



Muhlenberg

CELEBRATION OF STUDENT RESEARCH,
SCHOLARSHIP AND CREATIVE WORK

2023

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. Analytical Chemistry & Community Engagement: Water Quality Analysis at the Palmerton Zinc Pile EPA Superfund Site

Elizabeth Abrams, Nolan Eichorn and Cayla Zenie

The Lehigh Gap Nature Center (LGNC), situated on an EPA Superfund Site, aims to restore the ecosystem after decades of pollution by a zinc smelting company. Water quality analysis in our lab from specific sampling sites provides data to help inform continued rehabilitation efforts. Phosphate concentrations were determined by UV-Visible absorbance spectroscopy; nitrate, sulfate, and chloride were determined by ion chromatography; and calcium, magnesium, and zinc were analyzed by atomic absorption spectroscopy. While zinc concentrations are still elevated at some of the water sampling sites, all other analytes fell within normal freshwater ranges across the seven sites examined.

Advisor: Dr. Christine Ingersoll, Muhlenberg College

Funded by: Research in Biochemical and Chemical Sciences Fund



2. Analysis of Anaplasma Strains in Pennsylvania Ticks

Fuka Aizawa

My research investigated *Anaplasma phagocytophilum* bacterial strain variants in *Ixodes scapularis* ticks that were collected in all 67 Pennsylvania counties. One variant (ha) causes a serious disease in humans called anaplasmosis. The other variant only infects deer and is harmless to humans. In order to determine the risk that this pathogen poses to humans, it is necessary to tell the strains apart. The Pennsylvania Department of Environmental Protection detected *Anaplasma* DNA in 800 ticks. In this research, I identified these strains with a real-time PCR based SNP assay and then investigated statewide tick infection patterns.

Advisor: Dr. Marten Edwards, Muhlenberg College

Funded by: Vaughn Summer Research award

3. Gestational Change in Estimated Glomerular Filtration Rate (eGFR) and Risk of Adverse Pregnancy Outcomes

Anam Ali

The Pregnancy Hypertension Kidney Center at Lehigh Valley Health Network is a multidisciplinary program that offers combined Maternal-Fetal Medicine and Nephrology care to pregnant patients with renal disorders. A study protocol was developed to investigate if lower baseline eGFR in chronic kidney disease patients is linked to a smaller gestational eGFR increase and whether this reduced gestational increase in eGFR correlates with an increased incidence of adverse pregnancy outcomes. To achieve this, a retrospective chart review was performed to compile clinical and demographic data on patients and identify the incidence of adverse outcomes.

Advisor: Dr. Sharon Maynard, MD, Lehigh Valley Health Network, Allentown PA

Funded by: Lehigh Valley Research Scholars Program

4. The Regulation of *fax-1* by *Nhr-6* in *C. elegans*

Vivi Arking

The *fax-1* gene codes for a transcription factor involved in the specification of select neurons and regulates a peri-hatching arrest pathway in *C. elegans*. Another transcription factor, *nhr-6*, involved in the specification of many neurons, has been postulated to regulate *fax-1*. To test this, I created a mutant *C. elegans* strain (*bwIs4;nhr-6(lg6001)*) where *nhr-6* is mutated and *fax-1* is tagged with GFP, analyzing GFP expression through fluorescence microscopy. Observations revealed that *nhr-6* mutations cause a loss of expression of *fax-1* in the DVA neuron, indicating that *nhr-6* is a positive regulator of *fax-1* transcription in the DVA neuron.

Advisor: Dr. Bruce Wightman, Muhlenberg College

Funded by: The Crist Family Student Research Endowment in Biology

5. A Female Text–House Wrought in Response to Doireann Ní Ghríofa’s *A Ghost in the Throat*

Hope Austin

In conversation with Doireann Ní Ghríofa’s *A Ghost in the Throat*, I appropriate the role of homemaker to produce a text that is not bound by phallogentrism or traditional academic discourse, to physicalize literary analysis. The result is a house made of text: a text–house, if you will. In this text–house, I unravel Ní Ghríofa’s text, which emerges within and works to construct an Irish historical paradigm shift that locates Irish history within specific female bodies through acts of acknowledgement. This text–house considers the possibility for a kind of faith that centers female rituals of donation/consumption and active Love.

Advisor: Dr. Matthew Moore, Muhlenberg College

Funded by: The Galgano Research Grant

6. Odor Complexity: A Novel Paradigm for Quantifying Odor Discrimination in *Bombus impatiens*

Rebekah Ayre

Research documenting the negative effects of anthropogenic odor pollution on pollinator foraging behavior is extensive. Previously, our lab has used an associative odor learning task (FMPER) and odor–quantification paradigm (CWB) to explore these impacts. However, associative learning seems to measure generalization rather than the perceptual threshold of discrimination. This study presents a differential conditioning method that measures odor discrimination, which can be used to test the complexity threshold for a crucial shift between two types of neural encoding. By understanding this threshold, we can improve our understanding of how odor–pollution disrupts bumblebee odor–driven foraging.

Advisor: Dr. Jordanna Sprayberry, Muhlenberg College

Funded by: Neuroscience Collaborative Research Program



7. Forecasting IV Surfaces Using SDRs

Nicolino Berlinger

This project leverages data science and options to predict Implied volatility surfaces in FX options. It processes the DTCC's SDR to compile an options database that has 80% of the FX market represented. It then uses deep/machine learning to forecast IV surfaces and thus options price. It explores the use of VAE/LSTM to forecast option value/price. It is extremely useful for financial forecasting and uses a new way of feature engineering using a VAE for signal extraction.

Advisor: Dr. Allison Davidson, Muhlenberg College

Funded by: Ladley Research Grant



8. GC-MS Characterization of Acid-Catalyzed Acetal Kinetics in Ethanol

Victoria Brady

Acetal formation in fine fragrances occurs due to the reaction between the fragrance (often an aldehyde) and the solvent (ethanol), changing the scent over time. Due to the proprietary nature of fine fragrances, the kinetics of acetal formation is not widely known. This research aims to determine the effects of acid concentration on the reaction rate and mechanism, to determine rate constants, and to better understand the equilibrium process of the reaction. It was determined that reaction rate increases with increasing acid concentration, and the presence of water increases the reaction rate and produces less acetal over time.

