COLLEGE OF SCIENCE AND TECHNOLOGY
2018 Spring Poster Display

Applied Engineering, Safety & Technology

1. **Andrew Sellers**, (Mentor: Dr. Mehdi Khalighi, Applied Engineering, Safety and Technology)
Environmental Sound Level Measurements at Millersville University

The purpose of this experiment is to measure the sound levels of different environments around Millersville University. We plan to test sound levels in different laboratories, as well as buildings around campus. The results will determine if any areas on campus buildings measure above 85 dBA, the action level required by OSHA. These tests will help us to locate areas where employees and students may have potential exposure to harmful exposure to noise levels above standards, which may cause noise induced hearing loss and other possible adverse health effects. By locating areas where the noise levels are over 85 dBA, we will provide recommendations to control noise exposure to protect the affected population.

Biology

2. **Natalie Auman and Courtland Hess**, (Mentor: Dr. Aaron Haines, Biology)
Funding: Biology Student Investigator Grant
Do Small Mammals Prey Switch During the Winter? An Evaluation of Invertebrate Prey Availability in the Subfolium Level of the Forest Floor

Many small mammals such as shrews and rodents prey on terrestrial invertebrates, but some also eat vertebrates such as other small mammals, frogs, snakes etc. Our objective will be to determine if small mammals become more attracted to the scent of vertebrate prey as invertebrate prey numbers decline during colder temperatures. Here we present the first year results of a multi-year study. Our two study sites occurred on the Millersville University Biological Preserve. Each study site contained a trap line consisting of paired Sherman small mammal traps (treatment and control) (n≈32 traps at each site). Control traps had clean wood shavings while experimental traps had wood shavings soiled with mice urine (scent source of potential vertebrate prey). Traps were set and checked once a week from August 2017 until May 2018. Trapping success was recorded as the number of small mammal captures recorded on each trap line divided by the total number of traps. This was done separately for control and treatment traps. To sample for invertebrate prey abundance, four 24cm2 of subfolium (leaf litter) and topsoil were collected along each trap line and the ambient, subfolium, and soil temperatures were recorded. Invertebrate samples were collected in cloth bags and transferred into Berlese funnels to determine invertebrate prey abundance. Data is still being collected and analyzed. We will use a general linearized model to determine if small mammal trapping success was influenced by invertebrate prey abundance, ambient temperature, subfolium temperature and topsoil temperature. We will also run interactions between invertebrate abundance and the different temperature readings. This study will provide a greater ecological understanding of potential prey switching strategies of small mammals during different seasons.

3. **Sierra Baney and Mireya Lopez Jimeniz**, (Mentor: Dr. Carol Ely Hepfer, Biology)
Funding: Student Grants for Research and Creativity
Structural Differences in the Large Protein Twitchin Affect the Regulation of Muscle Contraction in Squid
Muscles in the squid, *Doryteuthis pealeii*, can extend further than muscles in vertebrate animals. Thompson et al. (2015) have demonstrated that the amount of force a muscle maintains as it stretches, referred to as the length-force relationship (LFR), differs significantly between squid muscle types. The mechanisms responsible for these differences are not understood, but it is likely that length-force relationships (LFRs) are regulated by large muscle proteins. Twitchin is known to play a role in controlling muscle activity in other organisms. The gene for twitchin was first identified in *C. elegans* by Benian et al. (1993) when mutations within it resulted in muscle twitching. Butler and Seigman (2010) have suggested that twitchin may function by establishing connections between filaments in smooth muscles that enable the maintenance of force. Distinct forms (isoforms) of twitchin may enable muscles types to express divergent contractile properties. In mussels, Funabara et al. (2005) have shown that twitchin isoforms play a role in the "catch" state, where muscle contraction is maintained using minimal energy. Our hypothesis, that squid muscles with distinct LFRs express different twitchin isoforms, was investigated by comparing sequences of RNA expressed by muscle fibers with distinct LFRs. Since RNA sequence determines the structure of proteins like twitchin, differential expression of twitchin RNA that correlates with LFR characteristics would support our hypothesis. Our results indicate that distinct isoforms of twitchin do exist in the squid funnel retractor and head retractor muscles and that alternative processing of RNA from the twitchin gene is responsible for these isoforms. This discovery provides insight into mechanisms regulating smooth muscle contraction.

4. **Rachel Davies**, (Mentor: Dr. Aaron Haines, Biology)
Millersville Hawkwatch 2017
Hawkwatch sites occur throughout North America and involve national survey efforts to document and quantify Raptor Population Indices (RPI) for North American Birds of Prey (e.g., hawks, falcons, eagles, vultures; aka raptors) during their migration. Hawkwatch sites have been around for decades and have provided valuable ecological data. For example, the hawkwatch site at Hawk Mountain Sanctuary (PA) documented the effects of pesticides on eastern North American raptor populations, showing that RPI data can serve as a bioindicator of environmental health throughout a geographic range. The goal of this project was to determine the feasibility of implementing a university student-run hawkwatch site. During the Fall 2017 migration season, in collaboration with Hawk Mountain Sanctuary, Millersville University student volunteers counted migrating raptors flying over campus. Students recorded RPI data using computer tablets and the Trektellan and Dunkadoo migration count programs. Students determined the average hourly hawk count numbers at Millersville in comparison to Hawk Mountain and the Cape May Bird Observatory (NJ) to determine how geography impacts RPI results. After the Fall 2017 migration season, a Mood's Median Test was used to compare RPI data between

Millersville, Hawk Mountain and Cape May. Our findings showed that Cape May recorded higher RPI numbers which was attributed to the narrowing of the Cape May Peninsula along the Atlantic coast that served to concentrate raptors flying south along the Nearctic-Neotropical migration corridor. Further studies are planned to document how individual raptor species utilize the Atlantic Coast and Appalachian Mountain range during migration.

