



Muhlenberg

CELEBRATION OF STUDENT RESEARCH,
SCHOLARSHIP AND CREATIVE WORK

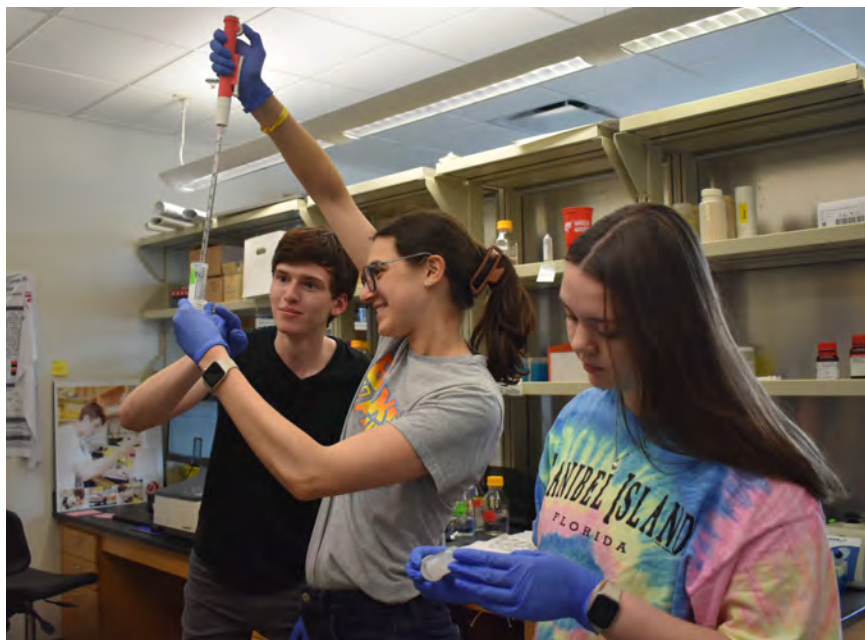
2024

M Muhlenberg
College

CELEBRATION OF STUDENT RESEARCH, SCHOLARSHIP AND CREATIVE WORK

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.



1. Flow Cytometry in Cell Therapy: Quantifying Stability of Antibody Cocktails for Quality Control

Elizabeth Abrams

At RAPA Therapeutics, flow cytometry (flow) is used in quality control (QC) to identify T-cell varieties in cell products. This process involves creating fluorescent antibody cocktails daily, which is time-consuming. The project aimed to optimize QC by evaluating the shelf life of these cocktails, determining if they could be prepared in advance. An additional aim was to learn about flow and its procedure. The study included preparing cocktails ahead of time and assessing their stability using flow. Results showed that further testing is needed, as some markers were missing or present in low concentrations, preventing clear conclusions about cocktail stability.

Funded by: RAPA Therapeutics

2. BPAF Toxicity in Sea Urchins Embryonic and Skeletal Development

Fuka Aizawa

BPA is used to produce plastic and is toxic to dozens of animals, including humans. BPA analogues, such as BPAF, are replacing BPA, which is banned in many countries. Few studies have examined BPAF's toxicity. I examined BPAF's toxicity on the embryonic and skeletal development of a sea urchin. Embryos were exposed to 1–1000 ug/L BPAF for 24 and 48 hours. With light microscopy, I categorized each embryo as abnormal or normal and calculated the EC₅₀, which was found to be significantly lower than BPA, representing higher toxicity. Scanning electron microscopy allowed me to measure skeletal arm widths and lengths.

Advisor: Dr. Elizabeth McCain, Muhlenberg College

Funded by: The Crist Family Student Research Endowment in Biology

3. Genomic Replicas: An Educational Activity for Exploring Genetic Homology

Anam Ali

Key concepts in evolutionary biology, including those related to molecular homology, can be challenging for students to grasp. This summer, I focused on creating an activity designed to help undergraduate students understand homology by exploring the concepts of “orthologs” and “paralogs.” The activity centers on two homologous genes in *Drosophila melanogaster*, *wdb* and *wrd*, and guides students in investigating their relationship while also developing their skills in using bioinformatics tools and interpreting primary literature. In the near future, I hope to have this activity implemented in an undergraduate introductory biology class before submitting it for publication.

Advisor: Dr. Amy Hark, Muhlenberg College

Funded by: The Dr. James R. Vaughan '52 Student Research Award in Biology



4. Cleavage and Purification of Tagless L-DOPA 2,3 Dioxygenase from *Streptomyces Hygroscopicus Jingganensis* for Crystallization

Or-El Ankori

With a final goal of obtaining the crystal structure of L-DOPA 2,3 dioxygenase from *Streptomyces hygroscopicus jingganensis* (JING) for structural and comparative studies, a less expensive tag-cleaving and protocol using free-floating thrombin protease was piloted. Using nickel columns, free-floating thrombin incubation experiments were performed, followed by a heparin column to obtain tagless JING. The protocol was modified to produce the greatest protein yield. Tagless JING was then subjected to a Superdex 75 Increase column for further purification before being sent to crystallization at our collaborator lab.

Advisor: Dr. Keri Colabroy, Muhlenberg College

Funded by: REBCS Research Grant



5. Cinema and Human Rights in Latin America: The Power of Visual Storytelling

Ednah Asiema

This research examines how directors' backgrounds influence the portrayal of human rights injustices in Latin American cinema, focusing on documentaries and fictional films and the benefits and challenges of representing such complex subjects on film. By analyzing films that address the Dirty War and Los Desaparecidos in Argentina and the exploitation of indigenous communities in Peru, Guatemala and Bolivia, the study explores how filmmakers' cultural and personal contexts shape their narrative choices and their work. The research seeks to illuminate the complexities of representing sensitive issues on screen and how these films contribute to the broader discourse on human rights.

Advisor: Dr. Amy Corbin, Muhlenberg College

Funded by: The Galgano Student Research Fund

6. Radical Self-Love as a Community-Based Practice

Hope Austin

“There is always within her at least a little of that good mother’s milk. She writes in white ink.” —Hélène Cixous (“The Laugh of the Medusa,” *Signs*, 881)

Is our capacity for radical self-love a reflection of our ability to love humanity more largely, to actively love the bodies that have sustained us within echoed lineages? Employing a practice-as-research-minded methodology, this project practices performance to explore these questions through re-embodiment and the cultivation of community. It is inspired by the Quaker concept of Inner Light, adapting it to reflect that there is that of love in each of us.

Advisor: Professor Jim VanValen, Muhlenberg College

Funded by: The Galgano Student Research Fund

7. You Can’t See Us ... or Maybe You Can!

Kemeria Barnett, Ashtyn Curnow and Angel Madrigal

Camouflage is a common defense strategy against visually oriented predators, particularly for slow-moving prey that lack obvious chemical or structural protection, like isopods. No previous studies have examined this potentially adaptive behavior in stream isopods, although *Lirceus* sp. resembles the color of the benthos, and some marine and pond isopods use crypsis. We used a laboratory artificial stream with five distinctive colors of substratum to determine where free-ranging populations of isopods would reside: in matching sediment (gray or brown), black, or neon colors (blue or green). Our results to date indicated that the isopods do not disproportionately move to matching substratum.

Advisor: Dr. Erika Iyengar and Professor Karen Tuerk, Muhlenberg College

Funded by: The MUHLES Program funded by a grant from the Arthur Vining Davis Foundations (K.B.); The Dr. John E. Trainer '35 P'65 GP'04 Research Fellowships in Ornithology and Biological Sciences (A.C.); REBCS Research Grant (A.M.)