Advisor: Dr. Christine Ingersoll and Dr. Robert Fuller, Muhlenberg College

Funded by: Hollenbach Chemistry Endowed Scholarship Fund

9. Music and Distraction With Visual Search Tasks Between Empathizers and Systemizers

Abigail Bresalier

Background music while completing visual search tasks has had mixed effects on task performance in terms of sustaining people's attention. The purpose of this study is to investigate whether preferred music among two cognitive styles - empathizers and systemizers - would have distracting effects on doing visual search tasks. Results suggest that empathizers performed significantly better on the task regardless of music type, pointing to the possibility of differences of general distractibility on visual search tasks among the two cognitive styles. Rock music may also have a generally distracting effect on completing visual search tasks as opposed to silence.

Advisor: Dr. Laura Edelman, Muhlenberg College

Funded by: Summer Research Grant from Dean of Academic Life

10. Variable Star Photometry: SS Cygni

Jonathan Cuadra

In the research, a telescope, CCD camera, and photometry software were used to locate, observe, and attempt to record data for the variable star SS Cygni (a cataclysmic variable star). The AAVSO Photometric Database (which includes measurements of SS Cygni) was also utilized. These data were plotted as light curves (graphs of the star's brightness over time) and subjected to Fourier Analysis. The poster will address the research question: "Are there significant deviations from the star's typical variability in the new data?" The instruments employed, light curves, and preliminary results of the Fourier Analyses will also be discussed.

Advisor: Dr. Brett Fadern, Muhlenberg College

Funded by: Timothy A. Birch Student Research Grant

11. Synthesis and Characterization of the Chiral C_2 -Symmetric Tetraamine Ligand (N,N')-bis(1-methylimidazolyl-2-methyl)-(S,2),(S,2')-bispyrrolidine (Imbp) and Molybdenum and Tungsten Complexes

Graziella Dal Bon and Daniel Torres

The C_2 -symmetric tetraamine ligand (N,N')-bis(1-methylimidazolyl-2-methyl)-(S,2),(S,2')-bispyrrolidine (Imbp) was synthesized (57.3%). Two molybdenum complexes, (2,2'-bipyridine)Mo(CO)₄ (80.9%) and (1-methylimidazole)(bipyridine)Mo(CO)₃ (94.9%), were synthesized through reflux methods and glovebox techniques and characterized using ¹H NMR and ¹³C NMR spectroscopy. Future research will investigate the behavior of the CO₂ ligand on *cis*- α -[(Imbp)Mo(NO)(CO₂)]PF₆ and *cis*- α [(Imbp)W(NO)(CO₂)]PF₆ and whether these can be used as dearomatizing agents.

Advisor: Dr. Joseph Keane, Muhlenberg College

Funded by: Smart/Stehly research grant

12. The Muhlenberg Observatory

Sofia Davvetas

My research this summer focused on planning for the Muhlenberg observatory. The observatory will be located at Muhlenberg's Conrad W. Raker Wildlife Reserve. Located in Germansville, the observatory will be in a spot with less light pollution, allowing us to see more through the telescope than we can on campus. The goal of my research is to set up the observatory for optimal observing capability; this includes using Stellarium to motorize the telescope. Moving forward we hope to begin astronomy projects at the observatory to interest and include many students.

Advisor: Dr. Brett Fadem, Muhlenberg College

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



13. “We Must Be Over the Rainbow”: The Musical Significance of the Rainbow in *The Wizard of Oz*

Dylan De Magistris

Through the analysis of the original score to *The Wizard of Oz*, the symbol of the rainbow provides a new lens in which to understand the film’s music. Starting with the inception of the songs, such as “Somewhere Over the Rainbow,” written by composer Harold Arlen and lyricist E.Y. “Yip” Harburg, this essay traces their development to the big screen. Composer of the underscore, Herbert Stothart’s contributions to the score and their relationship to the rainbow are analyzed as well. As the music teaches us, and as Dorothy poignantly puts it, “there’s no place like home.”

Advisor: Dr. Paul Murphy, Muhlenberg College

Funded by: The Mazur Research Fund for Musical Inquiry



14. Dispersal-mediated Resilience to Altered pH in Aquatic Arthropods

G. Andrew Doubleday, Caprina Licopoli and Taylor Brandt

While anthropogenic acidification of aquatic environments is worrisome, taxa will likely vary in their response to these alterations. Ponds can naturally differ greatly in their pH due to factors such as incoming leaf species and amounts, bedrock, and plant growth. In the laboratory, we investigated whether aquatic arthropods with high dispersal potential (damselfly larvae) were more resilient to pH alterations than those with low dispersal ability (isopods). Using pH treatments of 5, 7, and 10, we monitored survivorship over the span of one week. Surprisingly and fortunately, neither species showed much mortality to any of the pH's tested.

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

Funded by: Research in Biochemical and Chemical Sciences Fund

15. Long-term Monitoring of Pond Health at Graver Arboretum Using Aquatic Invertebrates

Abigail Erickson and Joseph Pizolato

The varying biodiversity of invertebrates among ponds can reveal the overall water quality and ecosystem health, and monitor for change over time, both seasonally and across years. We are in the second year of a long-term qualitative monitoring project (in collaboration with Emmaus High School), collecting invertebrates from seven ponds within Graver Arboretum. We identify all the benthic invertebrates to species level if possible, and photograph the ponds, their surroundings, and key morphological traits used to differentiate the taxa. We are compiling this information into an interactive website to facilitate future research for students and faculty.

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

Funded by: Trainer Summer Research award

16. Effect of Juglone on Colonization by Stream Invertebrates

Miles Forman and Kira Wiener

Juglone, an herbicidal chemical produced by trees in the walnut family, is currently under consideration for wide-spread use as organic herbicides. However, no research has examined the potential impact of run-off from this chemical on stream communities. We created leaf packs of freshly-removed leaves of Black Walnut, Shagbark Hickory, and Tulip Poplar trees, which respectively have high, medium, and no levels of juglone. After placing the leaves in streams, and allowing one week for colonization, we collected, identified, and enumerated the invertebrates in each leaf pack. Surprisingly, juglone-laden leaves did not have a marked negative effect on stream invertebrate colonization.

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

Funded by: Trainer Summer Research award

17. What Allentown Read: Establishing Allentown's Free Public Library

Sophia Framm

This project is a deeper investigation into the Members Until Married (M.U.M.) Circle, a local organization that spearheaded fundraising for the establishment of the Allentown Public Library (APL) in the early 20th century. My research investigation focused on individual members of the Circle as well as the formation and transformation of the group's impact on the local Allentown community, from a social club to a philanthropic organization. As a continuation of previous research into the establishment of the APL, this new information emphasizes the rich history of community engagement within Allentown and the Allentown Public Library.