5. **Megan Davis**, (Mentors: Dr. John Wallace and Dr. Brent Horton, Biology)
Funding: Biology Student Investigator Grant, Student Grants for Research and Creativity, Neimeyer-Hodgson Research Grant
Potential for the Bioaccumulation of Endocrine Disrupting Chemicals: An assessment of water, sediment and aquatic insects
Endocrine Disrupting Chemicals (EDCs) are compounds that mimic or antagonize hormone actions and thus have the potential to cause adverse effects on the development, growth, and reproduction of aquatic and terrestrial wildlife. One group of EDCs, polychlorinated biphenyls (PCBs), is of particular concern due to their widespread presence in the environment, low rate of degradation, and tendency to be stored in fatty tissues. We hypothesize that PCBs have the potential to bioaccumulate from the water and sediment of wetlands to aquatic insects to insectivorous birds. As a first step in testing this hypothesis, I measured PCB levels in water, benthic sediment, and aquatic macroinvertebrates at five different Pennsylvania wetlands to determine whether PCB loads in aquatic insects reflect those of their wetland habitats. My objectives included: 1) development of a tractable protocol for assessing PCB levels in water, sediment, and insects, 2) quantification of PCB levels in each sample type, and 3) a comparison of PCB levels among sample types and across sites. Wetland sites were selected based on their surrounding land use and potential for persistent pollutants. Samples (water, soil, and macroinvertebrates) were collected from each wetland and are currently being assayed for PCB levels using an enzyme-linked immunosorbent assay. Macroinvertebrates from six different taxonomic orders representing five different functional feeding groups were collected and are being assayed for PCB levels. These data will be analyzed to determine whether variation in water and sediment PCB levels across sites predicts variation in aquatic insect PCB loads, a finding that would establish the potential for this EDC to bioaccumulate in insects and, ultimately, higher organisms such as insectivorous birds. The findings of my study also provide a basis for identifying long-term research sites for impending investigations on how the bioaccumulation of PCBs may impact avian physiology, behavior, and fitness.

6. **Moira Dougherty**, (Mentor: Dr. Judith Cebra-Thomas, Biology)
Funding: Biology Student Investigator Grant, Neimeyer-Hodgson Research Grant, Student Grants for Research and Creativity, National Science Foundation
Characterization of premigratory NCCs in between the two waves of migration in slider turtle (Trachemys scripta)
The bones of the ventral turtle shell (the plastron) develop similarly to facial bones, suggesting they are produced by the same type of cells, a migrating cell population known as neural crest cells (NCCs). In most embryos, NCCs migrate away from the developing central nervous system over a very short period. There is a unique second migration of

NCCs out of the developing spinal cord of turtle embryos; these migrate ventrally and contribute to the bones of the plastron. The hypothesis being tested is that these late-emerging cells result from dormant premigratory NCCs that are not depleted at the end of first wave of migration. The lack of depletion could be due the inability of those NCCs to migrate from the neural tube. The goal of this project is to determine whether a set of neural crest specifiers are expressed in premigratory NCCs during this dormant period using immunofluorescence. Specifiers are transcription factors that control gene regulatory networks important for cell differentiation. This set of genes has been shown to be required for premigratory NCCs to emigrate, and the lack of expression of one or more of these specifiers could be preventing them from exiting the neural tube. This explanation would further our understanding of the role of this unique population of trunk NCCs in the development of the turtle shell.

7. **Jennifer Houtz**, (Mentors: Dr. Brent Horton and Dr. John Wallace, Biology)
Funding: Biology Student Investigator Grant, Keever Biology Research Training Fund, MU-MUSE, Student Grants for Research and Creativity

Postmortem succession of the European starling (Sturnus vulgaris) gastrointestinal microbiota

Gastrointestinal microbiota impact vertebrate host health through functional roles in immunity, nutrition, and waste removal. Although several studies have demonstrated an importance for the functional role gut microbes play in living organisms, the fate of the gut microbiome after death is less understood. Postmortem succession has been characterized in human-associated microbial communities, but no studies have investigated this phenomenon in birds. Here, we examined postmortem microbiome dynamics in the gastrointestinal tracts of European starlings (*Sturnus vulgaris*). The primary objectives of this study were: 1) to characterize the gastrointestinal microbiome in antemortem and postmortem starlings; 2) to compare microbial composition among different gastrointestinal tract regions and; 3) to determine how the gastrointestinal tract microbiome changes during decomposition. To date, we have characterized shifts in the gastrointestinal microbiome of starling nestlings at 0, 24, 48, and 72 hours postmortem. Immediately prior to death, the microbiome was diverse and comprised of microbes from multiple phyla of variable relative abundance. Interestingly, the relative abundance of each phyla varied across regions of the gastrointestinal tract. For example, the small intestine, ceca, and cloaca were dominated by Proteobacteria, whereas the large intestine was dominated by Tenericutes. After 72 hours of decomposition, the diversity of the microbial communities diminished in all gastrointestinal tract regions to only include Proteobacteria and Firmicutes. We conclude that the microbiome of the gastrointestinal tract in living starlings is variable and region-dependent, but as decomposition progresses only a couple of microbial phyla persist. To our knowledge, these findings are the first to describe the necrobiome community in an avian model.

