



# *Muhlenberg*

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CELEBRATION OF STUDENT RESEARCH,  
SCHOLARSHIP AND CREATIVE WORK

2022

*M* Muhlenberg  
College

## CELEBRATION OF STUDENT RESEARCH, SCHOLARSHIP AND CREATIVE WORK

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A fundamental component of the Muhlenberg liberal arts experience is the support and celebration of student work, including research, scholarship and creative activity. Every year, students from across the curriculum present their research and scholarship in this interdisciplinary poster fair.

We invite members of the Muhlenberg community to share in this celebration of student-faculty collaboration.

*All photos in which students and faculty are not wearing face masks were taken during the Summer of 2022 when facemasks were optional indoors.*



### 1. Electrophysiology on Bumble Bee's Odor Neural Pathway

Tomoyuki Amano

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~~Exposing bumble bee's antennal lobe by performing microscopic surgery on its brain; insert electrode to obtain odor sensation to determine its neural signaling pathway.~~

*Advisor: Jordanna Sprayberry, Muhlenberg & Georgia Institute of Technology*

*Funded by: Lake Road Fellowship*



## 2. “A Manifesto in Question Form”: The Liminal Relationship Between Book and Body

Hope Austin

“A nineteen-year-old drama student finds a scrap in a box in the theatre section of the basement of a rural college library. The group Goat Island has long since vanished from the face of the earth.... She, the only one in her class fascinated by the dreary times before the hyperweb helmet and the hovercraft skateboard, reads the paragraph. ‘We discover a performance by making it.’” That nineteen-year-old drama student is me. “She receives the seed of an idea. For her it is a new idea. The search follows the discovery. She is less alone” (Small Acts of Repair xv).

Advisor: Matthew Moore, Muhlenberg College

Funded by: Summer Research Grant from Dean of Academic Life

## 3. Identifying *Anaplasma phagocytophilum* Strains in *Ixodes scapularis* Nymphs

Tessa Barrett

Black-legged ticks (*Ixodes scapularis*) are vectors of anaplasmosis in the Lehigh Valley. Anaplasmosis is caused by the bacteria *Anaplasma phagocytophilum*. Two *Anaplasma* variants are endemic to the Lehigh Valley, one infecting humans and white-footed mice (*Peromyscus leucopus*), and the other only infecting deer. We differentiated between strains based on sequence differences in the *Anaplasma* Ankyrin A gene. Our results indicate that the “deer” strain is more prevalent in the Lehigh Valley region and that nymphs infected with the causative agent of Lyme disease (*B. burgdorferi*) are more likely to be infected with the human strain of *A. phagocytophilum*.

Advisor: Marten Edwards, Muhlenberg College

Funded by: Trainer Summer Research award

## 4. Fractal Patterns and Dimension in Architecture and Beyond

Cathy Barrish and Amanda Sodl

We examine the Marmorari Romani ancient architecture which are found in Italian and some English churches and the fractal patterns found within, as well as utilizing graphing software to mathematically recreate said fractals. Fractal dimension is explored, using different calculation methods. Non-fractal patterns of the Marmorari Romani that exhibit similarities to fractals are investigated and inspire the creation of new fractal patterns. We also alter Sierpinski’s algorithm, using code, to create and examine variations of the Sierpinski fractal. From these new fractals, we observe relationships between dimensions of the variations and the original fractal.

Advisor: Michael Huber, Muhlenberg College

Funded by: The Ladley Grant and the Math & Computer Science Department



## 5. Effects of Virgin Coconut Oil on Oral Commensal and Pathogenic Bacterial Species

Eric Brown and Felicia Wong

Virgin Coconut Oil (VCO), a pure, unrefined oil extracted from the meat of a coconut, has been shown to have antimicrobial properties. The oral cavity houses both commensal and pathogenic bacteria that form microbial communities called biofilms. This study aims to evaluate and compare the effects of VCO on oral commensal and pathogenic bacteria growing in biofilms. Growth curves, crystal violet staining, CFU counting and SEM were used to determine that a 2% concentration of undissolved VCO causes oral commensal bacteria to grow while slightly inhibiting the growth of oral pathogens, thus disrupting the oral bacterial community.

Advisor: Giancarlo Cuadra, Muhlenberg College

Funded by: Vaughn Summer Research award and a Summer Research Grant from the Dean of Academic Life

## 6. Sustainable Cultivation of Commonly Foraged Fungi

Faith Bugman

Commonly foraged oyster mushrooms (*Pleurotus ostreatus*) are used as a model system to develop methodologies for cultivating edible fungi as a means to protect them in their natural environment. Oyster mushrooms were grown at all life stages (cultivation/ collection of spores, etc.). I was able to harvest 59.89 g from Treatment 1, consisting of straw, spawn, and used coffee beans.... Mycelium colonized in other bags, which consisted of completely recycled materials (cardboard and coffee beans), but mold appeared before fruiting occurred. Literature suggests these mushrooms may be able to consume plastic. Exploring this will be the objective of my future work.

Advisor: Richard Niesenbaum, Muhlenberg College

Funded by: Trainer Summer Research award



## 7. Electronic Cigarette E-Liquid and it's Effects on Multispecies Oral Biofilms

Danny Burden

Electronic Cigarette popularity has prompted research to address the effects of vaping on the lungs. However, the first site exposed to vaping, the oral cavity, has received little research. Herein, the effects of flavored and unflavored Electronic Cigarette E-liquids on mixed commensal and pathogenic bacterial oral biofilms were examined. Crystal Violet quantification of biofilm biomass demonstrated greater growth inhibition of 3% E-liquid compared to 1% E-liquid. Colony Forming Unit Assays also indicated growth of the oral pathogen, *Porphyromonas gingivalis*, was most inhibited by 3% compared to 1% E-liquid. In both experiments, growth was most inhibited by cinnamon flavored E-liquid.

Advisor: Giancarlo Cuadra, Muhlenberg College

Funded by: The Crist Family Student Research Endowment in Biology



## 8. Telling Truthful Stories: Taino – A Contact Story

Ian Butz

This project is a three-part video series intended for an elementary school-aged audience telling a truthful story about Christopher Columbus's first contact with the Taino, an indigenous people living in the Caribbean. The video series is a continuation of a video I created last fall about the Tulsa Race Massacre. The video is divided into three chapters. Chapter 1 sets the context for Columbus's first voyage to the Caribbean. Chapter 2 examines Taino culture. Chapter 3 describes the devastating impact Columbus's voyages had on the Taino. I wrote and narrated the script and drew images.

