured by the Kepler Space Telescope for tens of thousands of stars in conjunction with a software written by Dr. Harmon that is able to create a reconstruction of the stellar surface from the data, we are able to map the stellar surface, allowing us to gain a better understanding of how factors like star size, temperature and rotational period affect the formation and evolution of these spots, giving us insight into the physics of stellar magnetic fields, including our own Sun's. Throughout this project, I have developed a set of python tools to automate the measurement and detection of starspot evolution, as well as develop tools to help detect stellar phenomena such as differential rotation, which is crucial due to the large number of stars to analyze.

DETERMINING HOW STELLAR MAGNETIC ACTIVITY DEPENDS ON STELLAR PARAMETERS USING DATA FROM THE KEPLER SPACE TELESCOPE

Starspots are cooler, and thus darker patches on a stellar surface where heightened magnetic activity suppresses convection, reducing the flow of energy to the star's surface from the layers below it. Due to their distance from Earth, almost all stars other than the Sun are too far away to image directly. However, as the star rotates, the starspots on its surface are carried into and out of view, leading to periodic changes in the star's brightness. Using software written by Dr. Harmon that creates a reconstruction of the stellar surface from these periodic changes in the stars brightness, we are able to determine the position of starspots on the stellar surface, and track their evolution over time.

Our goal in this project is to utilize a dataset of tens of thousands of stars, each with dozens to over a thousand lightcurves (plot of brightness vs time representing a single rotation of the star) captured by the Kepler Space Telescope, to gain a better understanding of how stellar parameters such as size, temperature, and rotational period affect the formation and evolution of these spots and their associated magnetic fields. In order to track these starspots, we use a process known as centroiding to determine their positions on the surface map for a rotation. Over the course of the summer, I developed a set of python tools that automate the process of detecting and centroiding starspots, which was necessary due to the sheer size of our dataset. I also designed and programmed the Differential Rotation Toolkit, a python package containing an assortment of utilities to aid in tracking the starspot centroids over time to study differential rotation. Differential rotation refers to different latitudes on the stellar surface having different rotational periods, and is thought to play a crucial role in the generation of stellar magnetic fields.




Board 26

GEORGE NAPLES

Research Mentor: Ashley Toenjes
Department of Environment & Sustainability

We collected, extracted, and analyzed maps of the Gaza Strip from 2020 through 2025. In analysis, we looked for consistent inconsistencies that ultimately promoted United States foreign policy interests in the region. Our results concluded that there is a strong relationship between U.S. foreign policy interests and media maps of the Gaza Strip during geopolitical conflict.

UNMAPPING U.S. FOREIGN POLICY IN THE MEDIA

This study analyzes media maps of the Gaza Strip, Palestine from 2020-2025, asking what is the relationship between United States foreign policy interests and media maps of the Gaza Strip during geopolitical conflict? Prior studies document how U.S. foreign policy interests are promoted through media maps of Kurdistan, Afghanistan, and Iraq during previous geopolitical conflicts. Despite these studies of Southwest Asia, there are currently no studies examining how U.S. imperial interests have been mapped onto the Gaza Strip. Maps from The New York TImes, The Washington Post, and the Wall Street Journal were collected, organized, and coded to critically assess their alignment with U.S. foreign policy. Our findings demonstrate strong alignment between U.S. foreign policy interests and media maps of the Gaza Strip during geopolitical conflict.

Board 27

ANUSHKA SHARAD

Research Mentor: [1]Robert Harmon, [2]Shane Larson
[1]Department of Physics and Astronomy
[2]Department of Integrated Engineering and Applied Science at Clarkson University

The research explores how gravitational waves, which are tiny ripples in spacetime, are produced when a low-mass object, like a star or black hole, orbits a much higher-mass black hole. These systems, called Extreme Mass Ratio Inspirals (EMRIs), are expected to be major sources for the upcoming Laser Interferometer Space Antenna (LISA), a space-based gravitational wave detector launching in the 2030s.

To study them, we simulate the orbits and compute the resulting gravitational waves using a model by physicist H. D. Wahlquist. This gives us two waveforms, or polarizations, that describe how spacetime stretches and squeezes as the orbit evolves. I solve for the orbital motion numerically and use it to generate waveforms. We represent the waveforms in different numerical and graphical ways to better understand the features that make them recognizable.

The goal is to map how different orbital shapes and angles affect the waveforms. This will help develop templates for LISA to detect and decode signals from distant black holes, offering new ways to explore how gravity behaves across space and time.

SIMULATING AND ANALYZING GRAVITATIONAL WAVES FROM EXTREME MASS RATIO INSPIRALS (EMRIS)

In collaboration with Dr. Shane Larson, my research focuses on simulating gravitational waveforms from Extreme Mass Ratio Inspirals (EMRIs), systems in which a compact stellar-mass object orbits a supermassive black hole. EMRIs are prime sources for the Laser Interferometer Space Antenna (LISA), a space-based gravitational wave observatory scheduled for launch in the 2030s.