8. **Seth Martin**, (Mentor: Dr. Judith Cebra-Thomas, Biology)
Funding: Biology Student Investigator Grant, Neimeyer-Hodgson Research Grant, National Science Foundation
Multipotency of Trunk Neural Crest Cells in Trachemys scripta
The ventral part of the turtle shell (the plastron) comprises several bony plates formed by intramembranous ossification, the same process that produces many of the bones of the skull. Several anterior skull bones and facial structures are produced by a population of migrating, multipotent cells originating from the developing central nervous system, known as neural crest cells (NCCs). Previous research has demonstrated that trunk NCCs, arising from the developing spinal cord instead of the brain, migrate in two distinct waves in turtle embryos. This experiment tested the hypothesis that the second wave of trunk NCCs in turtle embryos is capable of differentiating into bone. Turtle (*T. scripta*) NCCs were isolated and allowed to differentiate, and the resulting cell types were analyzed with bright field microscopy and immunofluorescence. The fraction that produced typical NCC-derived cells (i.e. pigment cells) was compared to the fraction that produced osteoblasts. Our results suggest that the late trunk NCCs are predisposed to differentiate into osteoblasts, and thus provide good candidates for the cells that form the plastron. Craniosynostosis is a common human developmental deformity involving premature fusion of the calvarial sutures. A better understanding of intramembranous ossification, and analysis of an enriched population of osteogenic NCCs, could result in improved treatment options.

9. **Corie Mellinger**, (Mentor: Dr. Dominique Didier, Biology)
Funding: Biology Student Investigator Grant, Keever Biology Research Training Fund, Noonan Endowment Award, Neimeyer-Hodgson Research Grant, Student Grants for Research and Creativity
Morphological Analysis of Electroreceptive Organs in the Elephantfish, Callorhinchus milii (Chondrichthyes; Chimaeriformes)
Electroreception is a unique sensory modality found in many fishes, particularly the Chondrichthyan fishes (sharks, skates, rays and ratfishes). Among Chondrichthyes, the ratfishes are the least understood and in particular the morphology and function of electroreceptors in this group of fishes is relatively unstudied. It has been assumed that the pits and pores covering the head, snout, and "plow" are all ampullae of Lorenzini; however, the pits and pores appear to have different morphologies. We hypothesize that 1) The ampullae of Lorenzini on the head and snout of *C. milii* are different morphologically and 2) *C. milii* may possess two different types of ampullae of Lorenzini. These morphological differences may indicate different electrical detection capabilities with possible differences in function, specifically related to detection of their prey.

10. **Katelyn Newcamp**, (Mentor: Dr. Jean Boal, Biology)
Funding: Neimeyer-Hodgson Research Grant, Student Grants for Research and Creativity
Analysis of Internal Parasites Between Native and Captive White-tailed Deer in Lancaster County, Pennsylvania
Disease transmission between farmed and wild white-tailed deer was studied using endoparasites as a model. Because wild deer visit captive deer frequently during the

breeding season in late October and November, samples were collected during the fall of 2017. The fresh fecal samples were collected from inside and outside of deer pens around Lancaster County and stored in 10% formalin. Parasite analysis was conducted in the winter of 2018, using the fecal float method and light microscopy. The hypothesis was that there would be a positive correlation between the types of parasites found in the farmed and wild deer populations in each area, because of similar environmental factors and transmission through potential direct and indirect interactions. The results of this research will directly aid farmers and veterinarians in improving herd health and in mitigating disease.

11. **Carli Parenti and Olivia Rosensteel**, (Mentor: Dr. Aaron Haines, Biology)
Documenting success: recovery of species from the Endangered Species Act
As of March 2018, only 51 domestic and foreign species have been removed from the United States Fish and Wildlife Service's (USFWS) list of endangered and threatened species due to recovery. However, this means that of all the species that have ever been on the list, only around 2% have been recovered. In order to determine the most important factors and strategies that have played a role in species recovery, delisting documents from the USFWS's Environmental Conservation Online System (ECOS) and the U. S. federal government's Federal Register were examined for reasons for delisting species. We found that protection, restoration and acquisition of habitat on public and private land was a common reason given for delisting. Work with private landowners and nongovernmental organizations, prohibition of hunting or restrictions on hunting, and memorandums of understanding (MOUs) were also common contributors to species recovery. As far as legislation, Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), The Migratory Bird Treaty Act (MBTA), The Marine Mammal Protection Act (MMPA), The Sikes Act, The Clean Water Act, The Lacey Act, and state and local laws were instrumental in protecting species so that they could recover. As our laws protecting wildlife come under threat, this research underlines the importance of legislation and protected habitat in delisting species under the Endangered Species Act of 1973.

12. **Edwin Sanchez and Noelle Olsen**, (Mentor: Dr. Bradley Stevens, Biology, University of Maryland Eastern Shore)
Funding: National Science Foundation
A Comparison of Two Cancrid Crab Species: Cancer borealis and Cancer irroratus
Jonah crabs, *Cancer borealis*, and Atlantic rock crabs, *Cancer irroratus*, were collected from Maryland and Delaware coastal waters to create a species-identification card for local fishermen. Recently, Jonah crabs became federally and state regulated while Atlantic rock crabs remain unmanaged. For males of both species, the morphometric attributes studied were the length of the right third pereiopod merus (R3 merus), right chela height (RChH), right cheliped weight, right chela width (RChW), right chela length (RChL), total body weight, and carapace width (CW). There were distinct markings and color patterns on the manus that proved useful for identification purposes. The variables that differed the most between the two species are the length of the R3 merus, the RChH, and the difference between the long carapace width (LCW) (maximum width perpendicular to the medial axis) and the short carapace width (SCW) (distance between indentations anterior to the