*Advisor: Kim Hoeckele, Muhlenberg College*

*Funded by: Summer Research Grant from Dean of Academic Life*

## 9. Rising Ninth Graders' Perceptions on the Transition from Eighth to Ninth Grade

a-Caban-Echevarria

Students transitioning to ninth grade are more vulnerable when facing academic and social challenges. Adolescents in this transitional period make decisions based on their social contexts. This research intends to explore sources of information that students use, how they think about the importance and the significance of the academic and extracurricular choices they make, and the ways students' family backgrounds (e.g. parental education) may impact the decision-making process. Disparities in high school outcomes – such as grades or graduation rates – exist and are functioning in the school environment before students enter ninth grade and consider the possibility of college.

*Advisor: Erika Bagley, Muhlenberg College*

*Funded by: The Rosenberg Grant*

## 10. Annotation of Pdk1 in Various Drosophila Species

Aviv Rene Campbell

The insulin signaling pathway is an essential system within the genome of many organisms. In collaboration with the Genomics Education Partnership (GEP), Pdk1, a gene encoding a kinase acting in the pathway, was annotated in several *Drosophila* species. Resources accessible through the GEP, to uncover similarities in Pdk1 in *D. melanogaster*, were utilized to identify the precise genetic coordinates of Pdk1 coding sequence. Interestingly, some annotated Pdk1 orthologs displayed alterations in a number of exons compared to the *D. melanogaster* reference. Our data and other individually annotated genes can be combined to further understand evolution across elements in this pathway.

*Advisor: Amy Hark, Muhlenberg College*

*Funded by: Vaughn Summer Research award*

## 11. Exploring the Enzymatic Reaction of L-DOPA Dioxygenase with Non-Native Substrates

Hunter Caplan

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L-DOPA dioxygenase (LmbB1) participates in the biosynthesis of natural products by cleaving the aromatic ring of its native substrate L-DOPA, a catechol. A non-native substrate, DHHCA (3,4-Dihydroxyhydrocinnamic acid) is similar to L-DOPA with the amino group removed. To understand the catalysis, functional group changes were made to DHHCA to increase reactivity and perturb the electronic structure of the catechol. The kinetics of the enzymatic reaction of DHHCA derivatives were studied on a millisecond time scale using stopped flow. The data indicate formation of an enzymatic intermediate consistent with a semiquinone. The substrates and products were characterized by (ESI) mass spectrometry.

*Advisor: Keri Colabroy, Muhlenberg College*

*Funded by: G.N. Russel Smart and David Stehly Summer Research Grant and NSF CHE 1708237*

## 12. What Allentown Read: The Culture of Reading at Allentown Public Library, 1912-2022

Hector Chen and Sophia Framm

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The current Allentown Public Library (APL) opened to the local community as the Allentown Free Library in 1912. As far back as the early 19th century, institutional and subscription libraries existed in Allentown; however, it took local community efforts from women-led organizations to create a true public library in Allentown. This project site focuses on the twenty-year fundraising effort of the Women's League and the M.U.M. Circle.

*Advisor: Susan Falciani Maldonado and Lynda Yankaskas, Muhlenberg College*

*Funded by: Council of Independent Colleges (CIC)*

## 13. Regeneration of *S. benedicti* Branchial Appendage

Anna Connolly and Alexa Ufberg

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Regeneration is the restoration of lost body parts. During regeneration, species will redeploy accessible developmental programming when a structure is unexpectedly lost. This research displays the first documentation of the regenerative pathway in light of development in any polychaete. Using the SEM we examined the regeneration of branchia in *Streblospio benedicti* to determine the pathway of regeneration and whether regeneration recapitulates the developmental pathway. We compared our regeneration data to the developmental pathway and were able to see similarities. Through analysis of these data, regeneration of the branchiae appears to follow the same pattern of development from larvae to adult.

*Advisor: Elizabeth McCain, Muhlenberg College*

*Funded by: Vaughn Summer Research Award*

## 14. Seed Box

Eli Coopersmith and Gabbi a

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The Seed Box is a 3 person venture to make a sustainable mulch and business to sell it. We started off trying to learn how to synthesize mulch. Then we tried to find multiple alternatives to the standard market product. Once we did, we started going out to gardening store to learn the business side of mulch (customer preference, selling prices, customer base, etc.) Eventually, we decided that pushing our product into the general mulch market was not a good idea. Instead, we went into the mulch-for-house-plant market. That was where we ended up.

*Advisor: Rita Chesterton and Richard Niesenbaum, Muhlenberg College*

*Funded by: VentureWell*



## 15. Tuning Resonators to Explore Quantum Spins

Sofia Davvetas

My research this summer focused on making resonators compatible with the molecular nanomagnet (MNM) CrMn. MNMs are tiny magnets whose spin states can be controlled by electron spin resonance. The goal of our lab is to explore MNMs viability as quantum bits, or qubits. This is beneficial because in certain cases a quantum computer can outperform a classical computer. The goal of my research is to get resonators on resonance in order to observe how the spins of CrMn behave in a magnetic field. Moving forward we hope to test our setup with known samples like quartz and borosilicate glass.

*Advisor: Charles Collett, Muhlenberg College*

*Funded by: Provost's Grant for Faculty-Student Collaborative Research*

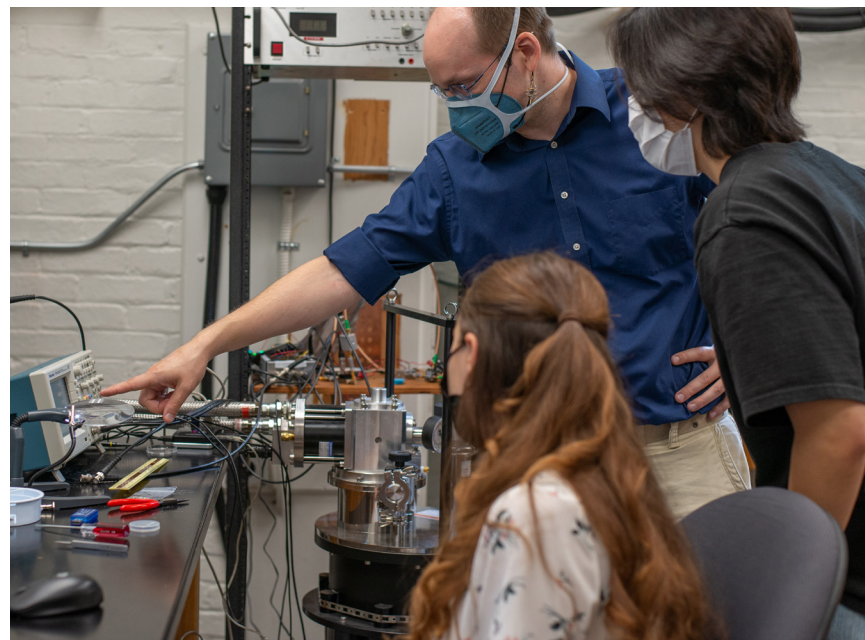
## 16. Mutating *Streptomyces sclerotialus* L-DOPA dioxygenase (SsDDOO) to improve its catalytic activity on non-native substrates

Lam Doan

L-DOPA dioxygenase cleaves L-DOPA with molecular oxygen, an essential step in the conversion of L-DOPA to the antibiotic, lincomycin. Diversifying the substrate pool of L-DOPA dioxygenase could yield new antibiotic structures, but enzymatic activity on non-native substrates is poor due to impaired oxygen binding. Using the recently solved crystal structure of L-DOPA dioxygenase from *Streptomyces sclerotialus* (SsDDO), active-site mutations were designed to improve activity on non-native substrates. Mutants L46W and L46R were prepared using site-directed mutagenesis, expressed and purified. Future work will assess the steady-state activity of these mutants and crystallography will reveal how active site perturbations accommodate new substrates.