8. Transcension, Gender Deviance and the Uncanny: An Analysis of David Bowie's Spectacular Personas

Sonny Berenson

David Bowie's early 1970s career is iconically defined by his spectacular stage personas. These characters — alien superhero Ziggy Stardust, postgender Aladdin Sane or eyepatched Halloween Jack — tested the limits of both gender and humanity to envision a path for a freer and more fluid existence. Through the manipulation of the body and its stylization through fashion, Bowie altogether transcends, not merely transgresses, social and gendered conventions. This research explores Bowie's employment of the uncanny alongside Judith Butler's theory of gender performance, using visual examples from music videos and album covers to emphasize such transcendence and agency over the body and identity.

Advisor: Dr. Cassandra Hartford, Muhlenberg College

Funded by: The Mazur Research Fund for Musical Inquiry

9. From Pills to Plants; Phytoextracts and the GABA(A) Receptor

Teigan Brown, Bryan Carter and Sylvia Sarnitsky

The γ -aminobutyric acid (GABA) receptor, a key inhibitory neurotransmitter receptor in vertebrates, regulates neural activity. By studying phytoextracts' effects on the GABA receptor, we explore the molecular impact of herbal treatments. Our lab focuses on two phytoextracts, *Scutellaria lateriflora* and *Ziziphi spinosae* semen, which may modulate the benzodiazepine site of the GABA receptor. We also investigate the extrasynaptic GABA receptor, $\alpha_4\beta_2\delta$, for its role in altered consciousness. This could lead to novel pharmacotherapies for anxiety, insomnia and seizures that pose less risk than synthetic drugs.

Advisor: Dr. Jeremy Teissere, Muhlenberg College

Funded by: Summer Research Grant from the Dean of Academic Life (T.B.); REBCS Research Grant (B.C. and S.S.)



10. *Lower the Drawbridge: A Short Film*

Seannie Cahill-Swenson

A short film about a stutterer, tasked with scheduling an appointment and making a film. With his anxiety rising and self-confidence at risk, will he be able to pull through? A stark contrast to other films about stuttering, this film has a lighter tone and sheds light on the more mundane experience of having a stutter.

Advisor: Professor David Romberg, Muhlenberg College

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



11. Claiming Spaces

Roman Craig and Alexa Cinelli

Our research project focused on LGBTQ+ history at Muhlenberg College through the perspectives of LGBTQ+ students and faculty. We chose this topic to explore history through the eyes of those who experienced it firsthand. Prior to our research, Muhlenberg lacked a cohesive narrative of this history; our goal was to bring awareness to the story. Our research findings were stories of Muhlenberg LGBTQ+ community members who all had different experiences in different eras. The importance of the research is to demonstrate how students and faculty claimed space at Muhlenberg when they were not completely accepted elsewhere.

Advisor: Susan Falciani Maldonado, Head of special collections & college archives, Trexler Library; Anthony Dalton, Digital cultures media assistant; Dr. Kate Ranieri

12. Investigating the Reaction Pathway of L-DOPA 2,3-Dioxygenase through Kinetic Models of Reactions With Various Substrates

Jon Cohen

Lignin is an untapped source of carbon that can be valorized into natural products, feedstocks and biofuels. L-DOPA 2,3-dioxygenase (DDO) enzymes oxidatively cleave catecholic monomer units, like those common to lignin, to produce desirable synthons. The recently discovered DDO from *Streptomyces hygroscopicus jingganensis* (ShjingDDO) demonstrates kinetic flexibility and catalytic potential. Reaction buffer formulation and pH were optimized in order to observe reactions between ShjingDDO and different substrates in the pre-steady state and to model those substrate-dependent reaction pathways in KinTek Explorer software.

Advisor: Dr. Keri Colabroy, Muhlenberg College

Funded by: REBCS in Chemistry, NSF CHE 1708237

13. An Examination of Radon Awareness and Knowledge in Reading, Pennsylvania

Zayon Cordova Febres

Radon is a radioactive, naturally-occurring, invisible gas that becomes trapped in buildings. It is the second-leading cause of lung cancer after smoking, accounting for more than 21,000 lung cancer deaths per year in the United States. Pennsylvania has the highest reported indoor radon levels in the country. To assess the level of radon knowledge and awareness in Reading, Pennsylvania, a cross-sectional face-to-face survey was conducted. There were significant differences in awareness amongst residents of different zip codes, education levels, homeowner status, ethnicity and annual income. Conclusion: A multilingual radon risk education and outreach program is needed

Advisor: Dr. Chrysan Cronin, Muhlenberg College

Funded by: The Dr. Chrysan Cronin and Mark Cronin Research Fund for Public Health

14. Hexagonal Ice Simulation by Deep Neural Network Using SCAN0 Density Functional Theory

Jonathan Cuadra

This project integrates Density Functional Theory (DFT), machine learning (ML) and Temple University's Owl's Nest High-Performance Computing (HPC) Cluster to investigate water structures under varying conditions, particularly temperature's impact on molecular dynamics. A hexagonal ice simulation will be showcased. DFT-generated datasets will train and validate a neural network algorithm, creating a predictive model for water structures. This interdisciplinary approach, combining HPC with ML, has the potential to accelerate research across physical chemistry, computational biology, materials science and planetary science fields.

Advisor: Dr. Xifan Wu, Temple University's Institute for Computational Molecular Science & High-Performance Computing (ICMS & HPC)

Funded by: National Science Foundation Grant

15. Taming the Rhinoceros: A Gestural, Shape-Based Approach to Song Analysis and Compositional Style in Pop-Rock Guitar Music

Daisy Cunningham

There is a whole experiential world of guitar playing that lies beyond Western music notation. Corporeal experiences of guitar playing and the physical “shapes” a guitarist makes on the strings inform the melodic and compositional styles of the instrument, for which there is little framework to analyze outside of a gestural approach. This research project juxtaposes a Western notation-based analysis and a gestural/fretboard orientation analysis of The Smashing Pumpkins' song “Rhinoceros” (1991) in an attempt to highlight underrepresented gestural frameworks of understanding composition styles in pop-rock guitar music.

Advisor: Dr. Paul Murphy, Muhlenberg College

Funded by: The Mazur Research Fund for Musical Inquiry



16. Double Split-Ring Resonator Design for Optically Detected Magnetic Resonance of NV Centers

Sofia Davvetas

Nitrogen-vacancy (NV) centers are spin-triplet systems with a fine structure that can be manipulated using microwave pulses. These centers can be studied through optically detected magnetic resonance (ODMR), which enables the control and detection of their spin states. To achieve this, efficient microwave pulse delivery via an antenna is crucial. This work introduces an antenna design tailored to NV centers, enabling ODMR across the relevant frequency range. The antenna is capable of operating at a single frequency or simultaneously at two frequencies. The efficiency of this antenna is demonstrated through simulations using Ansys High-Frequency Structure Simulator (HFSS).

Advisor: Dr. Nicholas Curro, University of California, Davis

Funded by: National Science Foundation Grant



17. Effect of Juglones on Colonization by Stream Macroinvertebrates

Lisa DeCristofaro, Maya Richwine and Quentin Walker

Juglones are naturally occurring chemicals some plants (such as black walnut) use for allelopathy, inhibiting the growth of nearby sensitive plants. In the Lehigh Valley, black walnut trees are common, often being used to stabilize stream banks, as playground mulch and increasingly as an organic herbicide. We examined colonization of leaf packs by stream macroinvertebrates using three tree species varying in juglone content: black walnut (high), shagbark hickory (medium) and tulip poplar (none). Leaf mats were deployed in two different streams for six days, then the invertebrates within were identified and counted to determine whether juglones impacted colonization.