Advisor: Dr. Lynda Yankasas and Susan Falciani Maldonado, Muhlenberg College

Funded by: The Impact of Provider-patient Relationship and Invalidation on Treatment Adherence for Patients with Hypermobile Ehlers-Danlos Syndrome

18. The Impact of Provider-patient Relationship and Invalidation on Treatment Adherence for Patients with Hypermobile Ehlers Danlos Syndrome

Megan Franco

This study will examine the impact of provider-patient relationship and medical invalidation on treatment adherence. The participants will have a diagnosis of Hypermobile Ehlers Danlos Syndrome (hEDS), a connective tissue disorder that is a multisystem disorder with diverse clinical presentation, lack of understanding and diagnostic delays. Research shows that these characteristics can make provider-patient relationships more challenging for patients and experiences of invalidation more prevalent. Understanding the effects of negative provider-patient relationships on adherence is imperative to combat the worsening of chronic health symptoms.

Advisor: Dr. Stefanie Sinno, Muhlenberg College

Funded by: The Crist Family Student Research Endowment in Psychology



19. Beating the Market: A Generalized Machine Learning Approach

William Furge

This study investigates the effectiveness of various machine learning techniques in forecasting stock price direction using technical analysis and time series analyses. With the growing interest in quantitative methods for financial analysis, it is crucial to explore the potential of statistical models in predicting stock market movements. The study uses historical stock prices and technical indicators for 12 securities, where eleven of the twelve are stocks which represent a respective stock market sector, and the final is an exchange traded product which tracks the Information Technology Sector as a whole.

Advisor: Dr. Allison Davidson, Muhlenberg College

Funded by: Ladley Grant



20. Harmonizing Security: Developing a Robust Cryptosystem for Musical Communication

Melanie Halbert

Commonly used for secure message transmission, mathematical cryptosystems are able to send messages over secure and insecure channels. Music is a universal way to communicate, but the true potential of musical communication is often overlooked. While several musical cryptosystems exist, they lack the pertinent characteristics of complexity and security. Secure mathematical systems were analyzed, and the favorable characteristics were merged with music theory concepts, successfully developing a new secure musical cryptosystem.

Advisor: Drs. Gary Cutter and Hemant Tiwari, University of Alabama - Birmingham

Funded by: Hillel Connections

21. Ethics and Business as Partners Not Enemies: An Analysis of the Worker-owned Cooperative Model

Rowan Hauk

Inlight of increasing worker unrest and transgender discrimination in America I explored a trans and gender-nonconforming worker-owned cafe. This work investigates the worker-owned cooperative model and its potential to facilitate ethical work, poverty reduction, belonging for marginalized groups as well as its ability to meet the needs of workers and consumers. Through archival research of previous scholars, in-depth interviews with the cafe staff and participatory observation I define eight principles necessary within the co-ops structure to create long-term ethical work.

Advisor: Dr. Sahar Sadeghi, Muhlenberg College

Funded by: The Galgano Research Grant

22. A Method for Testing Odor Valence in Bumblebees (*Bombus Impatiens*)

Paige Henderson

Bumblebees are essential pollinators who use odor cues to find resources. Odor valence, the degree to which an odor is appetitive or aversive, has been peripherally observed but not concretely tested in this taxon. Here we present a forced-choice proboscis extension reflex (PER) paradigm for testing odor valence. In this protocol, we remove learning trials to test for innate preference. These data are used to select stimuli for companion foraging arena experiments, which test preference in freely foraging bumblebees. Elucidating the structural boundaries of appetitive and aversive odors is likely a critical step in understanding bumblebee responses to odor pollution.

Advisor: Dr. Jordanna Sprayberry, Muhlenberg College

Funded by: The Crist Family Student Research Endowment in Biology

23. Zeeman Spectral Line Fitting

Jui-Teng Hsu

The Zeeman effect plays a pivotal role as an observational technique for directly assessing the magnitude of magnetic fields within star-forming regions. This study delves into two potential automated methodologies for Zeeman analysis: one grounded in a least squares framework and the other the maximum-likelihood approach. Our investigation reveals that the utilization of Markov Chain Monte Carlo, anchored in the maximum-likelihood framework, results in improved spectral line fitting outcomes with more favorable residuals. Concluding our efforts, we have encapsulated the automated analysis procedure within a software package installable through pip, accompanied by a command-line interface.

Advisor: Dr. Preshanth Jagannathan, National Radio Astronomy Observatory

Funded by: National Radio Astronomy Observatory Summer Research Assistantship

24. Muhlenberg College Muon Telescope Mechanical Designs

Noah Hubal

I redesigned the mechanical parts for the Muhlenberg muon telescope using Fusion 360 design software and a Dremel 3D printer. Muon telescopes detect muons from cosmic ray collisions in the Earth's upper atmosphere. My primary design goal was to make the mechanical structure more stable and compartmentalized. I designed a structure which combined parts that were previously separate. My design will also ultimately allow a power supply to be mounted directly to the telescope. Towards the end, my collaborator, Georgios Xenis, and I created new structures to hold printed circuit boards.

Advisor: Dr. Brett Fadem, Muhlenberg College

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



25. GABA Quantitation by High Performance Liquid Chromatography

Zachary Huseman and Dhivya Shepherd

Gamma-aminobutyric acid (GABA) is an inhibitory neurotransmitter shown to have anxiolytic and hypnotic effects. GABA has been found in plant extracts like *Passiflora incarnata*; however, the effects of other chemical constituents on the GABA_A receptor are not completely understood. Using High-Performance Liquid Chromatography (HPLC) with dansyl chloride derivatization, a method was developed and is being optimized to quantify GABA in natural extracts. A calibration curve was generated with $R^2 = 0.998$. In the future, we aim to quantify GABA in different extracts and determine the chemical constituents responsible for the activation and potentiation effects on the GABA_A receptor.