We model the binary as a restricted three-body system, treating the small body as a test mass evolving under the background spacetime of the primary. Using the Wahlquist (1987) analytic waveform formalism, we compute the two gravitational wave polarizations h_+(t) and h_x(t) based on orbital parameters and the evolving source position, which is obtained by numerically solving Kepler's Equation for eccentric motion.

The project systematically varies eccentricity and inclination to explore how these parameters shape waveform morphology and spectral content. Fast Fourier Transforms (FFTs) are used to analyze the harmonic structure of the signals, particularly the emergence of high-frequency bursts near periapsis. Through this process, we aim to build physical intuition about EMRI signal families and their parameter dependencies.

Future extensions will include more realistic orbital modeling, improved waveform generation techniques, and interactive visualization tools. This work contributes toward the development of EMRI waveform templates and analysis strategies essential for extracting astrophysical and relativistic information from LISA observations.

Board 28

KIRSTEN QUINN

Research Mentor: Nick Geis
Department of Math & Computer Science

The Riemann Hypothesis, which is the largest unsolved problem in mathematics, is concerned with the question: "Can we predict prime numbers?" A successful proof of the hypothesis will in turn prove hundreds of other important theorems. One approach to studying the hypothesis is through a mathematical function known as the Mertens function. Because this function is exceptionally difficult to study in practice, some mathematicians developed a random model of the Mertens Function known as Random Multiplicative Functions. While much work already exists that looks at the theoretical properties of Random Multiplicative Functions, our research instead focuses on using computer simulations to generate millions of Random Multiplicative Functions to analyze their behavior, helping us understand the nature of the Mertens Function.

NUMERICAL INVESTIGATION OF PARTIAL SUMS OF RANDOM MULTIPLICATIVE FUNCTIONS

The Mobius function, μ(n), and other multiplicative functions are central objects in number theory. Recently, there have been several breakthroughs in number theory where proof techniques were motivated by those for probabilistic models for multiplicative functions. One such model is called random multiplicative functions (RMFs). An RMF, f(n), is defined as a sequence of random variables where f(p) = ±1 with equal probability for each prime p; f(n) equals the product of f(p) for all p|n for each square-free n; and f(n) = 0 otherwise. This mimics the definition for μ(n). Although RMFs have been investigated thoroughly using analytic methods within the last decade, there is significantly less work based on numerical methods.

We use C++ to extensively perform Monte Carlo simulations of partial sums of RMFs for n ≤ 10^9. Rather than studying the sizes of these sums, we instead analyze other properties like the growth rates of the number of sign changes and zeroes, as well as the proportion of sign changes to zeroes. We compare these findings to known results for simple random walks and partial sums of multiplicative functions, like μ(n), making new conjectures as appropriate.

Board 29

ANINDITHA NAIR

Research Mentor: Mehwish Abbasi
Department of Math & Computer Science

Data centers are critical to the digital economy but can be extremely harmful to the environment. This study evaluates data centers of varying sizes and operational types in Ohio and their environmental footprint by analyzing their electric energy use and associated greenhouse gas (GHG) emissions and water consumption. The findings identify key drivers of environmental impact and suggest mitigation strategies such as renewable energy adoption and energy-efficient technologies.

ASSESSING THE ENVIRONMENTAL FOOTPRINT OF DATA CENTERS IN OHIO

Data centers are critical to the digital economy but contribute significantly to environmental impacts through their substantial electricity consumption. This study evaluates the environmental footprint of data centers in Ohio by analyzing their electric energy use and associated greenhouse gas (GHG) emissions, as well as water consumption driven by electricity generation. The research quantifies the carbon footprint related to electricity consumption and examines patterns influencing energy demand across data centers of varying sizes and operational types. Additionally, the study assesses water usage indirectly attributed to electricity generation. The findings identify key drivers of environmental impact and suggest mitigation strategies such as renewable energy adoption and energy-efficient technologies. This research provides a detailed assessment and actionable recommendations to promote sustainable data center operations while reducing their climate and water resource footprint.

Board 30

ABRIANNA HITE

Research Mentor: Juan de Dios Ruiz Rosado,
Yuriko Sanchez-Zamora
Kidney and Urinary Tract Research Center, Abigail Wexner Research Institute at Nationwide Children's Hospital

Looking into a specific Type II Diabetes Mellitus medication, sodium glucose cotransporter 2 (SGLT-2) inhibitors, and its controversially associated risk with UTI susceptibility. Determining if this medication truly increases UTI risk in Type II Diabetes patients within a murine model in a controlled environment. Additionally, looking into Vitamin B6 as a prospective antioxidant that could possibly reduce the susceptibility of UTI due to the medication.