Advisor: Dr. Erika Iyengar and Professor Karen Tuerk, Muhlenberg College

Funded by: The Dr. John E. Trainer '35 P'65 GP'04 Research Fellowships in Ornithology and Biological Sciences

18. Tick Diversity and Abundance in the Lehigh Valley

Matthew Baresh and Erin DiSandro

Ixodes scapularis (blacklegged) ticks are vectors of human disease. Our research team collected these ticks from 10 different forested sites in the Lehigh Valley to assess their abundance in each area. Using a square-meter corduroy cloth that we dragged along the forest floor, 1,171 ticks were collected across all 10 sites. The distance we dragged was recorded to determine the density of ticks per 100 square meters. Comparing data from previous years, the average tick density in 2024 was slightly lower than average. Almost all ticks we collected were nymphal *Ixodes scapularis* and only one nymphal longhorned tick.

Advisor: Dr. Marten Edwards, Muhlenberg College

Funded by: The Dr. James R. Vaughan '52 Student Research Award in Biology

19. Identification and Analysis of Pathogens in Pennsylvania *Ixodes scapularis*

Erin DiSandro with Matthew Baresh

Ixodes scapularis ticks are vectors of *Borrelia burgdorferi*, *Babesia microti* and *Anaplasma phagocytophilum*. Using data from the Pennsylvania Department of Environmental Protection (PA-DEP), we analyzed trends in the prevalence of each of these pathogens. *Babesia microti* was more prevalent in the Lehigh Valley than in the rest of the state. We also performed Single Nucleotide Polymorphism analysis on 626 *Anaplasma*-positive ticks collected by the PA-DEP to determine the *Anaplasma* variant in each sample. We found a significant increase in the prevalence of anaplasma-human variants in the western regions of the state in 2023 compared to the past three years.

Advisor: Dr. Marten Edwards, Muhlenberg College

Funded by: The Dr. James R. Vaughan '52 Student Research Award in Biology

20. Characterization of Dioxygenase Enzymes Using DHCAs and Their Derivatives as Substrates: Unlocking Lignin’s Potential for Biofuel and Antibiotic Development

Amen Demisew

Lignin, a complex polymer in plant cell walls, is a promising biofuel source due to its abundance, energy-rich structure and potential in pharmaceuticals, including antibiotics. However, it remains untapped energy unless efficiently broken down. My summer research focused on characterizing dioxygenase enzymes, crucial for breaking down catecholic rings in lignin. By understanding the enzymatic and non-enzymatic contributions to product formation, I aimed to elucidate these processes. Through steady-state kinetics experiments, we measured key parameters (K_M , k_{cat} and k_{sp}) for reactions involving substrates L-DOPA, dopamines and DHCAs. This detailed characterization supports the broader goal of sustainable biofuel technology and antibiotic production.

Advisor: Dr. Keri Colabroy, Muhlenberg College

Funded by: Buzzard Research Grant and REBCS Research Grant

21. Achieving the Flow State: Task Engagement and Group Development

Simone Dutton

Inherently, each person has some tasks that engage them more than others, with some of those tasks bringing us to a state of prime engagement and other tasks being something we dread. This research explores what exactly causes us to be engaged, particularly if engagement is tied to a group relationship between coworkers. Additionally, this study explores where a leader’s role in their group engagement lies and potential actions that leaders can take to either help boost a person’s engagement or even potentially limit it.

Advisor: Dr. Michael London, Muhlenberg College

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



22. 6-bromoDOPA as an L-DOPA 2,3-dioxygenase Substrate

Saja Elsayed

Lignin is a complex polymer of 1,2-dihydroxybenzene monomers, or catechols, and provides structural support to the cell walls of many plants. L-DOPA 2,3-dioxygenases enzymatically cleave and upcycle catecholic monomers, including L-DOPA, into natural products, such as the antibiotic lincomycin. The alternative substrate 6-bromoDOPA could yield brominated natural products. In this project, we investigated the reaction of 6-bromoDOPA with L-DOPA 2,3-dioxygenase from *S. hygroscopicus jingganensis*. Products of the enzymatic reaction appeared at three wavelengths: 360, 420 and 320 nm. Increasing concentrations of 6-bromoDOPA were examined by UV-visible spectroscopy through timescans at these wavelengths.

Advisor: Dr. Keri Colabroy, Muhlenberg College

Funded by: The MUHLES Program funded by a grant from the Arthur Vining Davis Foundations



23. There's No Way Around The Body: Restricting Hand Movement Affects Both Embodied and Disembodied Mental Rotation

Giovanna Evans

Previous research has reported involvement of body representations in mental rotation of body parts but not abstract objects. We asked whether the physical and imagined body can be involved even in the rotation of abstract objects if participants are explicitly instructed to employ an embodied strategy and contrasted this with a disembodied strategy. Results showed that mental rotation was possible but less efficient in both embodied and disembodied strategies when the participants' hands were restricted. This suggests that even when we're not explicitly engaging our imagined body, our physical bodies still play a role in abstract cognitive processes.

Advisor: Dr. Matthieu de Wit, Muhlenberg College

Funded by: Experiential Learning Grant & Travel Funding from the Dean of Academic Life

24. Using Fluorescence Quenching to Study Interactions Between Humic Acid and Triclosan

Emily Felix

Triclosan (TCS) is an antibacterial chemical used in many household products; however, triclosan contaminates the environment and harms aquatic life. The extent to which triclosan binds to organic components of soil and persists in the environment is poorly understood. Humic Acid (HA) is a complex molecule abundantly present in soil and water that comes from decomposed plant tissue. Interactions between triclosan and humic acid were monitored through fluorescence quenching to help explain triclosan persistence in the environment. Using fluorescence and UV-Visible spectroscopy, the interactions were found to follow patterns of static quenching.

Advisor: Dr. Bruce Anderson, Muhlenberg College

Funded by: Hollenbach Chemistry Endowed Scholarship Fund

25. Buggin' Out: Why Have the Insects Left Little Cedar Creek?

Emma Forster, Julian Pilet, Ava Lundy and Caprina Licopoli

Little Cedar Creek is an important recreational and drinking water resource for a large urban population (Allentown, Pennsylvania). The Pennsylvania Department of Environmental Protection deemed it impaired, based on remote sediment runoff estimates. Our study assessing stream health represents Year 2 in a long-term biological study. Benthic macroinvertebrates and sediment were collected from seven locations within the stream. The EPT index (evaluating pollution-sensitive species), Shannon-Weiner diversity index, and proportional representation of sediment size indicated that Little Cedar Creek is impaired. However, poor biological indicators did not correlate with poor sediment sizes. Something other than fine sediment is affecting the aquatic ecosystem.

Advisor: Dr. Erika Iyengar and Professor Karen Tuerk, Muhlenberg College

Funded by: The Dr. John E. Trainer '35 P'65 GP'04 Research Fellowships in Ornithology and Biological Sciences (E.F. and J.P.); REBCS Research Grant (A.L. and C.L.)

26. In Vitro Analysis of Non-Steroidal Anti-Inflammatory Drugs for Central Nervous System Delivery

Andrew Gagnon and Avi Sousan

Research has shown that non-steroidal anti-inflammatory drugs (NSAIDs) could serve as potential treatments for neuroinflammation, which is thought to be a significant contributor to central nervous system diseases like Alzheimer's disease (AD). Most, however, suffer from low brain exposure levels. To create anti-inflammatory drugs with improved brain bioavailabilities and suppressed plasma protein binding, our group has conjugated hydrophobic shuttles to NSAIDs. Hydrolysis of these NSAID derivatives in human plasma was then tracked using high-performance liquid chromatography. Preliminary studies indicate that (S)-naproxen and flurbiprofen derivatives hydrolyzed in PBS, but not in plasma.