outermost anterolateral spines). The R3 merus length of the Atlantic rock crab was significantly greater than that of the Jonah crab (P = 0.0002) for a given CW. Additionally, the merus length showed a significantly (P = 0.038) steeper slope in rock crabs than in Jonah crabs. Both RChH and RChW are positively correlated with CW for both species (Jonah: R2 = 0.6647, R2 = 0.7673, respectively; Rock: R2 = 0.8714, R2 = 0.8632, respectively). We found that chela height of Jonah crab was greater than rock crab for the measured range (60-140mm). The chela width did not differ significantly between the two species (P > 0.05). The difference between the carapace widths are significantly different (Student's t-test, P < 2.2e-16). The ratio of cheliped weight to total body weight did not differ with carapace width, nor did it differ significantly between the species (ANCOVA, P = 0.127). RChL increased with CW, but there was no significant difference among RChL between the species for a given size (P = 0.528).

13. **Marie Stoltzfus**, (Mentor: Dr. Carol Hepfer, Biology)
Funding: Biology Student Investigator Grant, Neimeyer-Hodgson Research Grant
Identification of Tissue-Specific Isoforms of the Large Elastic Protein Kettin in Squid Muscles Exhibiting Diverse Contractile Properties
In the longfin inshore squid, *Doryteuthis pealeii*, different muscle types have evolved to maintain maximum force over distinct ranges of length. Variations in length-force relationship (LFR) are correlated with distinctions in muscle ultrastructure. Muscles in the squid's funnel retractor, head retractor, nuchal retractor, arm, arm keel, and mantle have been found to exhibit different LFRs, but the molecular mechanisms responsible for these differences are not understood. In some species, diverse forms (isoforms) of myosin play a role in regulating muscle contraction, but myosin isoforms do not appear to be involved in controlling LFRs in squid. Kettin is a large muscle protein found in some invertebrates that is known to regulate the structure of sarcomeres, which are the basic units for muscle contraction. Our research has identified kettin-like RNA sequences in both the head and funnel retractors of squid. It is possible that differential expression of kettin isoforms may contribute to the differences in the LFRs observed for these muscles. To test this hypothesis, I compared RNA sequences expressed in the six muscle types listed above using RNA-Seq. A correlation between the abundance of a particular kettin isoform, or sequences for another protein, and specific LFR properties would suggest a role for that muscle protein in the regulation of contraction. This research will contribute to our understanding of the mechanisms of invertebrate muscle regulation and evolution.

Chemistry

14. **Aubrey Davis**, (Mentor: Dr. Maria Schiza, Chemistry)
Funding: Neimeyer-Hodgson Research Grant, Student Grants for Research and Creativity
Identifying Pigments in Art using SERS and Silver Nanoparticles
This project is focused on using silver nanoparticles to characterize pigments and materials found in fine arts. Surface Enhanced Raman Spectroscopy (SERS) is being used to build a spectral library of pigments and binders so that they may be more easily identified. SERS utilizes noble metal nanoparticles to enhance signals obtained by standard Raman Spectroscopy. This allows a much smaller sample size to be used for analysis, rendering

SERS a virtually non-destructive method. There are many ways to identify pigments and binders, but spectroscopy is the only form of analysis that gives conservators and historians exact results. By creating a library of reference spectra, this work will aid in art conservation and the investigation of art forgeries.

15. **Christa Gonzales**, (Mentor: Dr. Maria Schiza, Chemistry)
Funding: Neimeyer-Hodgson Research Grant, Student Grants for Research and Creativity
Detection of Lead in Drinking Water Using Modified Gold Nanoparticles and Ultraviolet-Visible Spectroscopy
Heavy metals, such as lead are found at hazardous levels in water sources across the world. Lead finds its way into water sources from old pipes, paints, gasoline, and other consumer products. When lead enters the body, it causes brain and nervous system damage, and in extreme cases, can be fatal. Lead contamination in drinking water is prevalent around the world, with millions of people being exposed to toxic levels every day. This project will use ultraviolet-visible spectroscopy in combination with modified gold nanoparticles as a simple, quick method to detect low levels of lead in water.

16. **Gillian Good and Weihao Ma**, (Mentor: Dr. Steven Kennedy, Chemistry)
Funding: Neimeyer-Hodgson Research Grant, Student Grants for Research and Creativity
Exploring the Regioselective Diels-Alder Reaction Scope of 1,4-Naththoquinones
Altersolanol P (AP), a new member of the altersolanol family of compounds, is the inspiration for multiple synthetic studies in our laboratory. The altersolanols, and structurally similar compounds, exhibit antibacterial activity. Recently, we reported our work toward the regioselective synthesis of intermediates en route to altersolanol derivatives via lewis acid catalyzed Diels-Alder reactions of the natural products isoprene and Juglone (5-hydroxy-1,4-naphthalenedione). Epoxidation or dihydroxylation of the resulting adducts is expected to provide a small library of altersolanol derivatives for antibacterial testing. To further expand the molecular diversity of our library, in this study, we will explore the reactivity of 1,4-Naphthoquinone dienophiles with dienes, such as (2E,4E)-2,4-Hexadienyl acetate and 2,4-Hexadien-1-ol. We eventually hope to substitute Juglone (5-hydroxy-1,4-naphthalenedione) for 1,4-Naphtoquinone to explore regioselectivity of the Diels-Alder reaction. New compounds will be tested for antibacterial activity.