*Advisor: Keri Colabroy, Muhlenberg College*

*Funded by: Timothy A. Birch Student Summer Research Grant and NSF CHE 1708237*



## 17. Exoplanet Detection

Ben Eber

In the 1990s exoplanets were first discovered, starting a journey beyond Earth and our own solar systems and looking beyond. While the main telescope that looks for exoplanets is the Hubble and now James-Webb telescopes, it is possible and common to use telescopes mounted on the Earth itself. The process of which this is commonly done is called photometry where the levels of light emitted from a star are measured. With the Physics department's new mount and telescope, I am adventuring into the night sky to show what is possible with equipment readily available to undergraduate students.

*Advisor: Brett Fadem, Muhlenberg College*

*Funded by: Summer Research Grant from Dean of Academic Life*



## 18. GABA<sub>A</sub> Receptor Modulation by Citrus Oils

Talya Feen

The  $\gamma$ -aminobutyric acid type A receptor (GABA<sub>A</sub>) is the major inhibitory receptor of the CNS and is a therapeutic target for treating anxiety, insomnia, and epilepsy, however the molecular actions of naturally-occurring herbal anxiolytics are poorly understood. Linalool and limonene are phytocompounds found in Cannabis and Citrus extracts that have been found to reduce anxiety and induce sleep. I want to know if the behavioral actions are due to direct activation and/or modulation of the GABA<sub>A</sub> receptor by linalool and/or limonene. If these do indeed potentiate the receptor, then our findings suggest a potential clinical application for linalool and limonene containing plants in the treatments of anxiety and insomnia.

*Advisor: Jeremy Teissere, Muhlenberg College*

*Funded by: Neuroscience Collaborative Research Program*

## 19. Domestic Politics: Correspondence of Muhlenberg Women, 1800-1855

Susa a

Using ephemera, such as letters, as a basis, insight could be found into life at the time and how women, especially those of this prominent German family, found their place amongst the political and masculine-dominated society. The letters are housed in the archives of Muhlenberg, Dickinson, and Winterthur. These letters were transcribed, read, and analyzed during an 8 week period, resulting in a massive finding aid across the three institutions and data/visual aids to represent the most prescient elements of the time.

*Advisor: Susan Falciani-Maldonado, Special Collections & Archives Librarian*

*Funded by: Tyson Donor Grant*

## 20. Diane

Giovanni Merrifield

'Diane' spotlights Diane Williams' life as a Muhlenberg student, change maker, and a voice for the Black community. The research takes a deep dive into who Diane was and why she was so passionate about Civil Rights, writing, and education. The research required a close look at Diane's upbringing and her environment, along with her life after college to better encapsulate her true essence. In order to do so, archival research and oral interviews were conducted. With that, Diane is truly someone to honor and to remember forever.

*Advisor: Susan Falciani-Maldonado, Special Collections & Archives Librarian*

*Funded by: Provost's Grant for Student-Faculty Collaborative Research*



## 21. Invertebrate Cage Fight: Isopods vs. Predators

Bethany Fluck

In freshwater systems, the density of macroinvertebrate detritivores, such as isopods, can drive the rate of decomposition and bolster the base of the food chain. Predators can control prey populations, but many prey have adaptive defenses, including vacating a predator dense area. However, past laboratory studies have failed to find a response to predators by the isopod *Caecidotea communis*. My study found that free-ranging *C. communis* in a fishless pond did not avoid caged invertebrate predators: neither of two species of dragonflies, nor a crayfish. Thus, surprisingly, these isopods consistently lack an avoidance response to a wide range of predators.

Advisor: Erika Iyengar, Muhlenberg College

Funded by: Trainer Summer Research award

## 22. Perception of The Importance of Pronouns Use for Gender Affirmation

Megan Franco

Research shows that non-affirmation of gender identity in transgender and nonbinary (TNB) individuals relates to elevated poor mental health outcomes, including an increase in anxiety, depression, and suicidality (Valentine & Shipherd, 2018). There is a gap in research regarding whether non-professional individuals understand the extent of this harm. We examined factors that may predict attitudes about the importance of pronoun use for gender affirmation, through a self-report survey. Results indicated that endorsement of social roles and transphobia, as well as low empathy are all predictors of negative attitudes towards gender affirmation, specifically pronoun use.

Advisor: Stefanie Sinno, Muhlenberg College

Funded by: Provost's Grant for Faculty-Student Collaborative Research



## 23. Dear Friend: A Queer Exploration of Dance Theatre

Nicola Ferro

Despite the intrinsically queer nature of musical theatre as a genre, explicitly queer stories are rarely seen on stage. Inspired by the 1963 musical overflowing with queer subtext *She Loves Me*, “Dear Friend” is a project examining the potentials of queer storytelling. This research consists of both academic research focusing on dance history and performance studies, and embodied research towards creating new movement that blurs the lines between different codified dance styles. The project culminates in a choreographed performance told through the structure of a visual playlist, in which music, theatre, and dance all play equal roles in storytelling.

Advisor: Nigel Semaj, Muhlenberg College

Funded by: Summer Research Grant from Dean of Academic Life

## 24. Music & Movement

Mallory Holson

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We conducted a study to understand emotional responses to music and movement. This study aims to isolate and combine movement and music to determine which art form may have a greater influence on the perception of the emotion and how might the conjunction of music and dance compare to the power of each stimulus separately. We predicted that when the music and dance are experienced simultaneously, the emotional response will be higher than music or dance experienced alone (Reason et al., 2016). We also predicted that participants with higher levels of empathy will have greater emotional reactions in general.

*Advisor: Laura Edelman, Muhlenberg College*

*Funded by: The Crist Family Student Research Endowment in Psychology*

## 25. Construction of the sPHENIX Event Plane Detector

Kaleb Gearinger

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The new sPHENIX Event Plane Detector (sEPD) will help characterize collisions at the RHIC collider located at Brookhaven National Laboratory in Long Island. RHIC's purpose is to emulate conditions like those microseconds after the big bang. Subatomic sized droplets of a novel state of matter, called a quark-gluon plasma, are formed in some of the collisions of atomic nuclei at RHIC. The sEPD will help to determine some of the bulk properties of this matter created in the collisions. This poster aims to describe the production and essential steps to create the sEPD.