Advisor: Dr. Christine Ingersoll, Muhlenberg College

Funded by: Research in Biochemical and Chemical Sciences Fund



26. Ecotourism and Neoliberalism in Costa Rica: The Impact of Climate Change and Imperialism on Indigenous and Local Communities

Jack Riccobono

Costa Rica has long been considered a pioneer of sustainable development, but political and economic factors have contributed to the rise of ecotourism as a method of sustainability. The image of Costa Rica represented in the Global North is typically a paradisiacal one, but ecotourism has had drastic social, economic, political and environmental effects on the nation. This research project examines the development of ecotourism in Costa Rica, its connection to neoliberalism, the sidelining of Indigenous people resulting from ecotourism, and the environmental consequences of such development.

Advisor: Dr. Cathy Marie Ouellette, Muhlenberg College

Funded by: Summer Research Grant from Dean of Academic Life

27. Role of Insulin Peptides in Developmental Progression and Arrest

Erin Jackson

C. elegans nematodes halt development in response to high salt in a process called peri-hatching arrest. A synthetic peri-hatching arrest phenotype can be created by mutating the *daf-2/insulin* receptor along with *fax-1* or *unc-42* transcription factors, which are involved in neuron differentiation. Development past the peri-hatching arrest phase depends on insulin signaling and neuronal function. We examined the role of various insulin peptides in the arrest pathway. I created mutant strains that combine four insulin peptide mutations with *fax-1(gm83)* or *unc-42(e419)*. None displayed peri-hatching arrest. These results could be due to redundancy in insulin peptide function or physiological compensation.

Advisor: Dr. Bruce Wightman, Muhlenberg College

Funded by: Summer Research Grant from Dean of Academic Life

28. Love Triangle of Bees, Flowers and Yeast

Victoria Jordan

Microorganisms like yeast can change the makeup of nectar in flowers. I explored how yeast spread via pollinators. Confirming there's a positive correlation between the density of yeast and amount of a change in nectar composition. By taking nectar-using microcapillary tubes and attaching it to a plastic syringe with tubing. Refractometers took the sugar concentration. Samples were swabbed on 4% glucose YED plates incubated for 6 days at 25°C. Samples interacted with 7µl Lactophenol Cotton Blue and analyzed. Due to weather, I was unable to get enough from one flower species to draw an exact conclusion besides a positive correlation between sugar and yeast concentrations.

Advisor: Dr. Richard Niesenbaum, Muhlenberg College

Funded by: Trainer Summer Research Award

29. The Impact of Newspaper Coverage of the Russian Revolution on the Lehigh Valley's Industrial Working Class, 1917-1918

Madeline Jutsen

This research paper examines the information that industrial workers in the Lehigh Valley, Pennsylvania read about the Russian Revolution from February 1917 to early 1918. By comparing coverage of the Revolution from mainstream local newspapers with reporting in socialist periodicals that were closely tied to the labor movement, this study uncovers the messages that these workers received about key revolutionary events, the character of Russian workers, and proletarian democracy. This paper draws conclusions about how the working class in the Lehigh Valley engaged with the Russian Revolution's developments and resonated with the goals of Russian workers.

Advisor: Dr. Thomas Cragin, Muhlenberg College

Funded by: Summer Research Grant from Dean of Academic Life

30. Can a Conference Be Epidemiologically Conscious? A Qualitative Analysis of Implementing COVID-19 Mitigation Measures at a Fall 2022 In-Person Conference

Lily Kaganov

At the fall 2022 North American Victorian Studies Association conference, qualitative data was collected regarding attendees' perceptions of the implemented COVID-19 mitigation measures. A sample of 84 participants commented on personal risk, as well as broader public health concerns, in their survey responses. The study's findings illustrate the conference's capacity to promote safety and underscore the importance of understanding the dynamics that influence health behaviors in large group settings. Furthermore, this research paves the way for developing public health policies that can help guide future conference organizers to foster safety at large, in-person events held during times of pandemic.

Advisor: Dr. Kathleen Bachynski, Muhlenberg College

Funded by: The Public Health Research Fund



31. **A Critical Analysis of P. Oxy 870 as It is Related to the Textual Tradition of Hippolytus' *Chronicon***

Declan Kelsey

This poster examines in detail the textual variants present in the papyrus fragment P. Oxy 870, which offers a unique look at the fragment's place in the textual tradition, and allows Hippolytus' *Chronicon* to better be placed into context by revealing the sources drawn upon for its composition. Our research also led us to the conclusion that P. Oxy 870 represents the oldest extant branch of the *Chronicon* tradition due to the Strabian influence on place names and Attic Greek dialect.

Advisor: Dr. William Gruen, Muhlenberg College

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



32. Developing Methods for Clearing and Staining Spicebush for Mycorrhizal Assay

Aa Khan

In this research, various methods were tested to clear and stain spicebush roots, in an effort to visualize arbuscules or vesicles of mycorrhizae under a microscope. Some of the methods for clearing involved using an autoclave on a sample of roots in potassium hydroxide solution, while others involved boiling roots in solution for varying amounts of time at 90°C. Roots were boiled in 0.05% trypan blue in lactoglycerol solution to stain them, and destained in 50% glycerol solution. The roots were examined under a microscope at 100x magnification. It's unclear if the images suggest mycorrhizae or reflect inadequate methods.

Advisor: Dr. Richard Niesenbaum, Muhlenberg College

Funded by: Trainer Summer Research award

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

Ashley Kim

Unlike humans, *C. elegans* are able to arrest development at different stages of their lives. Osmotic stress and reduced insulin signaling are two pathways that have been shown to lead to peri-hatching arrest, however, the cost of arrest is not well known. This brings up the question of whether arresting development is a good or bad thing. Since brood sizes of worms are a measure of a worm's overall health, investigating the brood sizes of peri-hatching arrested worms can give insight on the reproductive cost of arrest. Preliminary data suggests that there is no reproductive cost to arrest.

Advisor: Dr. Bruce Wightman, Muhlenberg College

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

34. Evaluating the Decrease in Medication Errors Using IV Pump Electronic Health Record (EHR) Integration

Jackson Kondak

When manually programming an infusion pump there is a high error opportunity in inputting values for dose, rates, and volumes. Integration is a tool that can help reduce error, it works by auto-programming the pump directly from the EHR database reducing the amount of button pressing. My goal in my research was to qualify how effective integration was by comparing integrated sites and non-integrated sites in the Lehigh Valley Health Network. To perform this, I primarily did content analysis of recent infusion events. The results of the research pointed to integration being a beneficial practice.