FLUSHING SUGAR, FUELING RISK?: PYRIDOXAMINE MITIGATES SGLT2 INHIBITOR–INDUCED UTI SUSCEPTIBILITY IN EXPERIMENTAL TYPE 2 DIABETES MELLITUS

Type II Diabetes Mellitus (T2DM) has become one of the most prevalent public health concerns in the United States. Sodium-glucose cotransporter 2 (SGLT-2) inhibitors are a diabetic drug that is becoming more commonly prescribed amongst this population. However, SGLT-2 inhibitors are quite controversial because of mixed results of increased UTI susceptibility as an adverse side effect. This project will test whether SGLT2 inhibition leads to increased UTI susceptibility in an experimental T2DM murine model and potential interventions to reduce infection risk. If pharmacological inhibition of SGLT2 using dapagliflozin increases UTI susceptibility in a T2DM model, then this effect may be attenuated by inhibiting formation of advanced glycation end products (AGEs). Diet-induced obesity (DIO) mice were fed a high fat diet (HFD) for 20 weeks followed by treatment with dapagliflozin for 3 weeks alone or with pyridoxamine. After treatment, DIO mice were transurethrally inoculated with uropathogenic E. coli (UPEC). In-vivo evaluation of diabetic traits—including hyperinsulinemia, hyperglycemia, and obesity—as well as bacterial burden in urinary tract tissues were conducted. In-vitro assays of intracellular and extracellular bacterial killing and attachment were performed with HBLAK (human bladder epithelial) cells. These results elucidate that SGLT-2 inhibitors do increase UTI susceptibility in T2DM model, and that co-treatment with pyridoxamine decreases glycosylation of the urothelium compared to dapagliflozin alone, therefore decreasing UTI susceptibility.

Board 31

ALEX BZDAFKA

Research Mentor: Isaac Park
Georgia Southern University

Flowers bloom at different times of the year, this means the availability of food sources for bees is variable across a season. We collected pollen from the common eastern bumblebee and identified the pollen grains to figure out what they were collecting pollen from. We were able to see that they have preferences for certain species, and these preferences were mostly native species.

VARIATION IN BOMBUS IMPATIENS FORAGING HABITS ACROSS SPACE AND TIME

Differences in flower phenology and community composition lead to floral resources varying over time and space. Such differences affect both the composition and quantity of pollen collected by generalist bees; the manner in which this occurs is often not well understood. To address this question, we collected pollen from Bombus impatiens throughout the foraging season across 3 field sites, in Statesboro Georgia, each with varying levels of invasion and human influence, to understand how generalist bees respond to variation in floral resource availability. Pollen was identified using light and scanning electron microscopy, allowing us to compare foraging habits over time and among sites. We visualized the differences in pollen collection communities with non-metric multidimensional analysis (NMDS) yielding 4 distinct communities; we also observed collection richness to be variable across a temporal scale. However, we found similar composition of pollen collected among sites, largely due to strong preferences for certain species, even if they were not observed in close proximity to a given site.

Board 32

ANASTASIA (ANYA) SHEVCHIK

Research Mentors: Marielle Brinkman, Ahmad El Hellani
The Ohio State University

Moist snuff is a tobacco product more prevalent in rural Appalachia than in the US overall. The tobacco industry, including moist snuff manufacturers, can manipulate its products to appeal to a wide range of users, from novice to experienced. By looking at moist snuff products popular in Appalachia and characterizing their physical (tobacco cut and percent moisture) and chemical (nicotine content and form) characteristics, we can better understand how these products appeal to different users and have varying addiction potential.

ABUSE AND APPEAL: A PRODUCT ANALYSIS OF POPULAR MOIST SNUFF BRANDS IN RURAL APPALACHIA

Moist snuff use in rural Appalachia is disproportionate compared to the US overall, and these communities experience health disparities related to cancer and oral diseases. Moist snuff manufacturers can manipulate their products to appeal to a wide range of consumers, from tobacco-naïve individuals to experienced users. Products' physical and chemical characteristics can impact nicotine bioavailability and flavor delivery (appeal). By analyzing popular market products, we can better understand their abuse liability. Using data from a convenience sample of rural Appalachian moist snuff users, the eight most popular products were analyzed. Characteristics analyzed include tobacco cut, percent moisture, pH (which can determine the bioavailable freebase nicotine level), and total nicotine content. Our data showed that moist snuff products popular in Appalachia vary widely in tobacco cut, pH, and total nicotine content, but were relatively consistent in moisture levels. We found that fine- and long-cut tobacco products are wetter and contain more nicotine than pouch snuff. Additionally, fine-cut tobacco has a lower pH and less freebase nicotine than other cuts. This work highlights that these products can appeal to a wide range of users based on their nicotine delivery. The data generated could inform the FDA for potential moist snuff regulations.

Board 33

FALLON KEETON

Research Mentors: Krithika Rajaram, James Blauwkamp
Microbiology Department of The Ohio State University

Malaria is a deadly disease caused by parasites that are able to quickly adapt and resist current treatments. My project focused on the understanding of one of the parasite's essential metabolic systems that helps it to survive by supporting important proteins. Using genetic tools, we created knockdown systems that will allow us to test how turning off specific genes in this system affects the survival of the parasites. This research could help to identify new ways to target and kill malaria parasites with future treatment.

CHARACTERIZATION OF THE MITOCHONDRIAL ISC PATHWAY IN MALARIA PARASITES

Malaria remains a serious global health concern, contributing to over 500,000 deaths annually, with the most severe cases predominantly being caused by Plasmodium falciparum. The development of effective treatments is limited due to the parasites ability to evade human immune response and quickly develop resistances to antimalarial drugs. To develop functional anti-malarial drugs, a thorough understanding of the malaria parasite's gene function is crucial. The mitochondrial iron-sulfur cluster (ISC) pathway is a metabolic system within the parasite that supplies Fe-S cofactors to client proteins in the mitochondrion and cytoplasm. Despite its importance, the pathway remains highly uncharacterized.