*Advisor: Brett Fadem, Muhlenberg College*

*Funded by: The Harry Raub Physics Department Fund*

## 26. Linear Perspective in Italian Architecture

Jake Ghamar and Regina Lau

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Linear perspective is a system of creating the illusion of depth on a flat surface or creating a three-dimensional space onto a two-dimensional plane. This technique originated from Filippo Brunelleschi, but a variety of artists made paintings involving linear perspective that gained popularity in the 15th century. Two centuries later, Brook Taylor, a mathematician, elaborated on the artistic definition of linear perspective in mathematical theory. Using Taylor's methodology to examine specific architecture in Italy, we will apply our technique to two structures, the Palazzo dell'Antella in Florence and the Twin Churches of Piazza del Popolo in Rome.

*Advisor: Michael Huber, Muhlenberg College*

*Funded by: Provost's Grant for Faculty-Student Collaborative Research*

## 27. How do bumblebees use visual versus olfactory information from flowers at different spatial scales?

Katelyn Graver

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Bumblebees are essential pollinators; utilizing sensory information to locate flowers while foraging. Considering climate change, an understanding of how they use floral sensory signals to find resources is crucial for conservation. Existing research explores the relationship between visual and olfactory floral cues only at local spatial scales, thus giving an incomplete picture of floral cue-use. This study uses a wind-tunnel paradigm to investigate how the bumblebee *Bombus impatiens* uses floral sensory information at local and distant spatial scales. This will help us understand if and how cue use changes as foraging bees transition from floral search to floral selection.

*Advisor: Jordanna Sprayberry, Muhlenberg College*

*Funded by: Lake Road Fellowship*



## 28. Attitudes Towards Treatments of Anxiety

Rebecca Grunberger

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This study will examine whether the pattern of these concerns differs across different ages. Childhood is a time for growth, and measures taken to assist that growth are typically seen as acceptable. Adult personality, however, is often seen as relatively more fixed. People of all ages can seek professional help for mental health and receive treatment in the form of medication. However, there is potential for differences among prevalent ethical/safety concerns for the different age ranges. This study will examine the perceptions of one's humanity, safety, and assigned stigma for antidepressant use across different ages.

*Advisor: Jeffery Rudski, Muhlenberg College*

*Funded by: The Crist Family Student Research Endowment in Psychology*

## 29. Connecting Music and Drama

Will Howitt

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Nearly twenty musicals and operas of the twentieth century formed the foundation for establishing the relationship between drama and music. From each piece, the researcher chose a specific passage for critical analysis. Sonic qualities of harmony, melody, rhythm, texture, and more were studied from a storytelling perspective. These passages were then compiled into a research paper for comparison and contrast.

*Advisor: Andrew Ardizzoia, Muhlenberg College*

*Funded by: Mazur Music Grant*

## 30. Computational Simulation of Atmospheric Muon Rates at Sea-Level

Jui-Teng (Roy) Hsu

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The measurement of muon rates as a function of angle from the zenith is a venerable undergraduate laboratory exercise. Hoping to better understand the physics that underlies the widely accepted parameterization that the rate is proportional to  $\cos^2(\theta)$ , we have developed simple computational models that replicate the parameterization. The model assumptions include: relativistic treatment of muon decay, flat earth approximation, muon energy loss, and the change in atmospheric density with altitude. The distribution of muons with altitude and the energy distribution of the muons is varied. We will report on the primary factors in the model that replicate the observed trend.

*Advisor: Brett Fadem, Muhlenberg College*

*Funded by: Provost's Grant for Faculty-Student Collaborative Research*



### 31. Acid Catalyzed Acetal Kinetics in Ethanol using GC-MS

Parker Hunt

Fine fragrances have been prevalent for centuries, but information about the kinetics of product stability has been kept largely proprietary. Acetal formation – due to the reaction between the solvent (ethanol) and fragrance compounds (often aldehydes) – occurs while the samples sit in industry possession resulting in a gradual change in scent. Also, this reaction is known to be catalyzed by acids. In this work, the reaction rate between benzaldehyde and ethanol was determined under varying acidic conditions. An 80% increase in the reaction rate of acetal formation was observed with the corresponding increase in acid concentration from 0.5 to 1%. Further analysis will allow for the determination of a kinetic model and a better understanding of the reaction mechanism.

Advisor: Robert Fuller, Muhlenberg College

Funded by: Hollenbach Chemistry Endowed Scholarship Fund

### 32. A Peek Into The Correspondences of Walter Benjamin Using BERT

Christian Johansson

German philosopher and critical theorist Walter Benjamin was famously known for his avid letter writing habit. In this research, we first constructed a tabular dataset of his letters to various correspondents, with various attributes. Then, using Google's Bidirectional Encoder Representations from Transformers (BERT), a Pre-trained Language Model, we analyzed the evolution of topics and emotions represented in these documents over time. Also, to align with research in XAI (Explainable AI) we used SHAP analysis to gain insight into how the model arrived at decisions.

Advisor: Hamed Yaghoobian, Muhlenberg College

Funded by: Math and Computer Science Department



### 33. Homeostatic and Context Specific IL-1 $\beta$ Expression

Ashley Kim

Traditional methods to detect IL-1 expression fail to capture lower level expression of IL-1 $\beta$ . The objective of this study is to map all IL-1 $\beta$  expressing cells in homeostasis and various specific contexts through a novel IL-1 $\beta$  trap-reporter mouse model. IL-1 $\beta$ -trap-reporter mice were injected with 1mg/kg LPS, 5mg/kg LPS, and 20 nanograms ICV IL-1 or 20 mg/kg kainic acid 12 hours following a 150mg/kg Tamoxifen injection. From this, we conclude that novel populations of microglia respond to various stimuli in context specific conditions in regions such as the parenchyma, ventricles, and vascular related areas.

Advisor: Daniel Nemeth and Ning Quan, Florida Atlantic University

Funded by: NSF



## 34. Exploring Qubit Coupling for Quantum Computation

Yujin Kim

Quantum computation can be done using little magnets called spins that interact with each other. The goal of our project was to simulate how two spins can interact in different ways, and explore the effects on experimental results through several visualizations. We are hoping to use our simulations with future experiment results to determine the interaction strengths, moving us towards implementing quantum computing gates.