Advisor: Alice Vrsan MSB, RN-BC, Lehigh Valley Health Network, Allentown PA

Funded by: Lehigh Valley Health Network Research Scholars Program

35. Human and Natural Resources of Jordan Creek Parkway

Hannah Kulbitsky

My research focused on the human and natural resources of Jordan Creek Parkway, taking into account the park's stakeholders and the park's assets with the goal of creating an asset map. In total, I documented 3612 coordinates of 72 different species of native plants and fungi using the QFIELD app in the field. Similarly, I documented recreational assets like sports fields and organized the points on the QGIS program to create an asset map. Analysis on the documented plant populations may lead to further research on how to best manage natural assets from the perspective of public use and conservation.

Advisor: Dr. Richard Niesenbaum, Muhlenberg College

Funded by: David Rabold Fund for Interdisciplinary Research in Sustainability Studies

36. Toxic Effects of Bisphenol A on *L. variegatus* and *A. punctulata* Sea Urchin Embryos

Jacob Kunsman and Maya Schlesinger

Bisphenol A is a small molecule used in plastic production with a reputation for being harmful to human health. Additionally, numerous animal studies contributed to BPA's classification as an endocrine disruptor. Our project investigated the toxic effects of this chemical on sea urchin embryos from *L. variegatus* and *A. punctulata*. The sea urchin is a marine organism that displays similar embryological development to that of humans. With this relationship in mind, we applied a range of concentrations of BPA to embryos and evaluated them for abnormalities and skeletal differences. Our results suggest embryotoxicity with variable severity depending on the species.

Advisor: Dr. Elizabeth McCain, Muhlenberg College

Funded by: Vaughn Summer Research award



37. I Do My Own Research: An Investigation Into Vaccine Conspiracy Narratives in the United States

Molly Levine

In January 2020 the World Health Organization declared an “infodemic”, in which there is such an overwhelming amount of information and not enough resources to separate fact from fiction. Infodemic met pandemic and resulted in an explosion of conspiracy, confusion, and conflict. Questions in political science of “what demographic factors correlate with believing in vaccine conspiracy theories?” are complicated by personal anecdote and cultural commentary. I hope to further deepen and complicate this conversation with stories from my own life as well as ones I discovered in my research through the form of creative nonfiction.

Advisor: Prof. Linda Miller, Muhlenberg College

Funded by: Summer Research Grant from Dean of Academic Life



38. Approximating Irrational Triangles

Emmy Lin

This research examines the approximation of quadratic-irrational right triangles represented by the triple (α, β, γ) with $\alpha^2 + \beta^2 = \gamma^2$. Given such a triangle, we can give a formula for the integer triple (a_n, b_n, c_n) which yields a more and more accurate approximation as $n \rightarrow \infty$. We prove that there exists a characteristic equation $pa + qb - r\gamma = 0$ with $p, q,$ and r being integers which encompasses the ratios of sides in the triangle. The value $|pa_n + qb_n - rc_n|$ remains the same for all positive n .

Advisor: Dr. Byungchul Cha, Muhlenberg College

Funded by: Ladley Research Grant

39. Effects of a Tactile and Visuospatial Interference Task on Memory

Gabrielle Mattei and Abanoub Marzouk

The present study examined the working memory capacity theory of memory disruption through the use of novel tactile visuospatial interference (VSI) (i.e., large LEGO-style blocks). In Phase 1, participants constructed a simple structure using blocks, followed by the VSI or control task. Results showed that tactile VSI significantly decreased recall for the original memory during testing [$t(36) = -3.845, p > .05, d = 1.25$]. In Phase 2 (currently underway), participants are completing an emotional virtual reality (VR) experience, followed by tactile VSI. Preliminary results show numerical reductions in VR memory following the VSI task, but no significant differences (yet) [$t(18) = -.731, p > .05, d = .332$].

Advisor: Dr. Gretchen Gotthard, Muhlenberg College

Funded by: Neuroscience Collaborative Research Program

40. Innovative 3 in 1 Pesticide, Fertilizer and Pathogenic Protectant with Cow Manure and Mycorrhizal: SoilPop

Deborah McDonald, Rowan Micklus and Jayson Williams-Johnson

During summer research, our team was interested in investigating a new, innovative, 3 in 1 product that would serve as a fertilizer, pesticide, and pathogenic protectant. By combining cow manure, neem oil, thyme, rosemary, peppermint, and mycorrhizae, we are able create SoilPop through a dehydrating process. Throughout the summer, we tested our product on tomato plants against other plant protecting methods. We hope to continue developing SoilPop, as we are extremely interested in finding a novel way to combat pests, increase plant nutrient uptake, and plant fertility for sustainable gardening in the future.

Advisor: Dr. Richard Niesenbaum and Rita Chesterton, Muhlenberg College

Funded by: VentureWell

41. The Departure from Rural France: Analyzing the Decline and Aging in Population through Internal Migration in the Northeast

Sam McDonough

Simply walking around the rural villages of northeastern France is sufficient to notice their emptiness. By combining my French and photography studies, I aimed to expose and emphasize my seemingly vacant surroundings: my grandparents' village, Pierrefitte, situated in the Vosges department of le Grand Est. Drawing inspiration from my photography, I researched internal migration rates and population demographics in this region. The research paralleled the mood of my photography, revealing a declining and aging population in le Grand Est. The exodus of rural to urban living in France is disrupting the lives of those who reside in rural communities.

Advisor: Dr. Elieen McEwan, Muhlenberg College

Funded by: Donna M. Bradley and Alan L. Tyson Student Summer Research Grant

42. Investigating the Synthesis of Yttrium Complexes with Chiral C₂-Symmetric Tetradentate Ligands

Esther Oko and Yoav Susskind

Chiral C₂-symmetric tetradentate ligands (*N,N'*-(quinolyl-2-methyl)-2,2'-bispyrrolidine and (*S,S'*)-bis(1-methylimidazolyl-2-methyl-2,2'-bispyrrolidine)) were synthesized. Attempts were made to synthesize yttrium complexes with the ligands. Yttrium was used as a proxy for lanthanides, as chiral lanthanides complexes can emit circularly polarized light (CPL) and have applications in medical technology and data storage. Work this summer revealed that water in the yttrium triflate resulted in triflic acid and diprotonated ligands. Glovebox techniques, vapor diffusion and NMR spectroscopy were used to synthesize and characterize the compounds. Crystal structures of the protonated ligands were determined through x-ray crystallography.