17. **John-Paul Marrazzo and Samantha Simon**, (Mentor: Dr. Steven Kennedy, Chemistry)
Funding: Neimeyer-Hodgson Research Grant, Noonan Endowment Award, Student Grants for Research and Creativity
Expanding the Green Scope of Pentaerythritol Acetal Formation
Acetals are germinal diether derivatives of aldehydes formed by the reaction of an aldehyde with two alcohols. Collard et al. have shown that by utilizing temperature control, benzaldehyde and pentaerythritol, when mixed in water with catalytic acid, can selectively form monoacetal derivatives. The goal of our project is to expand the substrate scope of this monoacetal selective reaction to synthesize new monoacetals and to define their structure using 2D NMR techniques. Acetals similar to our target monoacetal products are

used in a variety of synthetic applications. They have served as alcohol protecting groups in route to polymer-based adhesives and synthetic glycodendrimers for nanomedicine applications in drug delivery and vaccines. Our work should help to broaden the synthetic utility of this user-friendly and environmentally benign reaction. It is also hoped that this work will produce starting material for multistep synthesis routes optimized for use in advanced-level undergraduate teaching laboratories. Preliminary results based on studies using the NMR internal standard dimethyl sulfoxide indicate that many substituted benzaldehydes will provide a level of selective monoacetal formation.

18. **Michael Rosen**, (Mentor: Dr. Lyman Rickard, Chemistry)
Funding: Neimeyer-Hodgson Research Grant
Calibration and testing of a Capillary electrophoresis (CE) system, for use in an undergraduate lab
A capillary electrophoresis analysis system was recently donated to Millersville University. This instrument has the capacity to separate and analyze biochemical compounds. The goal of this research project was to setup, calibrate and test the instrument in order for it to be used for an upper level chemistry course (CHM 465). Capillary electrophoresis (CE) is used to separate the components in a mixture and determine the molecular weights of each of its components. The mixture is separated by using a buffer solution which is passed through a capillary tube. The capillary tube is made of fused silica, which acts as the stationary phase and creates a two layered charged surface. A high voltage (10,00Volts) is applied across the capillary, which separates the mixture based on charge and size of the components. At the end of this research experiments that are in the scope of upper level chemistry will be developed if time permits. Examples of potential experiments include Determination of L-Ascorbic Acid in Tomato and determination of peptide conformation.

19. **Liam Schroeder and Frances Wenrich**, (Mentor: Dr. Kathryn Allen, Chemistry)
Funding: Neimeyer-Hodgson Research Grant, Student Grants for Research and Creativity
Improving the Mechanical Properties of Poly- δ -Valerolactone Through Aryl Ring Stacking and Hydrogen Bonding Interactions
Petroleum-based, non-biodegradable plastics, such as LDPE, HDPE, and PETE, are used in storage containers, chairs, water bottles, grocery bags, fuel tanks, car parts, prosthetics and many other applications. They are ideal because they are stable, chemically inert, and strong. However, petroleum based plastics are bad for the environment because, on average, it takes between 10 to 450 years for decomposition. Due to their durable properties, they can absorb, concentrate, and transport pollutants in the environment; threatening the natural flora and fauna. Biodegradable plastics are a growing field of interest as a means to replace these petroleum-based plastics. Polyhydroxyalkanoates (PHA) integrate oxygen into the polymer hydrocarbon backbone, which allows it to biodegrade when exposed to three notable bacteria strains; Bacillus sp. IBP-V002, Entrobacter cloacae sp. IBP-V001, and Gracilibacillus sp. IBP-V003. The problem with PHA is that they possess weak intermolecular forces, which leads to a brittle plastic. The integration of oxygen into the polymer backbone renders them vulnerable to certain enzymes. The modification of δ-Valerolactone, by α-substitution with aryl rings, will

produce a monomer that will impart more ordered structure to the polymer sample. This increased order will cause the mechanical properties of the polymer to increase and produce a strong biodegradable polymer that can be used in place of commonly used plastics, but which possesses a smaller environmental footprint.

20. **Samantha Simon and John-Paul Marrazzo**, (Mentor: Dr. Steven Kennedy, Chemistry)
Funding: Neimeyer-Hodgson Research Grant, Student Grants for Research and Creativity
Expanding the Green Scope of Pentaerythritol Formation
Acetals are geminal diether derivatives of aldehydes formed by the reaction of an aldehyde with two alcohols. Collard et al. have shown that by utilizing temperature control, benzaldehyde and pentaerythritol, when mixed in water with catalytic acid, can selectively form monoacetal derivatives. The goal of our project is to expand the substrate scope of this monoacetal selective reaction to synthesize new monoacetals and to define their structure using 2D NMR techniques. John-Paul's work will explore the reactivity of substituted cinnamaldehydes. Samantha's work will focus on the reactivity of substituted benzaldehydes. Acetals similar to our target monoacetal products are used in a variety of synthetic applications. They have served as alcohol protecting groups in route to polymer-based adhesives and synthetic glycodendrimers for nanomedicine applications in drug delivery and vaccines. Our work should help to broaden the synthetic utility of this user-friendly and environmentally benign reaction. It is also hoped that this work will produce starting material for multistep synthesis routes optimized for use in advanced-level undergraduate teaching laboratories.