*Advisor: Charles Collett, Muhlenberg College*

*Funded by: Provost's Grant for Faculty-Student Collaborative Research*

## 35. GABA<sub>A</sub> Receptor Potentiation from Cannabidiol (CBD)

Tanner Klingenberg

Cannabidiol (CBD) is a phytocannabinoid found in the hemp plant. Since its legalization in 2018, CBD has been used to treat a number of symptoms/conditions such as inflammation, chronic pain, anxiety, and seizures. While its effects on inflammation and chronic pain are believed to be due to its activity on 5-HT<sub>1A</sub> and TRPV<sub>1</sub>, the compound's anxiolytic and anticonvulsant properties remain unexplained. Recent findings suggest these effects are linked to activity of CBD on GABA<sub>A</sub> receptors, the primary method of inhibition in the nervous system. This suggests undiscovered targets of CBD with novel therapeutic uses and possible dangers.

*Advisor: Jeremy Teissere, Muhlenberg College*

*Funded by: Neuroscience Collaborative Research Program*

## 36. Acute Stress and Social Context: Do friends reduce stress responses?

Alissa Le

Stressors disrupt homeostasis. When the body experiences stress, there are emotional, behavioral, and physiological responses. Social stimuli can alter these stress responses. Social buffering occurs when social support reduces the physiological stress response, lowering heart rate, blood pressure, and glucocorticoid levels. While mounting a physiological response to stressors is critical to survival, there are many negative consequences to prolonged/repeated stress responses, including metabolic disorders, mental health disorders, and impaired memory. Thus, my research question is the following: Does social support from a friend buffer the stress response to a cold water stressor?

*Advisor: Leah Wilson, Muhlenberg College*

*Funded by: Neuroscience Collaborative Research Program*

## 37. Staining of Mycorrhizal Structures

Mayu Lee

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The goal of my research was to develop the methods to assess variation in mycorrhizal colonization in *Lindera benzoin* with respect to light environment, and to determine if mycorrhizae can become established on the College's green roof. I approached this work by developing the methodology to observe and quantify mycorrhizae: I tested around a dozen clearing routines to identify the most favorable method, and then advanced to staining the optimal samples. The methodology that I developed allows me to progress to the next step: observing the effects of light environments on the mycorrhizal structures of *Lindera benzoin*.

*Advisor: Richard Niesenbaum, Muhlenberg College*

*Funded by: Trainer Summer Research award*

## 38. Searching for Small Molecule Modulators of Autophagy by Targeting the Autophagosome Pathway

Sebastian Leyes Porello

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Autophagy is a mechanism by which cells degrade and recycle cellular components. During selective autophagy, cargo is targeted for degradation via receptors that contain an LC3 interacting region (LIR) that interacts with Atg8 family proteins (LC3 and GABARAP) on the developing phagophore. Autophagy inhibition shows promise in selectively inducing apoptosis in autophagy dependent cancer cells, so small molecule inhibitors of the LC3-LIR interaction may represent powerful therapeutics. Here, we develop a luminescent assay of autophagy to identify small molecule inhibitors of the LC3-LIR interaction, via transfection of HEK293T cells with various plasmids encoding an LIR-Nanoluc construct.

*Advisor: Tino Sanchez and Mark Henderson, NIH - NCATS*

*Funded by: NIH/NCATS Intramural Research Award*

## 39. Traffic Impact on Neighborhood Air Quality

Abigail Lofton

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Air quality is important to health, economics, and the environment. This study looked to see the gradient across a neighborhood in whether there were significant differences in PM<sub>2.5</sub>, as an indicator of air quality and result of traffic emissions. No significant trends were found relating traffic patterns to the air quality, however, trends showed a potential impact from humidity and temperature. No significance was found across the neighborhood gradient of up to one mile. The results are similar in other research in the field as well and will continue to be important as climate change continues to devastate environments.

*Advisor: Chrysan Cronin, Muhlenberg College*

*Funded by: The Public Health Research Fund*

## 40. The Orlando Furioso Atlas

Julianne Lucas and Audrey Taylor

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We worked on the Orlando Furioso Atlas, an online digital humanities project that converts Ludovico Ariosto's sixteenth-century romance epic, Orlando Furioso, into a series of online maps. Through our research, we designed digital maps that track each character's progress through a world that mirrors how the Italian poet would have imagined it to be by utilizing a map made in 1506 by Martin Waldseemüller. Users are able to see the maps side-by-side with hyperlinked versions of the poem in Italian and English. We hope to enhance understanding of the meaning of the text by visualizing spatial patterns in each plotline.

*Advisor: Daniel Leisawitz, Muhlenberg College*

*Funded by: Provost's Grant for Student-Faculty Collaborative Research and the Summer Digital Scholars Program, Practicing the Liberal Arts Grant from Mellon Foundation*



## 41. Effects of E-liquids on Macrophage Gene Expression

Emily Luo

Macrophages are white blood cells that engulf microbes through phagocytosis. Vaping is the use of electronic cigarettes to aerosolize and inhale flavored E-liquids. This study aims to determine the effects of E-liquids +/- flavors on macrophage gene expression, including genes for macrophage functions. Differentiation protocols to produce macrophages from THP-1 precursor cells were optimized. After exposure to E-liquids during differentiation, RNA was extracted for gene expression analysis. Macrophage morphology and phagocytosis were achieved as previously described. RNA was collected in the range of 1.5 to 34.5 µg/µL. Quantitative PCR will be performed to further determine E-liquid alterations on gene expression.

Advisor: Giancarlo Cuadra, Muhlenberg College

Funded by: Summer Research Grant from Dean of Academic Life

## 42. Buzzed and Alone: In zebrafish, the behavioral response to caffeine depends on social context

Megan Lyttle

Zebrafish are an increasingly popular species in pharmacology and toxicology studies. Zebrafish are highly social, but there is relatively little research on how social context impacts the behavioral and physiological response to exogenous compounds. Understanding the importance of social context on drug responses has implications for medicine. In this study, we show that in zebrafish, the effect of caffeine on impulsivity depends on social context. We found a significant interaction between social context (social vs alone) and caffeine ( $p=0.04$ ). Our findings suggest that social context should be considered when evaluating the efficacy of medications.

Advisor: Leah Wilson, Muhlenberg College

Funded by: Neuroscience Collaborative Research Program



## 43. A No-Brainer Approach to Reconsolidation: Habituation and Disruption of Memory in *Physarum polycephalum*

Jenny Makhoul, Liam Safran and Ava Duskc

Memories become vulnerable when reactivated. This phenomenon known as memory reconsolidation has been exclusively studied in organisms with a central nervous system. Our previous study was the first to examine reconsolidation in a non-neuronal organism, *Physarum polycephalum*, by testing its habituation to a vinegar deterrent and later disrupting it using Valerian root. Our results added to the literature, showing that a non-neuronal organism can experience reconsolidation. Our next study aims to investigate *P. polycephalum*'s efficacy at associative learning by using context-dependent cues to locate food hidden by obstacles. If semi-associative memory is formed, then we can study its capacity for reconsolidation.