This study focuses on the characterization of two genes within the ISC pathway, IscS and IscA1, to assess their essentiality to parasite survival. A pre-existing knockdown line for IscS was confirmed using Western blot analysis, confirming its functional suppression. To generate a new transgenic knockdown line for IscA1, we designed CRISPR-Cas9 constructs using multiple PCRs and InFusion Cloning to construct both the CRISPR-Cas9 plasmid and the repair plasmid carrying our conditional knockdown system. These tools will enable future analyses of ISC genes and may help identify potential antimalarial drug targets.

Board 34

CARSON FOX

Research Mentor: Michael Poirier
Department of Physics at The Ohio State University
(OSU-SURE program)

We studied DNA nanocaliper devices, which can be held at different angles. By measuring these angles and structures, we can capture all the possible interactions that might occur. This helps us realize how easily these DNA devices can be accessed by enzymes and proteins. Ultimately, we can measure the forces between DNA and nucleosomes, which is crucial for understanding how genetic material is packaged and accessed.

FORCE SPECTROSCOPY NANOCALIPER CONFORMATIONAL CAPTURE

This project focuses on developing nanoscale DNA Force Spectrometers (nDFS), which are nanodevices designed to measure mechanical forces acting on DNA and nucleosomes. By measuring these forces, we gain insight into the structural mechanics and binding dynamics of DNA. The core methodology involved testing DNA constructs within the device to undergo conditional restriction enzyme cutting or ligation. When restriction enzymes or ligase were introduced, the DNA was either cleaved or ligated, depending on the nanodevice's conformation and accessibility of target sites. Gel electrophoresis was used to analyze these reactions: successfully cleaved or ligated DNA produced distinguishable band shifts, indicating whether the device properly exposed or held the DNA. Notably, this method provides a wider array of possible confirmational captures than previous TEM (Transmission Electron Microscope) data. These results confirmed that the device can modulate DNA accessibility, enabling further testing of force interactions and the exposure of binding sites. Regarding future work, this system provides a platform for measuring the system's probable free energy landscape, an essential parameter in determining the probability of DNA clamp binding, and for quantifying the forces involved. Ultimately, this nanodevice lays the groundwork for future in vitro nucleosome assays and a deeper understanding of DNA and nucleosome interactions under force.

Board 35

MANNAT SIKAND

Research Mentors: Theodore Wagener, Ahmad El Hellani, Toral Mehta
The Center for Tobacco Research at The Ohio State University

This project aims to manipulate the dimensions of nicotine and observe how it affects an individuals vaping behavior. Young adults and older smokers try lab made e-liquids during a lab session where their puffing behavior and bodily reactions are recorded. The goal of the study is to find out what types of nicotine make vaping more or less appealing.

MANIPULATING E-CIGARETTE NICOTINE TO PROMOTE PUBLIC HEALTH

E-cigarettes (ECs) are often marketed as safer alternatives for adult smokers however, their rising use among young adults raises major public health concerns. The current study aims to examine the effects of the three manipulated nicotine dimensions—concentration, form, and isomer—on use behavior, nicotine pharmacodynamics and nicotine metabolic. Participants include young adult EC users (ages 21–24) and older adult smokers (ages 25–65). Each participant attends 8 lab sessions sampling lab designed e-liquids that vary across the three nicotine dimensions. Within each lab session blood samples, behavioral questionnaires, and puffing data are collected. A puff playback is conducted where the puff is replicated and exposed to live cells for toxicant exposure estimate. Preliminary data shows that ECs rapidly deliver nicotine, with 5% nicotine salt producing the highest and fastest boost. Lower concentrations of nicotine salt and menthol were rated as smoother and more appealing, and products containing R-nicotine reported less satisfaction that led to increased puffing. The study's findings can help guide FDA regulations to reduce EC appeal among youth while maintaining potential harm reduction benefits for adult smokers.

Board 36

CONNER KANKIEWICZ

Research Mentor: Christopher Jaroniec
Department of Chemistry and Biochemistry at The Ohio State University

In this project I worked to make a sample containing DNA and proteins to we can take a look at how they are interacting with one another. Various parts and pieces (DNA and proteins) had to be made before the sample can be assembled. Throughout that process, various tests, assessing the purity and condition of the DNA and protein were performed.

PREPARATION AND CHARACTERIZATION OF CBF1ΔN-NUCLEOSOME COMPLEX FOR NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY STUDY

The pioneer transcription factor, Cbf1, has been thought to play an important role in the regulation of DNA compaction through its interactions with the intrinsically disordered N-terminal tails of histone proteins in nucleosomes. The characterization of these interactions remain elusive as the result of limitations of the techniques, Cryo-EM and X-ray crystallography, in their attempt to visualize the disordered tail region. Solid-State NMR has been thought to work around the limitations but has yet to be a characteristic technique used. Creation of a solid-state sample requires the synthesis of Cbf1, DNA, and histone proteins. However, it is imperative to assess the quality of the sample thoroughly before they are used for testing as results obtained from samples that are not properly characterized (i.e., the contents of the sample are not understood) could lead to misinformation when analyzing results obtained using the sample. 15N labeled Cbf1, Widom 601 DNA containing E-box motif, and histone octamers were successively characterized following their expression through Escherichia coli and subsequent purification. Many biochemical techniques were used to assess their characteristics, including Electrophoretic Mobility Shift Assay (EMSA), sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE), and matrix assisted laser desorption/ionization (MALDI). All techniques provided valuable information that allowed for the assessment of the samples before creation of a solid-state NMR sample.