21. **Abdullah Syed and Frances Wenrich**, (Mentor: Dr. Kathryn Allen, Chemistry)
Funding: Student Grants for Research and Creativity, Neimeyer-Hodgson Research Grant
Synthesis of Highly Emmissive Covalent Organic Frameworks
We will focus on creating a highly emissive covalent organic framework (COF). Due to their ability to absorb light, which makes them effectively mimic solar cells, these COF are valuable tools for organic solar cell applications. We will be creating the proposed COF by using boronic esters to interconnect bifluorenes by phenyl linkers. By using UV-Vis and fluorescence spectroscopy, the sample of COF can be tested for absorbance and emission properties. Another method to monitor the results is through powder x-ray diffraction in collaboration with James Madison University, which provides data on structural regularity of the COF. The goal is to produce regular, working structures to make an effective solar cell resulting in high yields of photons.

22. **Joy Thames and Samantha Gillis**, (Mentor: Dr. Steven Kennedy, Chemistry)
Funding: Student Grants for Research and Creativity, Noonan Endowment Award
Imine Library Synthesis via Solvent-Free Reactions
We have initiated studies to expand the scope of Touchette's solvent-free imine formation reaction between ortho-vanillin and para-toluidine. These reactions are cost efficient and exhibit green chemistry properties. The primary goal of this project is to synthesize and characterize a variety of imines. We are taking two related approaches to this study: imine synthesis via para-toluidine and a library of substituted salicylaldehydes or imine synthesis

via ortho-vanillin and a library of substituted anilines. Previous studies on structurally similar imine ligands—and their bidentate metal complexes—have revealed multiple biological activities for this class of molecules, including bactericidal properties. We hope to further explore the antibacterial properties of new all compounds produced from our synthetic work. Future studies also include reductive amination of the synthesized imines.

Computer Science

23. **Alex Wilton**, (Mentor: Dr. Gary Zoppetti, Computer Science)

Parallel Pathfinding

Pathfinding is an important problem that is used in many applications ranging from video games to robotics. However, finding the best path between two points can often take a long time. So, the goal of this research is to look for ways to increase performance with parallel computing. We achieve this by analyzing several algorithms on randomly generated gridded environments and compare factors like execution time and path quality. Several of these algorithms use parallel computing to increase speed, including a new scalable algorithm devised to split up the search space evenly without using a high-level map of the environment. Additionally, this research investigates how varying tile costs in the gridded environments affect the performance and path quality of these algorithms.

Earth Sciences

24. **Cassandra Alexander, MarieClaire Egbert, Nathan Murray** (Mentor: Dr. Robert Vaillancourt, Earth Sciences)

Funding: College of Science and Technology UG Travel Fellowship

Cross-Frontal exchange of water masses at the New England Shelf Break: Preliminary Observations using the Coastal Pioneer Array

Intrusions of warmer, saltier continental slope and Gulf Stream warm core ring (WCR) water onto the New England continental shelf have become more frequent during the last several years (Gawarkiewicz et al., 2018), and may in the future world cause significant changes to the biological productivity and physical dynamics of the shelf seas. This undergraduate research poster reports preliminary observations and analyses of a Gulf Stream WCR intrusion onto the shelf during the late spring and early summer of 2014 (first reported by Zhang & Gawarkiewicz, 2015) using the Pioneer Array. We focus on the temporal changes in physical and bio-optical properties at two fixed mooring positions on the outer shelf. The high degree of similarity in the salinity time series allow us to use cross correlation analysis as a means of estimating along-shelf current velocity.

25. **Jan van der Veken**, (Mentor: Dr. Alex DeCaria, Earth Sciences)

Funding: Student Grants for Research and Creativity

Correlations of Lightning Occurrence with Weather Parameters in Lancaster, Pennsylvania

This study looks at correlations between lightning occurrence and observed weather parameters for Lancaster County, Pennsylvania. The lightning data are from the National Lightning Detection Network (NLDN) and the North American Precision Lightning Network (NAPLN). Weather observations are from the Millersville University weather station, and

are wind direction, wind speed, temperature, and dew point. The data sets cover the period from 2011 through 2016.

Geography

26. Sabrina Rowe, Nathan Bauer, Derek Boone, Tucker Cavallo, Arynn Cooper, Christian Ott, Angel Yamil Perez-Irizarry, William Todd, Edward Schick, and Cameron Strosser, (Mentor: Dr. Ethan Frost, Geography)

Assessing Climate Resiliency at Millersville University

Millersville University completed a climate action plan in 2016 with a goal of reaching carbon neutrality by 2040. An update to this plan requires that the University assesses climate resiliency on campus. This research analyzes current climate resilience assessment methodologies. Resilience assessment methods were selected and applied within the context of determining the climatic resilience of ecosystem services at Millersville University based on potential climatic impacts at varying scales. Vulnerability and risk analyses were conducted to analyze prioritized campus ecosystem services. Recommendations are made to maintain and improve resiliency of the identified services.

Mathematics

27. Quyen Do, Keri D'Angelo, Jamie Kunzmann, and Josh Radack, (Mentor: Dr. Trent Gaugler, Mathematics, Lafayette College)

Funding: Noonan Endowment Award, Student Grants for Research and Creativity, College of Science and Technology UG Travel Fellowship

Applying Kelly Criterion to College Football Betting

The Kelly criterion is a mechanism used for properly sizing a portion of one's capital for betting and investment purposes. In our research project, we explore a realistic application of the Kelly criterion. Our objective is to maximize a bettor's return while simultaneously minimizing the risk of ruin in the context of betting on FBS college football games. We build a selection of logistic regression models using scraped college football data of the 2008–2016 seasons, simultaneously comparing our models to the well-known PFR model designed by pro-football-reference.com. We then apply the predicted probabilities to our expansion of Kelly criterion to more than one betting event. Simulations are then run with varying approaches-differing number of bets, game filtering methods, and fractional Kelly sizes are all considered to come up with the most profitable betting strategy for an FBS season.