Advisor: Dr. Sherri Young, Muhlenberg College

Funded by: Chemistry Summer Research Fund in Honor of G.N. Russell Smart and David Stehly (A.G.); Kerilyn C. Burrows, Ph.D. '72 Research Fund in Honor of Donald W. Shive, Ph.D. (A.S.)

27. Smaller is Better — Developing a Microscale Ferrozine™ Assay for Quantifying Iron in Protein Samples

Lauryn Glass

L-DOPA 2,3-dioxygenase is an important enzyme in the biosynthesis of the antibiotic lincomycin. Over time, the low concentration of essential Fe^{2+} needed for this reaction oxidizes to the inactive Fe^{3+} . Utilizing the Ferrozine™ assay and measuring with the UV-visible spectroscopy, we can create a calibration curve; however, the current form of the assay sacrifices 500 μL or 0.5mL of protein sample each time, limiting further experiments. This summer I built a reproducible, scaled-down method for the Ferrozine™ assay that fit on the Nanodrop spectrometer and will save resources for future experiments with L-DOPA 2,3-dioxygenase.

Advisor: Dr. Keri Colabroy, Muhlenberg College

Funded by: The MUHLES Program funded by a grant from the Arthur Vining Davis Foundations



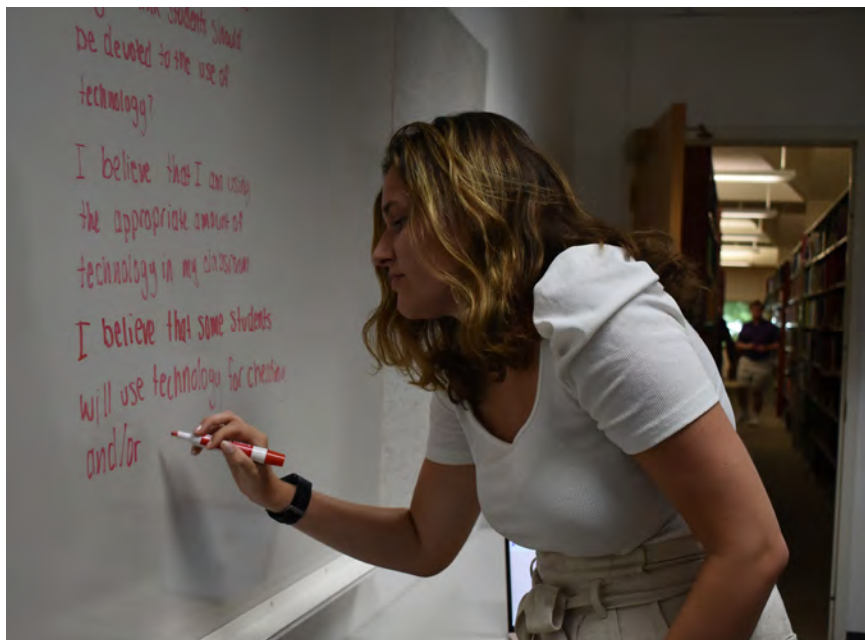
28. Effect of Emotional Information on False Memory

Dr. Gretchen Gotthard with Bernice Bazim, Anyimel Carpio, Emma Grace Bui, Ibrahim Sidibeh, Alexander Palmer and Natalia Mullings

This study examined the effects of emotional information on the creation of true or false memory using presuppositions (i.e., statements phrased in ways that presume something to be true). Participants saw neutral images paired with a positive or negative description, followed by true and false presuppositions in the form of true/false questions. Results showed that true presuppositions enhanced recall and recognition. When false memory was weak, emotional valence of the image produced no differences; however, when false information was well incorporated into a memory, negative emotional information significantly decreased false memory.

Advisor: Dr. Gretchen Gotthard, Muhlenberg College

Funded by: Summer Research Grant from the Dean of Academic Life (B.B.); The Neuroscience Collaborative Research Program (A.C. and I.S.); The MUHLES Program funded by a grant from the Arthur Vining Davis Foundations (E.G.B., A.P. and N.M.)



29. A Contemporary Analysis of DEI Measures Through Student Affinity Groups

Bryan Guzman

This study provides a historical and contemporary analysis of the DEIB movements in American institutions and begins to uncover the shortcomings of some of the initiatives. Conceptualizing and operationalizing DEI is something initiatives across college campuses have failed to articulate, alongside shortcomings to provide concrete information on improvement. I argue that DEI initiatives in American institutions fail to meet some of the objectives they claim to work toward, and through the case study of Muhlenberg College and its affinity groups, I further present suggestions to uphold the true values needed to decolonize academia.

Advisor: Dr. Janine Chi, Muhlenberg College

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

30. The Impact Technology Has on Secondary School Students: Preparing Them for Higher Education

Isabelle Hoffman

After COVID-19, the use of technology rapidly increased. As I embarked on my journey to become a secondary education teacher, I started to become acutely aware of the positive and negative effects of technology in the classroom. This research explores the influence technology has on students' learning and preparing them for higher education. Positive effects include the use of computer programs to provide additional support to students with learning disabilities and to emerging bilingual students, as well as creating diverse learning opportunities. At the same time, drawbacks included students having technology addiction and concerns about internet safety and academic integrity.

Advisor: Professor Sally Richwine, Muhlenberg College

Funded by: The Galgano Student Research Fund

31. Muhlenberg College Trajectories of Binary Star Systems

Noah Hubal

This summer's research was on binary star systems. It included reading journal articles that compared modified gravity (MOND) to Newton's Law of Gravity. It also included reading about stellar evolution. These readings were about how the mass and age of the stars determine their luminosity and temperature. I did numerical calculations for the orbits of the moon and the Earth, the Earth and the sun, and Alpha Centauri A and B using a spreadsheet. The ultimate goal of plotting these orbits was to compare the accuracy of MOND's data to Newton's Law of Gravity in other star systems.

Advisor: Dr. Brett Fadem, Muhlenberg College

32. Silicon Photomultiplier Scintillator-Based Muon Detectors

Zachary Huseman and Natalie Preble

Muons are high-energy particles created from collisions in the upper atmosphere. Using silicon photomultipliers (SiPMs) and plastic scintillators, we created telescopes to detect the presence and direction of muons' travel. These telescopes allow us to track the angle dependence and rate correspondence of cosmic-ray muons to determine the performance of our SiPM Scintillator-based detectors. Understanding these instruments allows us to interpret data from the sPHENIX Event Plane Detector, a component at the Relativistic Heavy Ion Collider. Preliminary data suggests the angle dependency of cosmic ray muons may not reflect the widely supported proportionality to $\cos^2(\theta)$.

Advisor: Dr. Brett Fadem, Muhlenberg College

Funded by: Student Research Assistantship (Z. H.); Harry Raub Physics Fund (N.P.)