Board 37

ASHLEY HAYWARD

Research Mentors: [1]Eva Kanso, [2]Hanliang Guo
[1]Department of Aerospace and Mechanical Engineering at the University of Southern California
[2]Department of Mathematics and Computer Science

To study collective motion among fish, models of different species can be created and compared. However, different species of fish exhibit a variety of swimming behaviors, and in order to understand their differences and similarities, we characterize these species by certain metrics, which are carefully chosen based on experimental data. We conducted analysis on experimental data of three species of tetras: Black neons, Buenos Aires, and Pristella tetras. The results of this analysis broaden our understanding of these three fish species and inform parameters for future models.

USING CORRELATION PATTERNS IN SCHOOLING BEHAVIOR TO DISTINGUISH TETRA SPECIES

Fish species are usually identified morphologically or genetically, but group-level kinematics may also provide diagnostic signatures. The advancement in automated tracking technology provides an opportunity to distinguish between collective behavioral signatures and to use those signatures to classify distinct species of schooling fish. In this work, we analyzed videos of schooling behaviors of three tetra species: Black neons, Buenos Aires, and Pristella tetras. We found that Black neon tetras have a higher polarization order parameter, shorter distance to their neighbors, and higher swimming speed than the other two species. We further found that the velocity correlation function of Buenos Aires tetras decays near exponentially up to very large distances while those of the other two species decay near linearly. Our findings show that simple correlation-based metrics can separate species and provide parameters to model these fish species.

Board 38

KAYLA BAYES

Research Mentors: Jackie Chini, Carissa Myers
Department of Physics at The Ohio State University

Physics graduate students and their well-being is a neglected research topic, so our project aims to fill some of that research gap. The purpose of this project is to determine what factors of a physics graduate program impact students' well-being, and how those factors impact their overall well-being. We found that hobbies are an important factor to physics graduate students as they work towards their degree, and it is common for students to lose those hobbies, negatively affecting their well-being.

IMPORTANCE OF HOBBIES TO THE JOURNEY OF PHYSICS GRADUATE STUDENTS AS OPERATIONALIZED THROUGH WELL-BEING

While graduate student well-being has become a priority in recent years, physics education research (PER) has not investigated the well-being of physics graduate students. PER does not have a concrete definition of well-being, nor is there a common way of conceptualizing well-being. Our work utilizes PERMA, a framework that combines multiple well-being components in order to conceptualize a student's overall well-being. These 5 core components include postive emotion, engagement, relationships, meaning, and accomplishments, and our work utilizes 5 additional components: environment, economic security, mindset, health, and safety. The purpose of this project is to determine what factors of a physics graduate program impact students' well-being, and how those factors contribute to their overall well-being. To answer these questions, we analyzed photovoice data from 4 participants that spent time at the same physics graduate program in order to identify the themes and PERMA components present in each photo. We also analyzed how the identified themes positively or negatively impacted PERMA components and how that contributed to the student's overall well-being. Our work indicates that physics graduate students find that hobbies are an important aspect of their graduate school journeys, and that partaking in said hobbies contributes positively to the student's well-being. Our work also shows that it is common for students to lose their hobbies throughout their graduate school journeys, and this negatively contributes to their overall well-being.

Board 39

SHARVI ARORA

Research Mentor: Rachel Abbotts
West Virginia University Cancer Institute

In Lung cancer, the TP53 gene, normally a protector, loses its ability to keep cells in check. But in some cases, instead of simply shutting down, it takes on new roles that actively promote cancer development. My project explored how different types of these "gain-of-function" p53 mutations affect lung cancer cells: how they move, how they respond to a drug that activates immune-like responses, and how they release tiny communication packages called exosomes. We found that each mutation behaved differently, which means understanding the exact mutation could help create more tailored treatments in the future.

INVESTIGATING THE EFFECTS OF GAIN-OF-FUNCTION P53 MUTANTS ON VIRAL MIMICRY AND EXOSOME DYNAMICS IN H1299 NON-SMALL CELL LUNG CANCER CELLS