Advisor: Gretchen Gotthard, Muhlenberg College

Funded by: Neuroscience Collaborative Research Program



## 44. Lights, Camera, Action, Dystopias: The Handmaid's Tale & Our Current Reality

Meghan McGorry

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Dystopian media surrounds us. It has come to life on screen in ways that can be subtly or overtly terrifying, relatable, and unique. This research focuses on real world events in conversation with the 2017 Hulu Original Series “The Handmaid’s Tale”, and what that implies for actors taking on these challenging roles in a dystopian environment. Through analyzing Instagram activity, Twitter feeds, and interview quotes, my work begs the question of an actor’s “civic duty” to the project they’re working on. Do actors have a responsibility to speak on certain issues for being cast in a particular genre of TV?

*Advisor: Elizabeth Nathanson, Muhlenberg College*

*Funded by: Summer Research Grant from Dean of Academic Life*

## 45. Activation of the GABA(A) receptor by natural *Erythrina velutina* and *mulungu* extracts

Rowan Micklus

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My research focuses on the potential activation of the GABA(A) receptor by *Erythrina velutina* or *Erythrina mulungu* extracts. *Erythrina* is a species native to Brazil that has been known to treat convulsions, nervous ticks, and promote sleep. I am focusing on the plants’ anticonvulsant effects when a mutation is present on the receptor that leads to seizure susceptibility in humans.

*Advisor: Jeremy Alden Teissere, Muhlenberg College*

*Funded by: Neuroscience Collaborative Research Program*

## 46. Queer Identity and Experience in Contemporary France

Anna Mikoski

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The French queer experience is rooted in beautiful authenticity, but is often limited by the thoughts and ideals of a society that likes to maintain the status quo and a linguistic tradition with strict gender binary. Non-binary individuals in particular are challenged with the task of finding belonging and legitimacy in a conservative society that cannot see beyond traditional notions of masculine and feminine. The fight for inclusion calls into question the very foundation of the French Universalist ideal, which has long been maintained by the people and the government.

*Advisor: Casey Miller and Eileen McEwan, Muhlenberg College*

*Funded by: Summer Research Grant from Dean of Academic Life*

## 47. The Effects of Transracial Adoption on Transracial Adoptees

Emely Minaya De La Cruz

Transracial adoption in the United States has generated a longtime concern on the toll it may take on the adoptee's racial identity. Several interviews with various adult transracial adoptees suggest that apart from the inherent trauma of being adopted, the little to no exposure to their cultural/racial roots always became a source of insecurity as adoptees approach their late teen years and well into their adult lives. This research aims to understand identity in adoptees and the ways in which they cope to fit into white spaces.

*Advisor: Janine Chi, Muhlenberg College*

*Funded by: Timothy A. Birch Student Summer Research Grant*

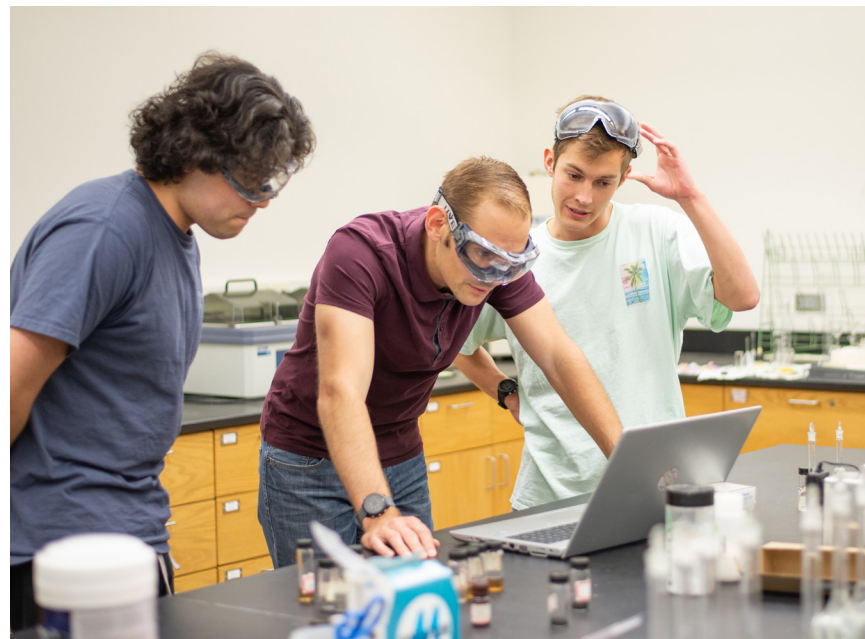
## 48. Spectroscopic Investigation of Artificial Light Harvesting Chromophores

Hannah Morris

Finding efficient materials for solar energy conversion is crucial to fight climate change and reduce CO<sub>2</sub> emissions. Artificial light harvesting chromophores (dyes) can act as models for natural systems in order to study their properties through nonlinear laser spectroscopy. The dyes Ox720 and LD690 were studied using two laser chemistry techniques: transient absorption (TA) and 2-dimensional electronic spectroscopy (2DES). The resulting spectra, analyzed in MatLab, provided information on the vibronic energy transitions and unique properties associated with each dye. Future work will assign vibrational modes and determine if the coherent energy transfer is similar in both artificial and natural systems.

*Advisor: Jessica Anna, University of Pennsylvania*

*Funded by: National Science Foundation*



## 49. Agency Nursing: An Analysis of the Secondary Labor Market for Nurses

Jacob Newman

Agency nurses have been utilized to fulfill labor shortages in hospitals for decades. As a result of COVID-19, many market inefficiencies have been exposed in the market for agency nurses. Wage spikes and staffing shortages grew both in magnitude and frequency in the early months of 2022. This study uses scholarly articles and data to examine the causes and effects of these inefficiencies through the perspective of the hospital, nurse, and patient. Potential regulations have been proposed, here I examine the effectiveness of a potential maximum wage cap, and find that this regulatory method would not correct for these inefficiencies.

*Advisor: Lindsey Nagy, Muhlenberg College*

*Funded by: The Galgano Student Research Fund*



## 50. The Enzymatic Activities Of Extradiol Dioxygenases

Bernice Owusu

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L-DOPA dioxygenase is an enzyme that activates oxygen to cleave the aromatic ring of L-DOPA. Steady-state kinetics for four L-DOPA Dioxygenases were determined using UV-Visible spectroscopy to measure the product CHAPCA at 414 nm. Out of the four enzymes, JING had the highest  $k_{cat}$  ( $\text{sec}^{-1}$ ). We hypothesized that oxygen consumption may exceed CHAPCA formation and indicate inactivation. The  $k_{cat}$  of Lmb1 on the oxygen electrode ( $2.70 \text{ sec}^{-1}$ ) was (2.35x) the  $k_{cat}$  by UV-Visible spectroscopy ( $1.15 \text{ sec}^{-1}$ ). These data indicate Lmb1 is consuming oxygen at a faster rate than forming product, which is consistent with a mechanism of inactivation by oxygen.