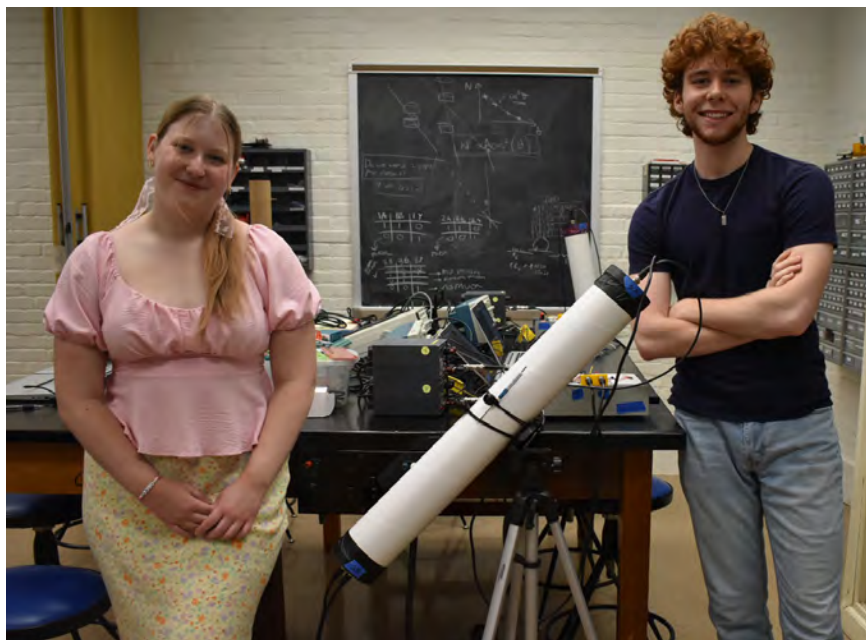
33. A Case Study Into Lowell Correctional Institution: Cultivating Safety in Incarceration

Shinam Hussain

This study examines complaint procedures at Lowell Correctional Institution. By analyzing existing investigations and reports filed against Lowell for abuse against incarcerated women, this study provides a comprehensive report on the abuse perpetrated at Lowell. Using this report, it was able to be analyzed that abuse was a systematic problem within the institution, and solutions were far past hiring new staff or reprimanding existing ones. Concern reports were available to incarcerated women; however, they were coerced and forced into not reporting. This study found that guard training and overseeing were necessary, along with an overall shift in attitude toward incarceration.

Advisor: Dr. Janine Chi, Muhlenberg College

Funded by: The Timothy A. Birch '80 Student Research Fund



34. Investigating the Reproductive Cost of Arrest in *C. elegans*

Ashley Kim

Unlike humans, *C. elegans* can arrest development at different stages of their lives. Osmotic stress and reduced insulin signaling are two pathways that play a role in arrest; however, what is not yet well understood are the benefits and drawbacks of arresting development. Brood size is commonly used as a proxy for overall nematode health, so investigating the brood sizes of arrested worms can give insight on the reproductive cost of arrest. Preliminary data suggests there is no reproductive cost to arrest, but the stress response associated with arrest may have reproductive implications.

Advisor: Dr. Bruce Wightman, Muhlenberg College

Funded by: The Crist Family Student Research Endowment in Biology



35. Differences in Cultural Attitudes Towards the Mainstream Models of Drug Addiction

Raja Darain Khan

My study focused on how cultural difference in attitudes towards substance abuse leads to a difference in stigma and associated stigma towards addicts in India and the United States. I measured attitudes towards harm reduction strategies and the mainstream models of addiction to get a clearer picture behind the reasoning of where this stigma stems from. I found that the Indian sample believed that drug abuse was much more of a moral failing whereas there was no significant difference between the other models.

Advisor: Dr. Jeff Rudski, Muhlenberg College

Funded by: The Crist Family Student Research Endowment in Psychology

36. Investigation of Phenylacetylene Dicobalt Hexacarbonyl Derivatives as a Model System for Electronic and Vibrational Properties

Avi Klein and Daniel Torres

This work focuses on the synthesis and experimental characterization of a series of substituted phenylacetylene dicobalt hexacarbonyl (PhA-DCHC) complexes in order to determine the relationship between the molecular structure of the ligands and the photophysical properties of the resulting complexes. The synthesized complexes were characterized using IR and NMR spectroscopy techniques. While ^1H and ^{13}C NMR experiments revealed no strongly correlated trends between chemical shifts and ligand properties, we found a very strong correlation in the infrared between the electrostatic potential of the substituents and the stretching frequencies of the metal carbonyls' normal vibrational modes.

Advisor: Dr. Joseph Meadows, Muhlenberg College

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

37. The Present Professional

Jordan Lavalle

In today's world, the art of being present is overlooked. My research focuses on "The Second Circle" technique, developed by Patsy Rodenburg, and how its implications go beyond performers. Stemming from a transformative study abroad experience at the Theatre Academy London, I became fascinated by the idea that presence work can extend to many fields of life by enhancing personal well-being, communication, relationships and professional endeavors. After engaging with various scholarly texts and conducting interviews with five professionals within the field, I have developed an understanding of how practicing presence can elevate one's self and one's communication with others.

Advisor: Professor Jessica Dean, Muhlenberg College

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

38. Bias Detection in Large Language and Natural Language Processing Models

Geoffrey Levy

While many techniques exist to detect bias in large language and natural language processing models, most of the methodologies underpinning these techniques favor an insular, disconnected approach when utilizing bias-detection tools. By incorporating two leading evaluative tools, CheckList and HuggingFace’s Evaluate, we are able to complement each one’s advantages to create more nuanced tests that further delineate the strengths and weaknesses of a model. We demonstrate this in a test using these tools by perturbing different names/religions/races/etc. over a collection of open-ended sentences, predicting the next most likely words, and evaluating model performance based on these predictions with varying metrics.

Advisor: Dr. Hamed Yaghoobian, Muhlenberg College

Funded by: The Ladley Endowed Student Research Fellowship Fund

39. “A Big Piece of Our Identity ... That Kind of Goes Away;” A Qualitative Analysis of the Transition for Student-Athletes Post-College

Kaya Mahy

The purpose of this study was to compare the experiences and transition of student-athletes who retire normatively versus non-normatively. Examples of normative ends are graduation, eligibility expiration or quitting, and examples of non-normative ends could be injury, being cut, mental health reasons or COVID-19 effects. More challenges were predicted to be found in non-normative ends than normative ends. Twelve Muhlenberg student-athlete alumni, three Muhlenberg coaches and one Muhlenberg athletic trainer were interviewed. All perspectives were used to see if the amount of non-normative retirement in Muhlenberg student-athletes can be reduced.

Advisor: Dr. Erika Bagley, Muhlenberg College

Funded by: The Rosenberg Student Research Fellowship in Psychology



40. Innovative 3-in-1 Pesticide, Fertilizer and Pathogen Protectant with Chicken and Sheep Manure: SoilPop

Deborah McDonald and Shajnin Howlader

Our team was interested in investigating a 3-in-1 product that serves as a fertilizer, pesticide and pathogenic protectant. By combining chicken and sheep manure, herbal powders and natural binder, we were able to create SoilPop through a dehydrating process. This summer, we further developed our SoilPop recipe. Additionally, we tested our product using different concentrations of manure on cabbage, eggplant and tomato plants. We hope to continue developing SoilPop, as we are extremely interested in finding a novel way to combat pests and increase plant nutrient uptake and plant fertility for sustainable gardening in the future.

Advisor: Dr. Richard Niesenbaum, Muhlenberg College

Funded by: VentureWell Student Research Grant (D.M.); The MUHLES Program funded by a grant from the Arthur Vining Davis Foundations (S.H.)



41. Investigating Political Engagement and Political Beliefs within Generation Z and Beyond: Interviews and Essays

Emma McKinley

With this project, I aimed to investigate the ways in which my generation chooses to engage politically. My goal was to interweave my own personal experiences with politics through a collection of creative nonfiction essays centered around cultural commentary. These cultural critique essays are creative nonfiction narratives centered around my coming-of-age as a political person, alongside research in sociology and politics. The two essays I completed this summer included a rumination on my past personal experiences with political engagement as opposed to my now lack of participation and an inquiry into hope and political division in the United States.