Gain-of-function (GOF) TP53 mutations are prevalent in non-small cell lung cancer (NSCLC) and are known to influence tumor progression, immune signaling, and resistance to therapy. Using TP53-null H1299 lung adenocarcinoma cells, we investigated how structural (R175H, R249S) and contact (R248W, R273H) GOF p53 mutants affect hallmarks of cancer and responses to Azacytidine (Aza), a DNA methyltransferase inhibitor that reactivates silenced endogenous retroviruses (ERVs), leading to cytosolic double-stranded RNA (dsRNA) and triggering interferon-stimulated gene (ISG) expression via antiviral mimicry. We also evaluated how GOF mutant p53 modulates exosome secretion, a key mechanism by which tumor cells influence the immune microenvironment. Methods included scratch assays for migration, WST-1 assays for cytotoxicity, qPCR for ERV, ISG, and BER gene expression, and nanoparticle tracking analysis for extracellular vesicle output. R175H enhanced cell migration, while R273H mutant showed strong ERV and ISG induction post-Aza. BER suppression occurred in WT p53, consistent with published reports, while GOF mutants showed inconsistent regulation. Notably, R175H exhibited the highest baseline exosome secretion, which declined significantly post-Aza, highlighting mutation-specific effects on vesicle dynamics. Overall, our findings suggest that GOF p53 mutants variably alter DNA repair, antiviral mimicry, and exosome-mediated signaling, reinforcing the need for mutation-informed therapeutic approaches in NSCLC.

Board 40

STEPAN DOBRIANSKYI

Research Mentors: Shivam Chaubey, Premashis Manna
Department of Chemistry and Biochemistry at The Ohio State University

This study is about how we smell things. While we know how light and sound work (like how colors and sound are determined), we don't really understand how smells work at the molecular level. We are studying an odorant receptor called OR51E2 that detects smells. To study it properly, we recreated a tiny, simplified version of the fatty environment it normally sits in, using nanodiscs. Our experiments helped figure out the best way to set up these nanodiscs, which is an important step toward developing future experimental approach.

OBSERVING OLFACTORY RESPONSE OF OR51E2

The wavelength of light and the frequency of sound determine their color and tone, respectively. In contrast, the relationship between the physico-chemical properties of odor molecules and their perceived smell remains poorly understood. A molecular-level mechanism of olfaction has yet to be discovered. This study represents an initial step toward uncovering the connection between the dynamics of odorant receptors and the sense of smell. Here, we focus on the odorant receptor OR51E2, a G protein-coupled receptor (GPCR) expressed in the epithelial cells of the human nose. Because OR51E2 is a membrane protein, its dynamics must be studied in a membrane-mimetic environment. To this end, we employ nanodiscs—discoidal lipid bilayers stabilized by membrane scaffold proteins such as MSP1E3D1—to mimic the native membrane environment. We successfully expressed and purified MSP1E3D1 using two rounds of Ni-NTA affinity chromatography and subsequently assembled empty nanodiscs. Size-exclusion chromatography indicated that the optimal formation of nanodiscs occurs at a 1:150 molar ratio of MSP1E3D1 to POPC lipids. These foundational studies pave the way for single-molecule investigations of OR51E2 and other odorant receptors, potentially shedding light on the molecular dynamics that underlie the perception of smell.

Board 41

ANDREW WEISGERBER

Research Mentors: Stephen Mackay, Willaim T. Harris
Department of Pediatric Pulmonology, (Harris Lab), Heersink Medical School at the University of Alabama at Birmingham

Cystic Fibrosis is a genetic disease that is caused by mutations in a single gene, but we now know that the genotype alone does not fully dictate the course of disease. We seek to analyze how to best model one of the most well known modifiers of CF disease.

DELINEATING VARIATIONS IN TGF-ß–INDUCED MIR-145 EXPRESSION ACROSS EPITHELIAL CELL LINE VARIANTS FOR CYSTIC FIBROSIS MODELING

Background: Although cystic fibrosis (CF) is a monogenic disease caused by mutation(s) in the CFTR gene, disease progression and therapeutic response is heterogeneous across patients, suggesting the importance of non-CFTR modifiers, the most established of which is TGF-β. We previously discovered that miR-145 mediates TGF-β inhibition of CFTR. This study investigates the optimal epithelial cell type to study miRNA regulation of CFTR expression in vitro.

Hypothesis: Primary CF airway epithelial cells have increased miRNA expression and TGF-β signaling compared to gene-edited cell lines.

Methods: Primary airway epithelia (CF and WT) and immortalized cell lines (16HBE WT, 16HBE F508del, 16HBE G542X, CFBE F508del) were cultured under air–liquid interface conditions to terminal differentiation. They were then treated with TGF-β (2 ng/ml) or remained unstimulated for 24 hours. RNA was harvested, purified, and quantified by qPCR. T-tests compared means at a confidence level of 0.05 using R.

Results: At baseline, CF primary cells have increased TGF-β signaling and miR-145 expression compared to primary WT or cell lines. Similarly, TGF-β stimulation of miR-145 expression is enhanced in primary CF epithelial cells, while WT and immortalized cell lines experience a more muted response.

Conclusions: We found that miR-145 expression is variable across cell lines in response to TGF-β, most dramatically shown in differences between primary and immortalized cell lines and between CF and WT. Therefore, when seeking to model the effects of miR-145 on CF treatment, we recommend the use of CF primary epithelial cells as the most representative in vitro system.