Advisor: Dr. Joseph Keane, Muhlenberg College

Funded by: Smart/Stehly research grant and KeriLyn C. Burrows, Ph.D. '72 Research Fund in Honor of Donald W. Shive, Ph.D.



43. Why Madame Mao?: A Comprehensive Literature Review of the Stereotypic Perceptions and Experiences of Asian American Classical Musicians

Shobha Pai

This project is a comprehensive literature review of stereotypical perceptions of Asian American classical musicians and their experience navigating those stereotypes in the classical music industry. The review primarily explored the relevant literature of two related psychological constructs: stereotype threat and the stereotype content model. The review highlighted the absence of scholarship focused on the specific and intersectional experiences of Asian Americans in the domain of music. The summer project also served as preliminary research for my senior thesis which combines my two areas of scholarly interest: Psychology and Media and Communications.

Advisor: Dr. Justin Preddie, Muhlenberg College

Funded by: The Crist Family Student Research Endowment in Psychology



44. Am I Dominican Enough? Finding Community and Cultural Identity Through Movement Research

Keanna Peña

As a first-generation Dominican-American, my connection to my culture and racial identity have been marred due to post-colonialism and my family's migration to the United States. In this paper, I analyze the communities I have been included and excluded from while growing up in binary America. I question the sources of my alienation from my Dominican culture. Through field research encompassing dance classes, cultural festivals, scholarly research, self-reflections, and my personal family history, I gain a deeper connection to my Dominican-American identity.

Advisor: Anito Gavino, Muhlenberg College

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

45. Procedural Memory Consolidation

Emma Prehl and Leah Toomey

The current study will examine procedural memory consolidation. It is known that the neurological process of procedural memory consolidation can be influenced by a variety of factors including repetition, sleep, and music. For example, in the field of exercise science, it has been demonstrated that fast paced music facilitates enhanced physiological and psychological responses to physical activities like exercise. Participants will learn a motor task, either while listening to fast paced music of their choosing or a white noise control. We hypothesize that early testing will reveal facilitated learning in the music group that will be maintained during delayed testing.

Advisor: Dr. Gretchen Gotthard, Muhlenberg College

Funded by: Neuroscience Collaborative Research Program

46. Buffer Effects on Electrocatalytic Hydrogen Evolution Reaction in Molecular Cobalt Catalyst and RGO Thin Films

Lily Press

The hydrogen evolution reaction (HER) is a promising route for achieving clean energy storage and retrieval, resulting in a need for efficient HER catalysts. A promising system for heterogeneous electrocatalytic HER is that of cobalt(III) bis(3,6-dichlorobenzene-1,2-dithiolate) in a reduced graphene oxide thin film physisorbed onto a glassy carbon electrode. However, factors impacting electrocatalysis are still under investigation. I will present work investigating the effects of different electrolyte salt solutions on catalytic activity within this system. This work will help elucidate the role of buffers in thin-film electrocatalysis and allow the optimization of this catalytic system.

Advisor: Dr. Nicolai Lehnert, The University of Michigan - Ann Arbor

Funded by: National Science Foundation

47. Assessing Invertebrate Diversity and Sediment Size in Little Cedar Creek

Kailani Reis and Lisa DeCristofaro

Fine sediment pollution decreases water flow in the benthos, smothering benthic invertebrates. The PA Dep. of Environmental Protection declared Little Cedar Creek impaired due to fine sediment pollution, mandating the local municipality to remediate the affected stream. Despite declaring the creek impaired for aquatic life, no comprehensive inventory has been attempted. Invertebrate biodiversity and sediment size was determined for seven sites in Little Cedar Creek within Trexler Park. Pollution-tolerant species like leeches, invasive mollusks, and ostracods were abundant in comparison to sensitive taxa, suggesting the stream is unhealthy. This project was in collaboration with the Allentown Storm Water Bureau.

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

Funded by: Research in Biochemical and Chemical Sciences Fund and the Trainer Summer Research Award

48. PA High School Demographics and College-Going Rates

Miriam Roeder

Academic literature shows racial disparities in students' likelihoods of attending post-secondary education and suggests student body demographics are a factor relating to these disparities. I used data from Pennsylvania's Future Ready PA Index to make regression models predicting different ethno-racial groups of students' likelihood of going to college using high school demographics while controlling for other factors. Asian enrollment frequently was a positive predictor for Black and white students. Enrollment from large underrepresented groups often was a negative predictor for white students. Same-race enrollment was often a positive predictor for Black students and a negative predictor for white students.

Advisor: Dr. Gregory Collins, Muhlenberg College

Funded by: Summer Research Grant from Dean of Academic Life

49. The Pyschophysical Voice

Samuel Roter

I explored theatrical process by combining the principles of the Michael Chekhov technique and Voice & Speech techniques and applying the tools to *The Catastrophist* by Lauren Gunderson. I also investigated the relationship between body, voice, and mind as well as how different techniques and approaches are combined to constructively strengthen and empower the performer. Through this experience, I discovered that Chekhov and Linklater are especially effective for myself because of how they are embodied in physical Gestures (manifestations of the character's inner Will) derived from Archetypes (fundamental patterns of human behavior), making their approaches intuitive and approachable.

Advisor: Prof. Jessie Dean, Muhlenberg College

Funded by: The Galgano Research Grant

50. Trogocytosis of Cancer-Associated Fibroblasts Promotes Pancreatic Cancer Growth

Alyssa Sipman

Pancreatic adenocarcinoma (PDAC) is composed of a desmoplastic stroma. Cancer-associated fibroblasts (CAFs) are the primary cells and they participate in collapsing the blood vessels. We still don't fully understand how PDAC cells obtain lipids but have found that CAFs play a critical role in the transfer of lipids to cancer cells via a new mechanism called trogocytosis. This lipid transfer occurs if CAFs express a phospholipid scramblase anoctamin 6 (ANO6), the major regulator of trogocytosis required for cancer cell survival. Blockade of ANO6 antagonizes tumor growth by blocking the delivery of essential lipids to the cancer cells.

Advisor: Igor Astsaturov, MD, PhD., Fox Chase Cancer Center

Funded by: NIH core grant No. CA06927, Pew Charitable Fund, gift from Mrs. Concetta Greenberg to the M&C Greenberg Pancreatic Cancer Institute at Fox Chase Cancer Center.