Advisor: Professor Linda Miller, Muhlenberg College

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

42. Exploring Contributors to Cervical Cancer Disparities in Hispanic Women Across Lehigh Valley Hot Spots: A Mixed Methods Analysis

Jocelyn Mertz

Alarming differences in incidence and mortality rates due to invasive cervical cancer exist between Hispanic and non-Hispanic white women. This study investigates the contextual factors that may be contributing to these disparities in geographic hot spots of the Lehigh Valley. Employing the focused Rapid Assessment Process (fRAP), we combined Geographic Information Systems (GIS) mapping with qualitative analyses from community field visits and depth interviews to identify key contributors. Our findings reveal significant variation in these factors depending on geographic location, highlighting actionable areas for intervention and emphasizing the need for tailored strategies to reduce survivorship disparities in the Lehigh Valley.

Advisor: Dr. Keri Colabroy, Muhlenberg College

Funded by: Lehigh Valley Health Network Research Scholars Program

43. Does Enriching the Environment Change How the Brain Regulates Behavior?

Jess Moskovits and Khadijah Chaudry

Our research focused on how environmental enrichment impacts the neural mechanisms that promote social approach in zebrafish. Previous work has found that the hormone oxytocin promotes social approach in zebrafish and that zebrafish prefer enriched environments. As predicted, environmental enrichment increased social approach, and social cues increased the preference for environmental enrichment. A surprising finding was that in an enriched environment, oxytocin receptor antagonism did not affect social approach. This highlights the importance of environmental context in behavioral research.

Advisor: Dr. Leah Wilson, Muhlenberg College

Funded by: The Lake Road Summer Research Fellowships in Neuroscience and the Biological or Chemical Sciences

44. Effects of Neuropeptides on the Growth and Development Pathway of *C. elegans*

Benjamin Mulford

In the model organism *C. elegans*, developmental progression can be halted to peri-hatching arrest via mutations in both *daf-2* and *fax-1* genes. These genes coordinate insulin signaling and neuronal development, respectively. *Egl-21* and *unc-31* are genes that function downstream of *fax-1* and encode proteins that control the release and production of neuropeptides. Although much is known about insulin signaling, there is little understanding of how *fax-1* promotes developmental progression. My project seeks to understand the potential role of neuropeptides in the growth and development pathway of *C. elegans*.

Advisor: Dr. Bruce Wightman, Muhlenberg College

Funded by: The Lake Road Summer Research Fellowships in Neuroscience and the Biological or Chemical Sciences

45. Effect of Maternal Experience in *Caenorhabditis elegans*

Pamela Najm

C. elegans are genetic model organisms used to understand mechanisms of animal development. This project focused on how neurons influence insulin signaling and progression of development, particularly the effect of maternal experience of nematode *C. elegans* progeny. When insulin signaling is reduced, animals arrest at hatching, leading to the question of whether maternal experience would affect the likelihood of offspring arrest. Animals with insulin-receptor mutations were compared with animals that have insulin-receptor mutations along with a gene controlling neuron development. Based on maternal experience, there was no difference in progeny, indicating that arrest doesn't appear to affect the likelihood of insulin-dependent arrest.

Advisor: Dr. Bruce Wightman, Muhlenberg College

Funded by: The MUHLES Program funded by a grant from the Arthur Vining Davis Foundations



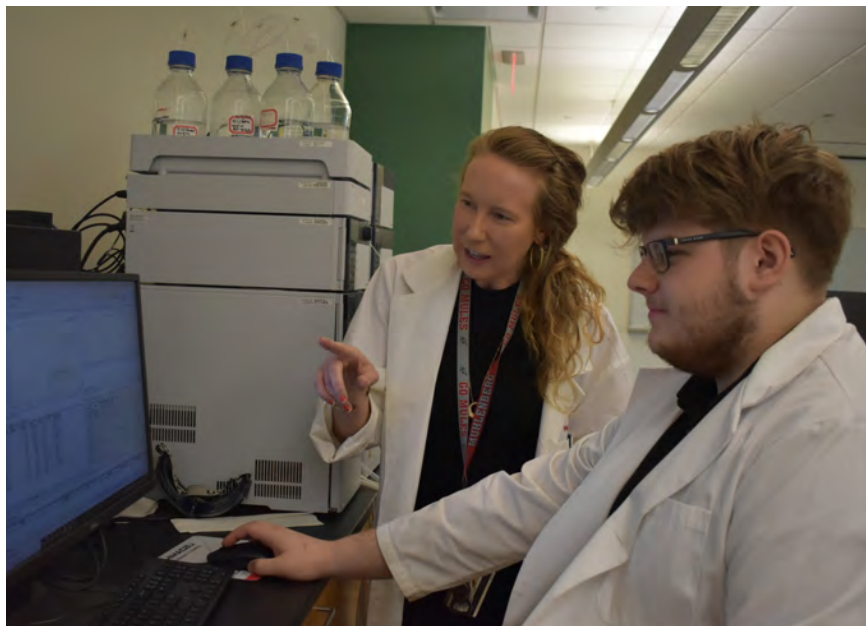
46. Complexity and Coding: How Does Odor Structure Influence Odor Encoding?

Sana Nauman

Bumblebees are essential pollinators that use odor cues during foraging. Anthropogenic pollution can disrupt olfactory behavior by altering scent structure. Previous work established a novel odor-quantification mechanism, Compounds Without Border (CWB), based on molecular features. Simple odors and complex odors are represented differently in the brain. CWB is good at representing complex odors. This presents an opportunity to identify how odor complexity impacts odor encoding. We use a Pavlovian associative learning paradigm to determine at what level of odor complexity CWB descriptors become efficacious, as this should mirror when olfactory processing shifts from 'simple' to 'complex' mechanisms.

Advisor: Dr. Jordanna Sprayberry, Muhlenberg College

Funded by: The Dr. James R. Vaughan '52 Student Research Award in Biology



47. Progress Towards the Enantioselective Total Synthesis of Tronocarpin

Esther Oko

Enantioselective synthesis of natural products allows for a more direct analysis of their biological applications. Described herein are recent efforts for the enantioselective total synthesis of tronocarpine during early-stage synthesis of the natural product. Desymmetrization following a non-stereospecific Diels-Alder reaction and subsequent catalytic dehydrogenation will be attempted to install chirality at the quaternary stereocenter. Kinetic resolution using a chiral Cu(I)-based catalyst and chiral phosphoric acid will also be attempted to separate the two enantiomers of tronocarpine.

Advisor: Dr. Pavel Nagorny, University of Michigan

Funded by: National Science Foundation Grant

48. Solving the Mystery of L-DOPA 2,3-Dioxygenase Inactivation: Evidence for Superoxide

Bernice Owusu

L-DOPA 2,3-dioxygenase is an enzyme that activates oxygen, generating superoxide, then cleaves the aromatic ring of the L-DOPA and other substrates. We hypothesized that L-DOPA 2,3-dioxygenase enzymes engage in self-inactivation by releasing superoxide mid-reaction, preventing the oxidation of the substrate. The inactivation of L-DOPA 2,3-dioxygenase and its mutants L46R and L46W was detected by an oxygen electrode using an “uncoupling experiment” to measure oxygen consumption with and without SOD and catalase. SOD and catalase convert superoxides back into oxygen. Results demonstrated that, in the presence of SOD and catalase, both L46W and L46R reacted more slowly with each substrate examined, suggesting inactivation by superoxide release.