28. Brooke Dobbs, (Mentor: Dr. Dorothee Blum, Mathematics)

Women Authors of Mathematical Textbooks

It appears that the majority of mathematicians who write textbooks for mathematics are men. The author investigates this situation by compiling a list of recent women authors of mathematics textbooks and the type of textbooks they have written. This data is accompanied by a brief history of women in mathematics. It is also compared to the number of male authors of mathematics textbooks. The author then presents her conclusions regarding the state of women authors of textbooks in mathematics.

29. **Quinn Minnich**, (Mentor: Dr. Ron Umble, Mathematics)

An A_∞-coalgebra Structure on a Polygon

Let P be a polygon with n vertices, let V be the graded vector space generated by the vertices, edges, and region of P, and let ∂: $V \to V$ be the map induced by the geometric boundary. There is a homotopy coassociative coproduct Δ_2: $V \to V \otimes V$, a *coassociator* Δ_3: $V \to V \otimes V \otimes V$, and non-vanishing higher order operations Δ_k: $V \to V^{\otimes k}$ for all $k < n$. The vector space V together with ∂ and the operations Δ_k is an A_∞-*coalgebra*. To our knowledge, this project presents the first such family of examples.

Nursing

30. **Charles Brooks**, (Mentor: Dr. Mary Lou Mortimer, Nursing)

Concept Analysis: Motivational Interviewing

Motivational Interviewing (MI) is a concept initially developed from clinical psychologists. This concept analysis seeks to understand the meaning(s) of MI and its application within the healthcare setting. MI is a collaborative effort between Providers and Clients, but also sometimes utilized amongst group discussion settings. MI has shown significant effect for high-risk lifestyle behavior changes through cognitive remapping of perceptions for what is "rewarding" to a person.

Physics

31. **Stephen Beegle**, (Mentor: Dr. Sean Hendrick, Physics)

X-Ray Properties of the Galactic Black Hole H1743-322

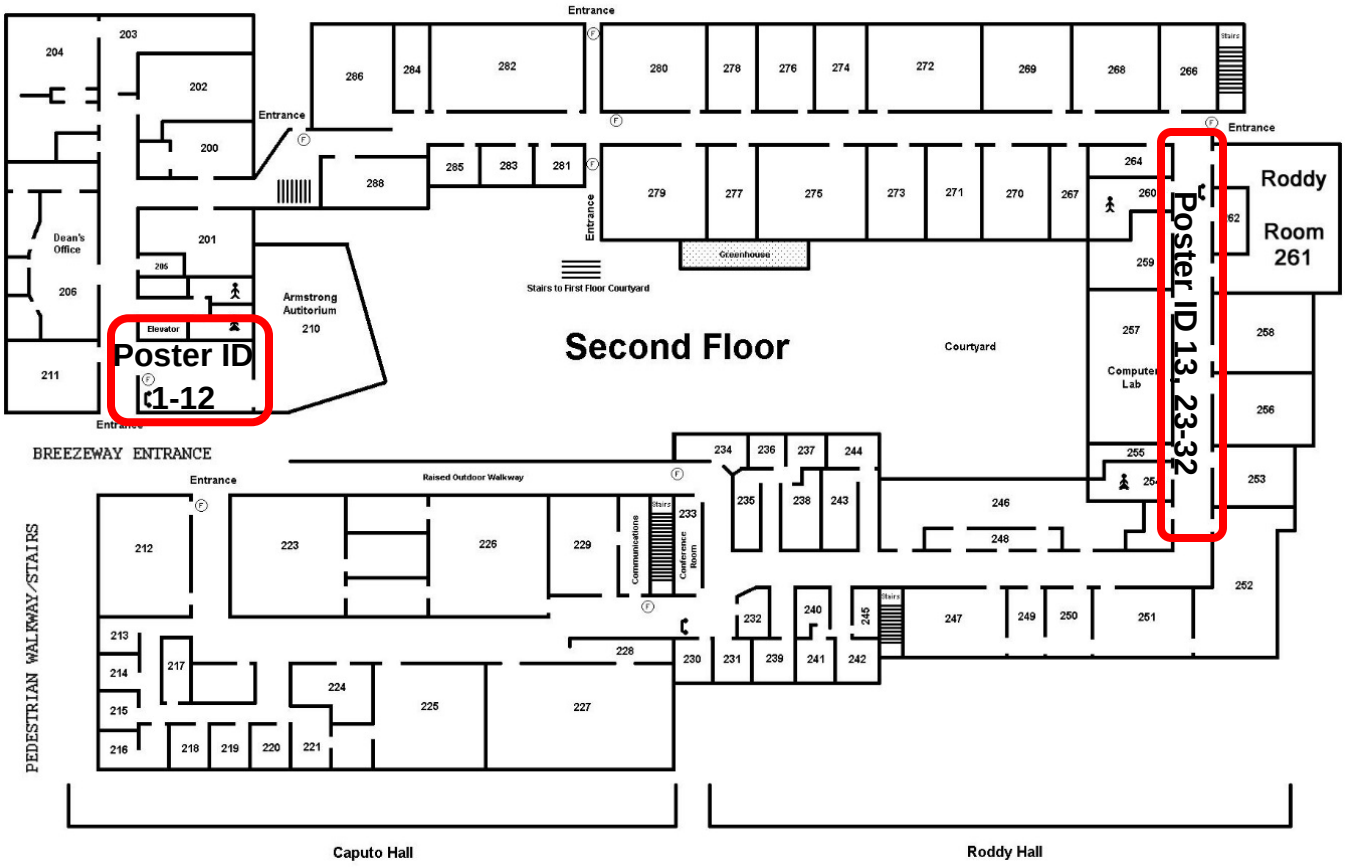
H1743-322 is an X-ray black hole binary system, located ~8.5 kilo-parsecs (~27,000 light years) from Earth, near the galactic center of the Milky Way Galaxy. The system consists of a galactic black hole and a donor star, which orbit about a center of mass. The system spends much of its time in a period known as quiescence, which is a low X-ray luminosity state. Over time, the black hole in this system gathers material from the donor star into a region known as an accretion disk, where friction heats this matter up. Once a critical amount of matter has been gathered in the disk, and it has been sufficiently heated, there is an outburst. This outburst state is dominated by high luminosity X-ray emission, which is studied to determine attributes of the binary system through spectroscopy. The goal of this research project is to analyze the spectra from an outburst state of H1743-322 using two prominent observatories, Chandra X-ray Observatory, which is most effective in the 0.5-10.0 keV range, and Swift XRT, 0.2-10.0 keV. The comparison will not only allow for the analysis of the X-ray spectra, but also show how each observatory compares to the other during their observations.