Advisor: Keri Colabroy, Muhlenberg College

Funded by: G.N. Russel Smart and David Stehly Summer Research Grant and National Science Foundation CHE 1708237

## 51. GC-MS Characterization of Benzaldehyde-Acetal Kinetics in E-Liquid Formulations

Lily Press

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E-cigarette use by the general public, especially youth, is widespread. Many of the compositions that users inhale contain chemical side products, one being acetals formed from the reaction of propylene glycol solvent with aldehydic flavoring agent. These new side products are harmful to the lungs, yet minimal investigation has been done on their formation. Using gas chromatography-mass spectrometry (GC-MS), our lab quantified the kinetics of the reaction between benzaldehyde - cherry flavoring - and solvent at several solubilizer concentrations. It was found that increasing the concentration of solubilizer decreased the rate of acetal formation.

Advisor: Christine Ingersoll and Robert Fuller, Muhlenberg College

Funded by: The KeriLyn C. Burrows, Ph.D. '72 Research Fund in Honor of Donald W. Shive, Ph.D. Foundation CHE 1708237

## 52. Acute vs. Chronic Salinity Effects on Isopods from Urban vs. Rural ponds

Katie Raab and Bethany Fluck

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Urban ponds are exposed to higher amounts of road salt brine runoff than rural ponds. This runoff increases the salinity of the pond and can affect the organisms living in those bodies of water. To test these effects, *Caecidotea communis* from urban and rural ponds were used and subjected to various salt treatments. In a lab setting, the isopods were exposed to various salinities in acute or chronic conditions for 7 days. They were tested at 0.75%, 1% and 1.5% NaCl with pond water. The isopods were checked for mortality after 1,3,5, and 7 days.

Advisor: Erika Iyengar, Muhlenberg College

Funded by: The Lake Road Research Fellowship

## 53. Exploring Alternative Pathways for L-DOPA Dioxygenase Homologs

Sara Ringenbach

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L-DOPA dioxygenase is an extradiol dioxygenase (EDX) enzyme that reacts oxygen with L-DOPA to yield an intermediate in the biosynthesis of several natural products, including the antibiotic lincomycin. A new EDX homolog of L-DOPA dioxygenase (i.e. JING) was identified from the organism *S. hygrosopicus jingganensis*. To identify the native substrate for JING, the rate of oxygen consumption by the enzyme was measured for a variety of catechol substrates. The data were best described by a five-step model: catechol substrate binding, oxygen consumption, product release, enzymatic inactivation and background. L-DOPA was the fastest substrate with the smallest amount of inactivation.

Advisor: Keri Colabroy, Muhlenberg College

Funded by: G.N. Russel Smart and David Stehly Summer Research Grant and NSF CHE 1708237



## 54. Heart and Shoal: Social Buffering and Oxytocin in Zebrafish

Anna Riordan

In many species, social stimuli can buffer stress responses. Here, we share data from two experiments investigating “social buffering” in zebrafish: in the first, we show that visual social stimuli sped recovery from an acute predator stress. In the second, we tested the hypothesis that oxytocin regulates social buffering. We measured behavioral stress responses in animals treated with either an oxytocin receptor antagonist or vehicle. We found oxytocin receptor antagonism tended to decrease locomotion, a possible marker of anxiety. Our data suggest that oxytocin signaling decreases anxiety and are consistent with our hypothesis that oxytocin is involved in social buffering.

Advisor: Leah Wilson, Muhlenberg College

Funded by: Neuroscience Collaborative Research Program

## 55. In Vitro Evaluations of Non-Steroidal Anti-Inflammatory Drug Conjugates

Margeaux Shelley and Madison Trump

Since Alzheimer’s disease (AD) is suspected to be linked to inflammation, non-steroidal anti-inflammatory drugs (NSAIDs) have the potential to treat this debilitating disease if the brain bioavailabilities of these molecules could be improved. A parallel artificial membrane permeability assay for the blood-brain barrier (PAMPA-BBB) was used to predict the effective permeabilities ( $P_e$ ) of various NSAIDs and novel NSAID conjugates. The log  $P_e$  values for a flurbiprofen carbamate conjugate were  $-5.98$  and  $-5.29$  and for a naproxen carbamate conjugate were  $-4.47$  and  $-4.51$ . Brain-bioavailable NSAID conjugates could be viable treatments for the inflammatory component of AD.

Advisor: Sherri Young, Muhlenberg College

Funded by: The Buzzard Summer Research Award

## 56. Estimating Tick Abundance in the Lehigh Valley

Anna Shigo

Black-legged ticks (*Ixodes scapularis*) are vectors of pathogens in the Lehigh Valley, including the bacteria that cause Lyme Disease. We estimated the relative tick density at ten sites to compare the risk of human infections with other years. Tick density is estimated by dragging a square piece of fabric for known distances along the forest floor and counting the attached ticks. Reproducible methods to estimate density allow for comparisons of studies by different researchers in different seasons and locations. We calibrated the relative accuracy and convenience of three GPS-based methods by measuring the known distance of the Muhlenberg College track.

Advisor: Marten Edwards, Muhlenberg College

Funded by: Trainer Summer Research award

## 57. Indigenous People of...Right Here

Danielle Siteman and Aya Kanan

The Lenape, also known as the Delaware, inhabited parts of Pennsylvania, New York, New Jersey, and Delaware for thousands of years before they were forcibly removed by colonizing European settlers. Beginning in the 1600s, the Lenape were subjected to a series of fraudulent treaties which stripped them of their land and progressively pushed them into Oklahoma, Wisconsin, and Ontario. It is Muhlenberg College's responsibility to acknowledge the ways it has benefitted from the colonization and displacement of the Lenape. By decentering white, colonizing voices and reckoning with past and ongoing injustices, the College can work towards a more just future.

*Advisor: Jacqueline Antonovich and Benjamin Carter, Muhlenberg College*

## 58. Silver Nanoparticle Synthesis from a Green Polyoxometalate (POM) Reducing Agent

Conner Soderstedt

Silver nanoparticles (AgNPs) have sparked interest due to their potential biomedical benefits such as antiviral, anti-inflammatory, and anti-bacterial properties. A novel green synthesis of silver nanoparticles was investigated using a polyoxometalate reducing agent and more specifically a Keplerate cluster  $\{Mo_{13}O_{42}\}$ . Keplerate has been shown to have limited if any environmental impacts and to be safe when used in biological systems. The newly synthesized AgNPs were identified and characterized via UV-Vis spectrometry.