Board 42

EL HEALEY

Research Mentors: Erin Shumans, Prabhu Parimi
The Metrohealth System Division of Neonatology

Expecting mothers who contract CMV can pass it along to their fetuses through the placenta causing a congenital infection that is the leading cause of birth defects and nongenetic sensorineural hearing loss. There is no standard method of testing for this infection so the goal of this project was to decide what protocol should be put in place for the MetroHealth System NICU. There are two options for testing protocols: targeted testing that only tests certain infants based on decided criteria and universal testing that tests every infant that is admitted to the NICU. We went through the records of all CMV positive infants in the last decade to see if a targeted protocol or the recently implemented universal protocol would be most effective in catching positive cases while not causing the patient and hospital too much money and/or emotional distress.

DETERMINING THE EFFICACY OF A TARGETED VS. UNIVERSAL TESTING PROTOCOL FOR CONGENITAL CMV IN METROHEALTH'S NICU

Cytomegalovirus (CMV) is the most common congenital infection in the US and the leading cause of birth defects and nongenetic sensorineural hearing loss. Of all positive CMV infants, 1/5 will have birth defects or long-term sequelae. No standard testing recommendation exists, so different hospital systems utilize either universal or targeted protocols. Universal testing has all infants tested while targeted testing only has infants who meet a set of testing criteria tested. Determining the best testing method for a hospital system is a question of capital costs of testing compared to the capital and emotional costs of lifelong medical conditions due by untreated CMV. The MetroHealth NICU began a universal testing protocol on 9/1/24. This study aimed to determine if a targeted or universal testing protocol is better for patient outcome. The difference in cost between the protocols was found to be ~$60,000/year to both the hospital and patient. Records of all CMV positive infants since 2015 were reviewed and case-matched to negative infants of the same gestational age, race, and sex. Logistic regression determined the most accurate positive status predictors were the birthing parent's CMV status, newborn hearing screen failure, and the presence of hepatosplenomegaly or elevated LFTs, but the proposed protocol is not yet effective at catching a significant amount of positive cases. For each additional testing criteria a patient met, they were 1.9x more likely to be CMV positive. Based on these findings, a sophisticated targeted testing protocol will be determined and implemented at MetroHealth's NICU before the end of 2025.

Board 43

RAAZIA AAMIR

Research Mentor: Vertiv

This project was about helping a company called Vertiv find university professors who are working on research relevant to their technology interests. Instead of searching manually through hundreds of websites and profiles, I built a smart tool that can read and understand researchers' work, and then recommend the best matches based on what the company is looking for. The tool uses a simple interface where users type in their topic, and it shows the most relevant experts along with summaries of their work. This makes it much faster and easier to find potential partners for innovation and collaboration.

PROFESSOR IN THE HAYSTACK: AUTOMATING UNIVERSITY PARTNER IDENTIFICATION

Identifying academic researchers for strategic partnerships is a key priority for innovation-driven companies like Vertiv. However, manual discovery of university collaborators is often inefficient and fails to leverage the vast volume of available academic data. This project presents two automated approaches to streamline researcher discovery: (1) an API-driven system utilizing the Open Alex scholarly database, and (2) a semantic search system powered by large language models (LLMs). The first approach enables structured querying based on keywords and institutions, offering real-time results filtered by citation impact and metadata. The second approach uses embedding-based similarity via Ollama's nomic-embed-text model and ranks researchers using a weighted scoring system that considers key terms, abstracts, citation counts, and institutional relevance. A language model (LLaMA3) is also used to generate concise summaries of researchers' work. Comparative analysis shows that while the API-based method is fast and structured, the LLM-based method captures semantic relevance and provides more insightful researcher matches. The project concludes that an ideal solution integrates both methods, using APIs and web scraping to build a dynamic dataset, and LLMs to conduct intelligent search and summarization, offering Vertiv a scalable, future-proof platform for academic collaboration.

Board 44

MILO MORTON

Research Mentor: Jennifer Wanyingi
School for Field Studies

Across Kenya, the killing of wildlife is illegal no matter if for sport, trade, or subsistence. However, giraffes and other wild species are still being poached at an alarming rate. This project reveals how non-governmental organizations, Kenya Wildlife Service, and the local community collaborate in order to protect giraffes and provide financial security to those that live amongst them.

LOCAL COMMUNITY MITIGATION MEASURES TO PREVENT GIRAFFE BUSHMEAT IN THE AMBOSELI ECOSYSTEM

Giraffe bushmeat is a menace to the savanna ecosystems of East Africa. This study was conducted to determine the current mitigation measures used by the community in the Amboseli ecosystem. The specific study sites within the Amboseli region included the villages of Olchoro, Elerai, Lemongo, Kiwanja Ndege, Noomayanat, Inkisanjani and Oloile. Data was collected through random sampling with a questionnaire and purposeful sampling was used to select key informant interviews and focus group discussions. This data was analyzed using the Statistical Package for Social Sciences, specifically frequency of mention. Results showed that when asked about what mitigation strategies were in place, 56% of respondents said patrols and 35% said employing rangers. 91% of interviewees believed the intervention methods of stakeholder organizations were effective in stopping giraffe bushmeat activity. From these findings, we conclude that stakeholders should continue to provide economic support and benefits to those that live alongside the giraffe.