51. Synthesis and Characterization of Tungsten Complexes with Chiral $N_4 C_2$ -Symmetric Ligands

Nesya Sloane

Novel complexes of tungsten and the chiral $N_4 C_2$ -symmetric tetradentate ligands Picchxn (*trans*- N,N' -bis(pyridin-2-ylmethyl)-1,2-diaminocyclohexane), PicchxnMe₂ ((*trans*- N,N' -dimethyl- N,N' -bis(pyridin-2-ylmethyl)-1,2-diaminocyclohexane), and PDP (2-[[2-(1-(pyridine-2-ylmethyl)pyrrolidin-2-yl)pyrrolidin-1-yl]methyl]pyridine)) were synthesized and investigated. The reported complexes are of interest for their potential applications in stereoselective dearomatization chemistry. Compounds were analyzed using cyclic voltammetry, Fourier transform infrared spectroscopy (FTIR), and 1D- and 2D-nuclear magnetic resonance (NMR) spectroscopy. [(κ^4 -PicchxnMe₂)W(NO)(CO)]PF₆ diastereomers were synthesized in an unknown yield. (κ^3 -PDP)W(CO)₃ was synthesized in 79.9% yield. [(κ^3 -PDP)W(NO)(CO)₂]PF₆ was synthesized in 76.4% yield. The long-term stability of additional compounds involving Picchxn, PicchxnMe₂, and PDP was explored using ¹H NMR spectroscopy.

Advisor: Dr. Joseph Keane, Muhlenberg College

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

52. Orientalism and Postcolonialism in Modern-day Medicine

Sinhayana Srinivasan

This research project explores the complex interplay of Orientalism, Postcolonialism, racism, Hinduphobia, and Islamophobia in the attitudes of doctors towards Hindu and Muslim patients. I explored how race, gender, and religion overlap to influence discrimination within the medical field. Recurring themes are the power imbalance and the evolution of views from older generations to more contemporary perspectives. The role of media, academia, and politics in perpetuating biases and misinformation is also important, particularly in the portrayal of South Asia. This project highlights the importance of addressing these issues to ensure equitable healthcare and promote cultural understanding in medical practice.

Advisor: Prof. Sharon Albert, Muhlenberg College

Funded by: Summer Research Grant from Dean of Academic Life

53. Changes in Attitudes Towards Adolescents with Age

Kay Tari

People have consistently shown in data that they develop negative perception of the youth with age (Farkas et al., 1997; J. Protzko, J. Schooler, 2019). There are links to memory biases influencing this perception, with adults projecting their current selves onto their memories of youth (J. Protzko, J. Schooler, 2022). One area where the data and research within this topic are lacking, however, is the connection between the perception of adolescents and differing ages of respondents. This study is meant to provide information regarding the biases and connections adults of all ages have to adolescents for further investigation.

Advisor: Dr. Erika Bagley, Muhlenberg College

Funded by: The Rosenberg Research Award

54. Healing Abilities of the Zimbabwean Mbira - Exploring the Interconnections Between Music and Medicine

Arielle Toutitou

The mbira is an instrument that plays important cultural, spiritual, and social roles in the Shona community in Zimbabwe. Mbira also critically functions to facilitate Shona healing practices. Researching the mbira, its music, and associated healing practices, I describe the ways in which mbira facilitates healing through the Shona spiritual belief system, social bonding, and meditative qualities of the music's compositional structure. Analyzing academic works across the fields of ethnomusicology, medical anthropology, sociology, psychology, and biology, I show how music can facilitate healing alongside medicinal treatment in healing practices cross-culturally, further showcasing how the practice of medicine is highly interdisciplinary.

Advisor: Dr. Cassandra Hartford, Muhlenberg College

Funded by: The Mazur Research Fund for Musical Inquiry

55. Does a Respiratory Organ Also Have a Reproductive Function?

Myra Wamah

Most marine worms have a respiratory organ called branchiae. *Streblospio benedicti* has a pair of branchia on its head. Our lab has previously documented that *Streblospio benedicti* branchiae are sexually dimorphic. The male branchiae possess a unique ciliated medial protrusion not seen in other annelid species. The presence of these unique ciliary groups, prompted us to hypothesize the male branchiae has a reproductive role, beyond respiration. We posited, the branchiae facilitate transfer of spermatophores (sperm packets) to the female. My research objective was to evaluate the medial protrusion dimensions in relation to the size of the spermatophores using the SEM.

Advisor: Dr. Elizabeth McCain, Muhlenberg College

Funded by: Vaughn Summer Research award



56. Application of Solid-State Nanopores Fabricated by Automated Controlled Breakdown to Hyaluronan Analysis

Lauren Washco

Hyaluronan (HA) is a prevalent polysaccharide that serves as a potent bioindicator. The size-dependent function of HA results in long chains having anti-inflammatory properties and short chains signaling pro-inflammatory responses. Analysis of the distribution of HA molecular weights in biofluids can contribute to disease diagnostics. Solid-state nanopores provide a solution to analyze HA with only a small sample of biological fluid. Automated controlled breakdown can be applied to fabricate nanopores for HA analysis. Optimal voltages and rates allowed for the fabrication of pores that could accurately detect poly-dispersed HA over multiple runs and the HA distribution from a clinical sample.

Advisor: Dr. Adam Hall, Wake Forest University School of Medicine

Funded by: National Science Foundation - Research Experiences for Undergraduates



57. Electronic Structure and Mechanisms of Substituted Criegee Intermediates

Riley Wexler

This study aims to deepen our understanding of electronic and mechanistic behavior of substituted Criegee intermediates (CR₂OO). Criegees exhibit mixed zwitterionic and biradical properties, and previous studies have suggested the ability to tune the zwitterionic/biradical characteristics by introducing electron donating or withdrawing substituents. DFT calculations were performed to quantify the degree of zwitterionic/biradical character in different electronic states. Additionally, reaction pathway searches were performed on a subset of Criegees to expand plausible reactions. Results suggest the electron-withdrawers trend towards zwitterionic systems, while electron-donors lead to increased biradical properties. The products/intermediates observed from reaction searches do not differ significantly from literature.

Advisor: Dr. Paul Zimmerman, The University of Michigan - Ann Arbor

Funded by: The National Science Foundation

58. Chronic Absenteeism and Its Impact on Academic Progress

Samantha Winegard

The number of days a student is absent has the potential to harm them not only socially but also academically. The purpose of this study is to collect data on students who attended Central Elementary School for 75% or more of their academic career to understand how attendance impacts academic progress. This school presented that younger students are more chronically absent. Multiple grade levels had higher percentages of chronically absent students when they were below proficient. Despite limited access to the factors leading to chronic absenteeism, it is important to continue studying its impacts on a child's development.