*Advisor: Johnathan Gooch, Muhlenberg College*

*Funded by: G.N. Russel Smart and David Stehly Summer Research Grant*



## 59. Diversity of Ticks and their Pathogens in the Lehigh Valley

Meghan Taber, Anna Shigo, and Tessa Barret

The Lehigh Valley is home to many species of ticks. The most common are black-legged ticks, vectors of more than three human pathogens. Invasive lone star ticks can cause an allergy to red meat, and longhorned ticks are of veterinary importance. We used active surveillance to estimate the prevalence of three human pathogens in black-legged ticks and the diversity of tick species in ten habitats. Compared to previous years, we did not find an increase in invasive ticks but did observe an increase in the number of black-legged ticks infected with *Babesia microti*, compared to previous years.

*Advisor: Marten Edwards, Muhlenberg College*

*Funded by: Vaughn Summer Research award*





## 60. Environmental valuation

Shuhong Tang

This is on-going research on the environmental valuation system from the lens of philosophy and ethics.

Advisor: Daniel Doviak, Muhlenberg College

## 61. Properties of Gold Nanoparticles (AuNPs) and their Synthesis using Anionic Polyoxometalates

Amen Taye and Riley Wexler

Our goal was to design an environmentally friendly way of synthesizing AuNPs and to replicate previous work done with molybdenum-based polyoxometalates. The ratio of the Keplerate/POM, (either  $\text{Mo}_{132}$ ,  $\text{Mo}_{154}$ , or  $\text{Mo}_{72}\text{Fe}_{30}$ ) to gold(III) chloride was varied with the hope that the resulting product, AuNPs with a specific surfactant ( $\text{MoOx}$ ), can lead to enhanced properties. Conditions such as different pHs and temperatures were tested to see if the AuNPs' stability and size were impacted. Additional experiments will be conducted during the year to help guide future research, specifically related to AuNP and silver nanoparticles' (AgNP) stability in various conditions.

Advisor: Jonathan Gooch, Muhlenberg College

Funded by: The Kerilyn C. Burrows, Ph.D. '72 Research Fund in Honor of Donald W. Shive, Ph.D.

## 62. The Genomics Education Partnership's Pathways Project: The Evolution of Phosphatase and Tensin Homolog in the Insulin Signaling Pathway

Arielle Touitou

The Genomics Education Partnership (GEP) aims to understand the evolution of biological pathways, using insulin signaling as a model network. In collaboration with the GEP, our lab analyzes genes within the pathway in *Drosophila melanogaster*, and defines and annotates their orthologs in various species of *Drosophila*. In my summer work, the evolution of phosphatase and tensin homolog (Pten) was analyzed and it was determined that Pten orthologs decrease in similarity to *D. melanogaster* Pten over evolutionary time. Looking at the relative conservation of genes that occupy distinct positions and roles within the pathway may reveal evolutionary constraints on networks.

Advisor: Amy Hark, Muhlenberg College

Funded by: Vaughn Summer Research award

## 63. A Collections Manager - What Does a Biology Collections Manager Do?

Myra Wamah

A Biology Collections Manager ensures that living and preserved specimens are healthy and protected from harm. The Biology Department has an extensive collection of live plants, which must be watered and protected from pests. The Acopian Center for Ornithology has over 2500 preserved bird specimens, which must be protected from museum beetles. Developmental biology research depends on a colony of marine worms that require precisely formulated artificial seawater. These are some examples of the work of a Biology Collections Manager. The outcome of my summer's work is a manual that describes the daily tasks of this job for future Collections Managers.

Advisor: Marten Edwards, Muhlenberg College

Funded by: Provost's Grant for Student-Faculty Collaborative Research

## 64. Analysis of the Fmr1 Gene

Lauren Washco

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In collaboration with the Genomics Education Partnership, I annotated coding regions of Fmr1 in several *Drosophila* species to analyze the conservation of the gene. In addition, the 5' untranslated region (UTR) was annotated in *D. sechellia*, closely related to the well-studied *D. melanogaster*. Understanding the evolution of the UTR provides insight into the regulation of Fmr1, which is of interest because misregulation can lead to Fragile X Syndrome (FXS). Analysis of Fmr1 and FXS was used to create a pedagogical case study that helps students expand their understanding of molecular biology and apply that knowledge to explore treatments for FXS.

Advisor: Amy Hark, Muhlenberg College

Funded by: Vaughn Summer Research award

## 65. Exploring the Foraging Behavior of Bumblebees (*Bombus impatiens*) in Agrochemically-Polluted Settings: An Analysis of Lily of the Valley & Fungicidal Olfactory Cues in a Wind Tunnel Apparatus

Nour Yousry and Paige Henderson

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*Bombus impatiens* bumblebees serve as one of the main pollinators in eastern North America. However, micro- and macro-stressors on bumblebees negatively impact both foraging efficiency and pollination efficacy, with agrochemical odor-pollution hindering floral-odor learning and recognition in an associative odor-learning assay. Our study aims to determine the effects of fungicide odor pollution on bumblebee foraging in a more active foraging environment. These experiments investigate whether the presence of a background fungicide odor (Reliant® Systemic Fungicide) impacts the ability and time to locate a learned floral resource in a wind tunnel through 'floral-search' and 'floral-selection' behavior.

Advisor: Jordanna Sprayberry, Muhlenberg College

Funded by: Vaughn Summer Research award and The Crist Family Student Research

Endowment in Biology

## 66. Investigating Possible Substrates for newly identified Dioxygenase Enzymes

Riri Yoza

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LmbB1 (L-DOPA dioxygenase from *Streptomyces lincolnensis*) acts on the catechol L-DOPA in a biochemical pathway that produces the antibiotic lincomycin. Recently, homologs of LmbB1 were identified from other biosynthetic pathways: these include, JING, NoCART, and SsDDO. In order to determine the preferred substrate for these homologous enzymes, different catecholic substrate analogs, including DHHCA, Dopamine, L-DOPA, were assessed using Michaelis-Menten kinetics on data collected by UV-Visible Spectroscopy. Steady-state kinetic parameters for the different enzyme-substrate pairs and oxygen, including the catalytic rate constant ( $k_{cat}$ ), maximum rate of reaction ( $V_{MAX}$ ), and the Michaelis constants  $K_M$  and  $K_{MO_2}$ , are presented and analyzed.

Advisor: Keri Colabroy, Muhlenberg College

Funded by: Research Experiences in the Biochemical and Chemical Sciences

## 67. Exploring the Communication Barriers that People with Invisible Disabilities Face when Seeking Medical Care

Rebecca Zickerman

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A survey was administered to members of the Invisible Disabilities Association (IDA) in order to explore the communication barriers that people with invisible disabilities face when seeking medical care. A total of 85 responses were recorded. One of the most notable barriers to communication was the perception of the physician's lack of understanding of the patient and their disability, regardless of invisible or visible disability. Additionally, in-person visits were found to be favored over telehealth visits for all disability types.

Advisor: Chrysan Cronin, Muhlenberg College

Funded by: The Public Health Research Fund

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