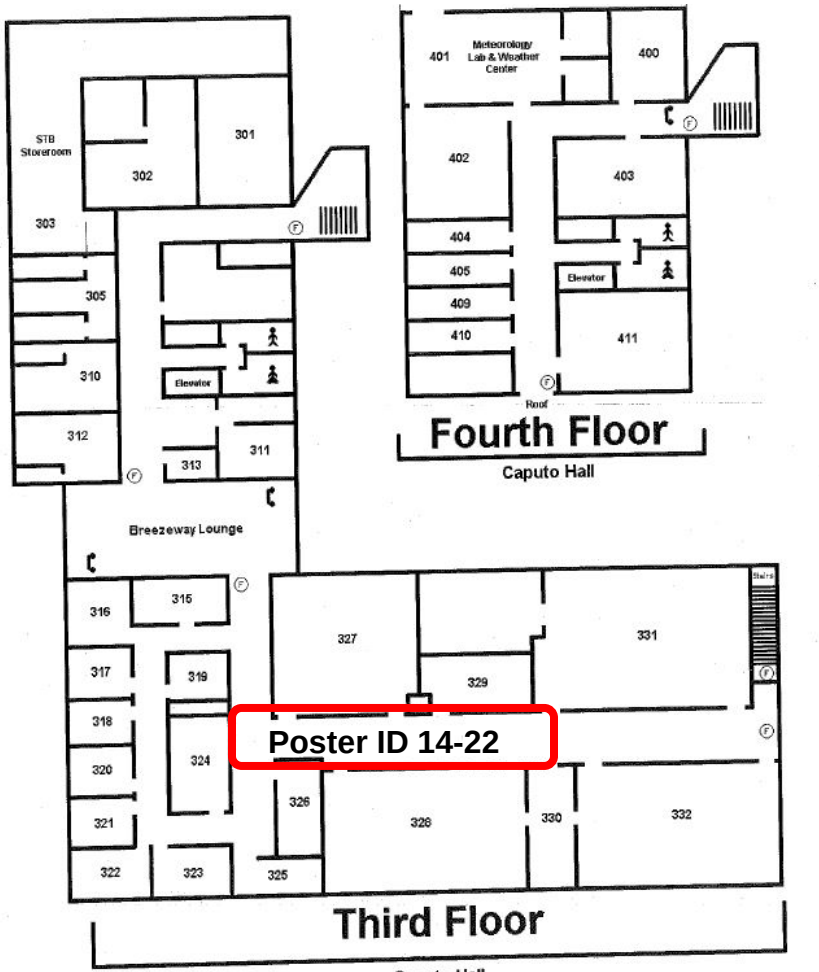
32. **Christopher Legerton**, (Mentor: Dr. Sean Hendrick, Physics)

Dark Matter in Galaxy Cluster Abell 1835

We have known about dark matter since 1937, thanks to Fritz Zwicky. However, just because we know of its existence, does not mean they know all about dark matter. They can make some educated assumptions by ruling out what dark matter is not. There are two types of matter, baryonic and non-baryonic matter. Baryonic matter is composed of

baryons, i.e. protons and neutrons. This type of matter is what we are made of and interact with. Non-baryonic matter is then defined as matter not made of baryons. Dark matter is classified as non-baryonic matter even though some types of baryonic matter may contribute, in the slightest, to the effects of dark matter. The reason for the name “dark” is that it does not emit or absorb light of any form. Some of this baryonic dark matter constitutes are; cold gas, black holes, and dim brown dwarfs.


Second Floor
Poster ID 1-12
Poster ID 13, 23-32
Roddy Room 261
Armstrong Auditorium 210
Dean's Office
Elevator
Entrance
Stairs to First Floor Courtyard
Greenhouse
Courtyard
Computer Lab
Communications
Conference Room
Raised Outdoor Walkway
BREEZEWAY ENTRANCE
PEDESTRIAN WALKWAY/STAIRS
Caputo Hall
Roddy Hall


Fourth Floor
Caputo Hall
Meteorology Lab & Weather Center
STB Storeroom
Elevator
Roof
Breezeway Lounge
Poster ID 14-22
Third Floor