Advisor: Dr. Stefanie Sinno, Muhlenberg College

Funded by: Office of Community Engagement Summer Grant

59. Revision of MPAs in Response to Spotted Eagle Ray and Sea Turtle Populations Around South Caicos and Long Cay

Megan Winters

Past studies documented declines in marine megafauna populations surrounding South Caicos, including spotted eagle rays and sea turtles, from overfishing and increased land development. We enumerated spotted eagle rays and sea turtles (hawksbill and green) appearing at dive sites around South Caicos and Long Cay over a five year period. Where these animals occurred, their populations increased and became increasingly concentrated within Marine Protected Areas ("MPAs"). These marine megafauna species promote nutrient cycling throughout the reef and serve as visibly-obvious indicator flagship species of community function. Our research suggests MPAs have somewhat reversed megafauna population decline, promoting ecosystem health.

Advisor: Dr. Erika Iyengar, Muhlenberg College

Funded by: SFS Turks & Caicos

60. Electronic Redesign of an Atmospheric Muon Detector

Georgios Xeinis

Over the summer, I worked with a detector that determines the rate and direction of muons that result from particles colliding in the Earth's atmosphere. Specifically, I redesigned existing electronics and converted them into PCBs using Kicad software. In addition to reworking the electronics, I worked on updating the physical design of the detector with help from fellow summer researcher Noah Hubal, who created various 3D printed components that complimented the newly created electronics. The purpose behind creating PCBs and reworking the electronics is to make the detector more portable and yield more precise results with less unwanted electronic noise.

Advisor: Dr. Brett Fadem, Muhlenberg College

Funded by: The Raub Fund

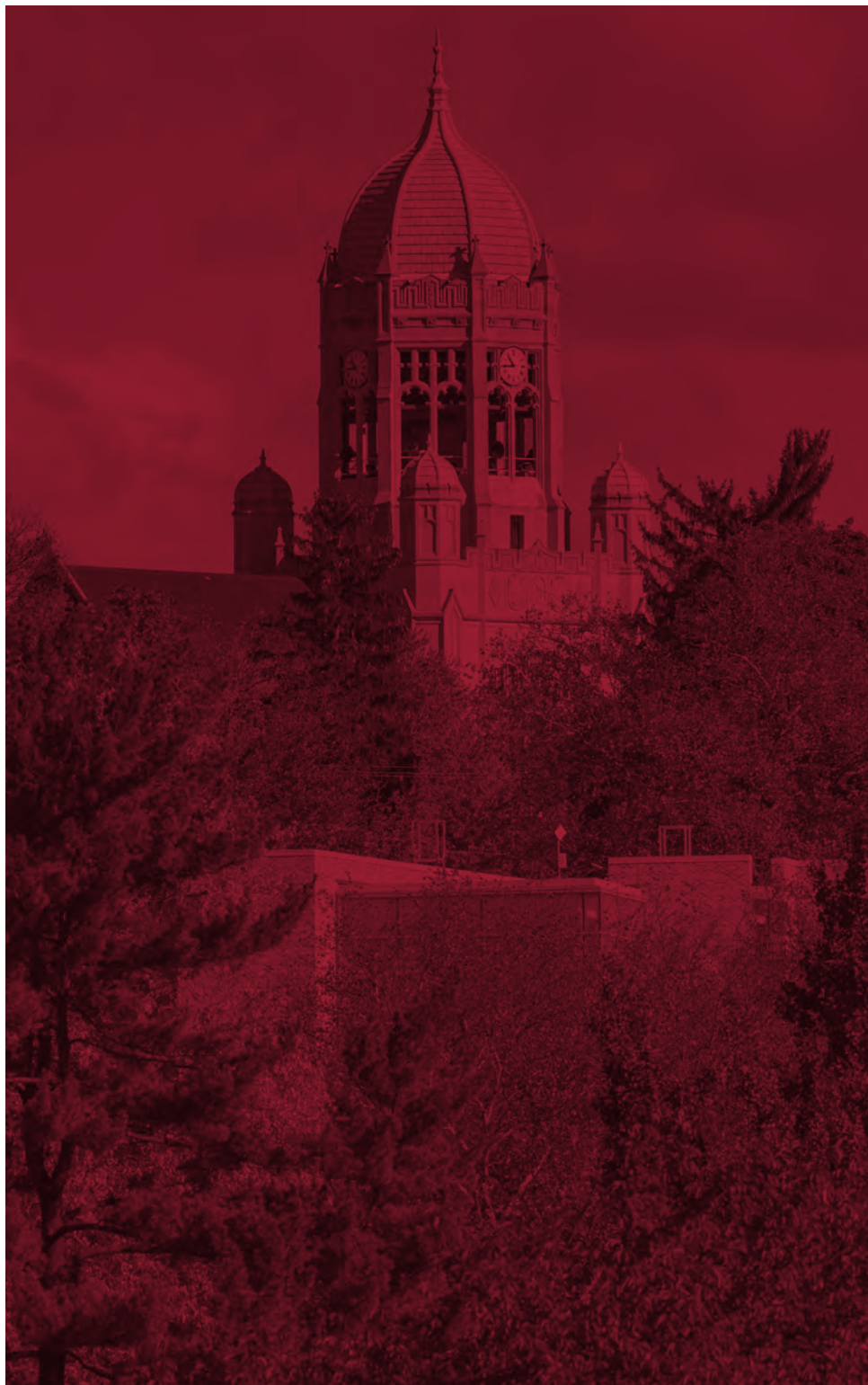
61. Small Rural Black Communities, Charcoal Production and the Underground Railroad

Michaela Zahner and Emma Teske

Six Penny Creek, a small, rural Black community in Berks County settled in 1842, lies beside thousands of acres of charcoal lands owned by the local iron furnace. Because of the access to wide open spaces of charcoal lands, this settlement played a central, but poorly understood, role in the Underground Railroad. This summer, we cleared and mapped the DeHart home (John, Levi, Jonathan and likely more) which we believe was occupied from 1847 until mid-1870s. This helps us better understand lives of residents of Six Penny Creek and plan continued research with descendants of Six Penny Creek.

Advisor: Dr. Benjamin Carter, Muhlenberg College

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



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