Advisor: Dr. Keri Colabroy, Muhlenberg College

Funded by: The Lake Road Summer Research Fellowship s in Neuroscience and the Biological or Chemical Sciences

49. The Ideal Viewing Point: Making Unequal Window Spacings on the Palazzo dell'Antella Appear Equal

Jason Rackas

Located in the Piazza di Santa Croce in Florence, Italy, is the Palazzo dell'Antella, a building whose windows toward the east side of its facade are grouped far closer together than those toward the west. As such, the architect likely intended a viewing point at which the windows would appear to be equidistant. Implementing formulae in the spreadsheet editor Microsoft Excel and incorporating its Solver function, each statistical measure was optimized for the possible coordinates located in the Piazza di Santa Croce to determine where one could stand to provide the most evenly spaced view of the structure.

Advisor: Dr. Michael Huber, Muhlenberg College

50. Molecular Structures of Poly(dimethyl siloxane) Incorporated with Silicone Oil Containing Phenyl Functionality

Samuel Roter

Marine biofouling is a multibillion-dollar global energy and environmental problem. It increases fuel consumption by 40%, releasing 390 million tons of greenhouse gasses. Poly(dimethyl siloxane) (PDMS) materials have been widely researched as fouling-release (FR) coatings. Incorporation of silicone oil into PDMS could lead to enhanced FR properties of PDMS materials. We applied sum frequency generation (SFG) vibrational spectroscopy to deduce molecular structural information of silicone oil, water and fibrinogen on surfaces/at interfaces in situ in real time. Different incorporated oils altered the surface structures of PDMS differently, leading to varied interactions with water and biological media, influencing the FR activities.

Advisor: Dr. Zhan Chen, University of Michigan

Funded by: National Science Foundation REU Grant

51. Self-Objectification, Gender Dysphoria and Menstrual Cup Attitudes

Emma Shay

This study explores the experiences of menstruators who do not identify as cisgender women. One hundred and forty-five menstruating, non-cisgender participants were surveyed in order to assess their level of self-objectification and gender dysphoria, attitudes toward menstruation, and awareness and willingness to use a menstrual cup. Self-objectification and gender dysphoria were found to predict negative attitudes towards menstruation, which also predicted negative reactions to the cup and feelings that it would trigger discomfort about identity and the body. Gender dysphoria was also linked to feelings that the cup would cause these discomforts.

Advisor: Dr. Kate Richmond, Muhlenberg College

Funded by: The Crist Family Student Research Endowment in Psychology



52. Role of *ngn-1*/neurogenin in Insulin Signaling and Organism Development

Alyssa Sipman

In *Caenorhabditis elegans*, insulin signaling is related to organism development. We have shown that transcription factors *fax-1* and *unc-42* are potentiators of insulin signaling. Mutations in either transcription factor, with a mutation in the *daf-2* insulin receptor, result in perihatching arrest, a novel phenotype in which animals arrest development near hatching. Recent work by Christensen et al., 2020, found that *ngn-1* mutations cause defects in embryonic nervous system development, similarly to *fax-1* and *unc-42*. Additionally, *ngn-1* was found to be upstream of *fax-1*, suggesting a linear relationship. My project seeks to understand the distinct role of *ngn-1* in these pathways.

Advisor: Dr. Bruce Wightman, Muhlenberg College

Funded by: The Dr. James R. Vaughan '52 Student Research Award in Biology



53. A Method for Testing Odor Valence in Bumblebees (*Bombus impatiens*)

Sinhayana Srinivasan

Bumblebees are essential pollinators who use odor cues to find resources. Odor valence, the degree to which an odor is appetitive/aversive, has been qualitatively observed, but not concretely tested in this taxon. Previous work has indicated that some agrochemical odors may be actively aversive to bumblebees. This study tests what attributes of odor structure are aversive, neutral or appetitive via a forced-choice proboscis extension reflex (PER) paradigm. These data will be used to select stimuli for companion foraging arena experiments to test odor preference in freely foraging bumblebees. Understanding the structural boundaries of odors is critical in understanding bumblebee responses to odor pollution.

Advisor: Dr. Jordanna Sprayberry, Muhlenberg College

Funded by: The Dr. James R. Vaughan '52 Student Research Award in Biology

54. Investigating Cyclic 1,2-diols as New Monomers for Ring-Opening Polymerization

Yoav Susskind

Various esters and alcohols were investigated as suitable reagents for the synthesis of biodegradable polymers. Two ethylene glycol diester compounds were synthesized, including a novel compound. Conditions of the reactions were optimized via replicate experiments and review of the literature. Organic characterization and purification techniques were utilized, including thin layer chromatography, flash column chromatography and nuclear magnetic resonance spectroscopy.

Advisor: Dr. Robert B. Grubbs, Stony Brook University

Funded by: National Science Foundation Grant CHE-1904932; National Science Foundation Grant CHE-20500541

55. The Phagocytosis Efficacy of THP-1-Derived M1 Macrophages on Oral Pathogenic Bacteria

Maya Tabakha and Kathy Christie

Vaping among adolescents has increased over the past decade. Although vaping is believed to pose fewer health consequences compared to smoking, its safety remains a public health concern. Macrophages exposed to e-liquids present aberrant morphology, suggesting dysfunction. Therefore, this project aims to evaluate the effects of e-liquids on the phagocytic capacity of macrophages using *Escherichia coli* and *Porphyromonas gingivalis*. It was found that e-liquids with flavors decrease the phagocytosis of these two bacteria. In the oral cavity, reduced phagocytosis may lead to oral disease, which is intimately linked to systemic health. Therefore, vaping may pose health consequences for users.

Advisor: Dr. Giancarlo Cuadra, Muhlenberg College

Funded by: The Crist Family Student Research Endowment in Biology (M.T.); The MUHLES Program funded by a grant from the Arthur Vining Davis Foundations (K.C.)

56. Corsi-Rosenthal Air Cleaner Project

Sofia Tartakovskaya, Sultan Almosbeh, Natalie Preble,
Megan Hegarty and Sofia Davvetas

Air quality is a growing concern, especially in urban areas where particulate matter (PM) levels can exceed safe thresholds. Our Corsi-Rosenthal air cleaner project constructs and delivers low-cost, effective air filters to community partner classrooms, where we use them to deliver lessons in data collection and analysis. This poster documents our first visit to a physics class at Dieruff High School. The project's objectives are to develop a deeper understanding of the importance of scientific data literacy (pedagogical), to demonstrate how air cleaning improves environmental quality and infection control (public health) and to expand students' experimental data analysis skills (learning).

Advisor: Dr. Adam Clark, Muhlenberg College

Funded by: Office of Community Engagement

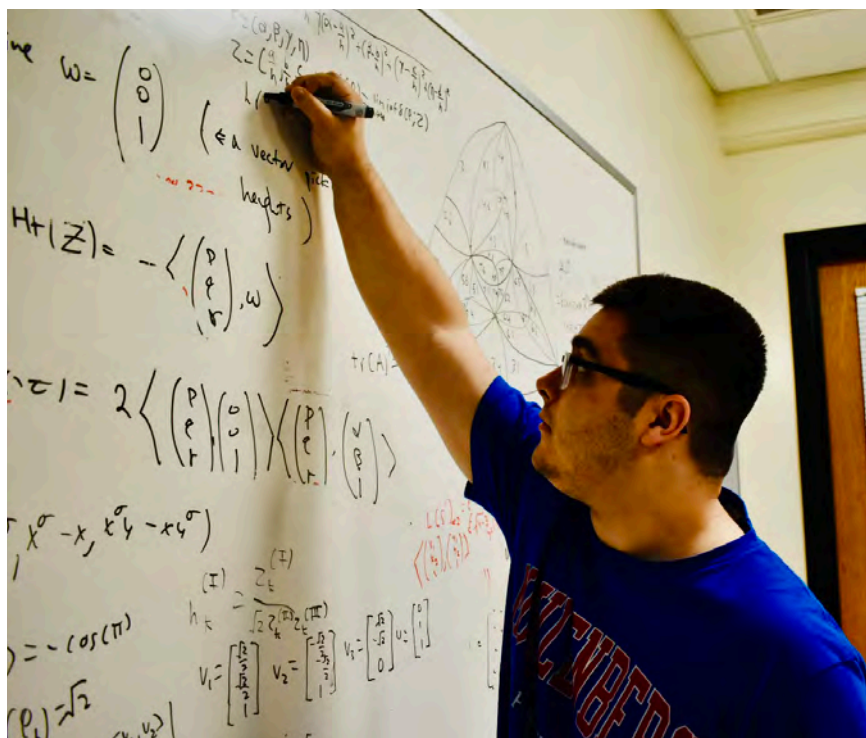
57. Redefining the Closet: Intersectionality, Queerness and Representation in Netflix's *Sex Education*