Board 45

ANDREW INAMDAR

Research Mentor: Oluyinka Olutoye
The Center for Regenerative Medicine at Nationwide Children's Hospital

Congenital diaphragmatic hernia (CDH) is a developmental defect in which the diaphragm forms incompletely. This leads to incomplete lung development that negatively affects infants. We created a surgical mouse model of CDH to better understand the molecular mechanisms of incomplete lung development. We found that our model successfully replicated the effects of CDH on the lungs.

EVALUATING A NOVEL SURGICAL MOUSE MODEL OF CONGENITAL DIAPHRAGMATIC HERNIA USING HISTOLOGICAL MEASUREMENTS AND RNA-SEQ

Congenital diaphragmatic hernia (CDH) is a developmental defect in which the diaphragm forms incompletely, allowing abdominal organs to herniate into the chest cavity. This herniation compresses the lungs, leading to pulmonary hypoplasia and pulmonary hypertension (PHTN). CDH occurs in approximately 1 in 2000-3000 live births and has high rates of morbidity and mortality. PHTN is the leading cause of death for infants with CDH. Little is known about the pathogenesis and cellular mechanisms of CDH. Current rodent models of CDH use Nitrofen to create a diaphragmatic defect. However, Nitrofen's toxicity is a confounding factor. A surgical model of CDH was recently developed in rats and was shown to be representative of human CDH. Mouse models are preferred due to the availability of transgenic mice for studying pathogenesis.

We created a novel surgical mouse model of CDH and aimed to determine if the model successfully induced morphological changes representative of human CDH. Medial wall thickness of pulmonary arteries and percentage of lung airspace were measured. Mice with surgically induced CDH had significantly less airspace than controls. No significant difference was found in arterial medial wall thickness. Bulk RNA-seq found 19 significant differentially expressed genes, many of which belong to the TGF-β pathway, which is involved in lung development, repair, and hypoxia-induced vascular remodeling.

We determined that a surgical mouse model of CDH is feasible and replicates the pathophysiology of CDH without the confounding effects of Nitrofen. This model will enable us to better understand the molecular mechanisms of pulmonary maldevelopment associated with CDH.

Board 46

HARUNO TADOKORO

Research Mentors: Justin North
Department of Microbiology at The Ohio State University

My research focused on increasing the production of ethylene, a gas that is important in agriculture and industry. I studied specific enzymes in a type of bacteria called Rhodospirillum rubrum to see how they affect ethylene production. By identifying which enzymes break down key molecules or convert alcohols in the process, we aimed to find ways to make the bacteria produce more ethylene efficiently.

SCREENING S-ADENOSYL-L-METHIONINE (SAM) HYDROLASES AND ALCOHOL DEHYDROGENASES IN R. RUBRUM FOR ENHANCED ETHYLENE PRODUCTION

According to the Organisation for Economic Co-operation and Development (2023), approximately 90% of greenhouse gas emissions in the lifecycle of plastics occur during the production stage. In this stage, ethylene—a key raw material for plastics—is typically produced via steam cracking of fossil hydrocarbons or through dehydration of bio ethanol. Alternatively, biological processes that directly produce ethylene have been developed, however, they require oxygen which can oxidize ethylene, reduce production efficiency, and generate harmful byproducts such as hydrogen cyanide.

To address these issues, our laboratory is exploring a biological route for ethylene production using a genetically modified bacterium, Rhodospirillum rubrum, which can naturally produce ethylene, without requiring oxygen. However, this process has some limitations. First, native quorum sensing, which leads to ethylene production, is slow. Second, an alcohol dehydrogenase (ADH) is expected to be involved in ethylene production, but a specific enzyme in R. rubrum is unknown.

To overcome quorum sensing limits, we screened bio SAM hydrolase genes that increase ethylene production. These genes were observed to be unstable in R. rubrum strain WR. So a new strain WR 2.0 is used that can stable produce ethylene. Second, we also uncovered ADH genes from our screens that increased ethylene production suggesting they may have specific functions in the ethylene pathway. Future work aims to combine these results to increase ethylene yields.




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

Nick Mankowski | University of Cincinnati to pursue a PhD in Mathematics.

Aubrey Gerhardt | Penn State for their Biochemistry and Molecular Biology PhD program

Haleigh Stover | doing an internship here with the Performing Arts Department over the summer, and after that I will be looking for a job within the Biology field.

Mannat Sikand | OH5-OSU SURE program this summer. I'll be working with Dr. Ahmad El Hellani at the Tobacco Center of Regulatory Sciences.

Giorgi Bediashvili | going back home (Georgia) for the summer then PhD in Agricultural, Environmental, and Development Economics at The Ohio State University.

Avery Panozzo | right after graduation, I will be traveling to Tanzania for a 10 day safari for BIOL 300_10. After that I will be taking a gap year at home, Denver, preparing to apply to PA schools.

Willow Rosser | gap year, then applying to graduate school

Grace Martin | tutoring and searching for a teaching position in the Columbus area. If all goes well I will be teaching either Middle or High School mathematics come fall

Logan McFarland | got my FAA remote pilot's license (part 107 exam) and will be doing drone-imagery/videography for a real estate company in my hometown. This fall I will be doing an environmental science program abroad in Perugia, Italy.

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