Marie Tohill

The Netflix series *Sex Education* redefines “coming out” by challenging hegemonic power structures and presenting it as a process involving multiple intersecting aspects of identity, such as spirituality and immigrant status, rather than solely focusing on queerness. Central to this argument is the portrayal of characters like Eric, a Black Queer student whose experiences illustrate the fluidity of the closet. My analysis begins with a review of literature on intersectionality, the evolving portrayal of the closet on television, and womanist theology. I then dissect the show's narrative, dialogue and cinematographic choices to reveal how *Sex Education* constructs the closet.

Advisor: Dr. Kiah Bennett, Muhlenberg College

Funded by: The Donna M. Bradley Tyson '78 and Alan L. Tyson '78 Endowed Student Research Fund



58. Approximations of Irrational Points of Higher Dimensional Spheres

Max Trimmer

We investigate the Lagrange spectrum from the Diophantine approximation on S^3 and its connection to Pythagorean quintuples. In particular, we find a relationship between the edge lengths of spherical tetrahedra with points determined by matrix-generated Pythagorean quintuples. We use this to conjecture an upper bound for the Lagrange number of an irrational point on S^3 .

Advisor: Dr. Byungchul Cha, Muhlenberg College

Funded by: The Ladley Endowed Student Research Fellowship Fund

59. Using Tissue-Specific Protein Degradation of Insulin Receptor in *C. elegans* to Identify Tissues Relevant for Developmental Progression

Sydney Vogel

In the nematode worm *C. elegans*, developmental progression is controlled in part by insulin signaling. *C. elegans* have one insulin receptor for all 40 insulin peptides: DAF-2. Using the Auxin-Induced Degron system, we hope to identify organs required for developmental progression by eliminating expression of the protein DAF-2 in four different tissues as well as in all somatic tissue. Eliminating insulin signaling by degrading the insulin receptor in a relevant tissue should prevent developmental progression and cause animals to enter perihatching arrest.

Advisor: Dr. Bruce Wightman, Muhlenberg College

Funded by: The Dr. James R. Vaughan '52 Research Award in Biology

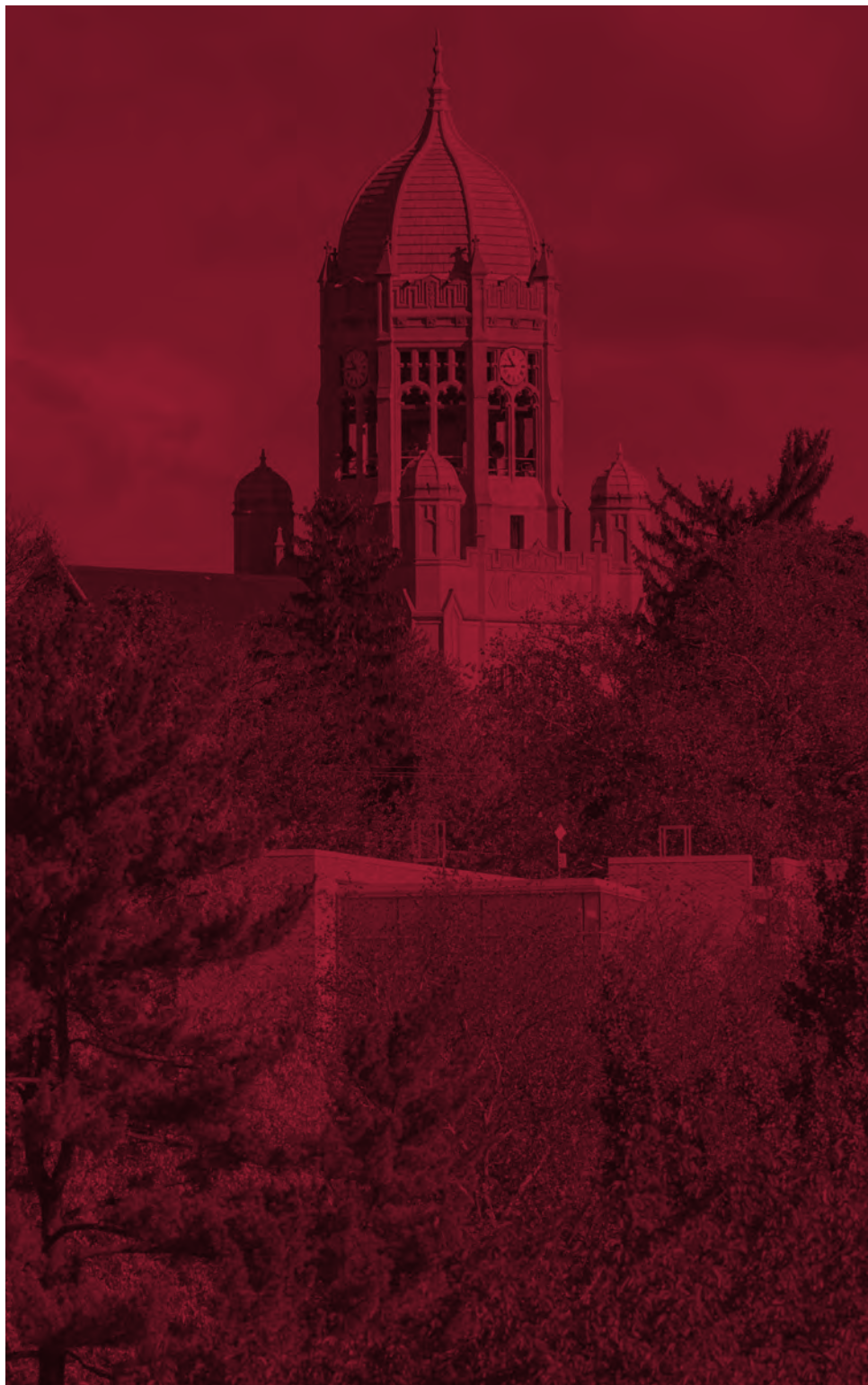
60. Understanding the Scope of Hepatitis B in Bong County, Liberia

Myra Wamah

Hepatitis B remains a significant public health concern in Liberia, West Africa. Most of what is known about hepatitis B in Liberia is from small studies done in the capital city. This gap motivated me to conduct a study to understand the scope of hepatitis B in other regions of Liberia. Although the rate of hepatitis B in Liberia is estimated to be high, most women I surveyed had not been tested for or vaccinated against hepatitis B. I hope my research findings can help people understand hepatitis B in Liberia and inform policy decisions.

Advisor: Rachel Hamelers, teaching and learning librarian, Trexler Library, Muhlenberg College

Funded by: The Dr. Chrysan Cronin and Mark Cronin Research Fund for Public Health



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