Jul 11th, 11:30 AM

Program Overview

Landmark Conference Summer Research Symposium

LANDMARK CONFERENCE

Landmark Summer Research Symposium

Thursday, July 11, 2019

Elizabethtown College

Schedule of Events

Event	Time	Location
Check in and Lunch	11:30 a.m. to 1 p.m.	BSC Concourse Marketplace
Welcome Remarks	1:05 p.m. to 1:20 p.m.	KAV
Concurrent Session #1	1:30 p.m. to 2:30 p.m.	Hoover Center
Concurrent Session #2	2:45 p.m. to 3:45 p.m.	Hoover Center
Dessert Reception and Closing Remarks	4 p.m. to 4:30 p.m.	KAV

Concurrent Session #1

Poster Presentations

1. Biological Survey of the Natural Lands of Elizabethtown College
The campus of Elizabethtown College possesses various ecosystems that frequently are overlooked by the student body and community. These ecosystems include forests, meadows, wetlands, streams, and ponds and provide habitat for a variety of plants and animals. We are advocating for the college to recognize these campus areas as the "Natural Lands of Elizabethtown College." The goal of our project was to determine what species inhabit these natural lands. Our primary taxonomic focus was on birds. We determined the absence and presence of bird species common to the eastern United States. About three times a week for three weeks in late May and early June of 2019, we birded in seven locations for 15-minute intervals. These locations included meadow, wooded, pond, and residential ecosystems. We determined the probabilities of occupancy and detection of birds within these ecosystems. In addition to birds, we also surveyed for salamanders and aquatic macroinvertebrates in streams on campus. We also mapped patches of milkweed on campus in anticipation of future research on monarch butterflies. These data on various taxonomic groups are a first step to understanding the biodiversity of the "Natural Lands." The Natural Lands of Elizabethtown College will demonstrate our college's commitment to preserving biodiversity and providing opportunities for the educational, physical, and mental well-being of students by creating connections with nature.

Student Authors: Caroline Fegley and Aprille Mohn
Faculty Mentor: David Bowne
Elizabethtown College

2. Exploring the Effect of TGFβ Signaling on Bipolar Cells Differentiation
The TGFβ signaling pathway is a complex circuit of signaling molecules such as Smad2 and Smad3 interacting with one another to activate or deactivate specific cellular responses that include changes in cell fate, cell growth, and differentiation. The goal of our experiments is to manipulate the TGFβ signaling pathway to investigate and regulate cell differentiation of bipolar cells in the developing zebrafish (Danio rerio) retina. The retina is the target brain tissue because it is the most accessible tissue in the central nervous system (CNS) that allows for this experiment. Within the retina, bipolar cells are a subtype of neurons with shorter axons, and as such, they do not require electrical impulses in order to induce an action potential.

Student Authors: Meliane Nomel, Elizabeth Hannifin, Karen Nga Tana and Nicole Fana Brito
Faculty Mentors: Jenny Lenkowski
Goucher College

3. Characterization of a Putative Lactate Transporter in Drosophila melanogaster
Lactate is a by-product of glycolysis, an energy-generation pathway, which is necessary in many organisms to produce energy from sugars in oxygen-deprived conditions. Generation of lactate allows cells to regenerate molecules necessary for glycolysis, and lactate can serve as an alternative to sugar in some cells. Lactate is moved into and out of cells by lactate transport proteins. Lactate transporters have been found throughout the body in structures such as skeletal muscles and the brain, and evidence suggests lactate transport is important in some tumor cells. In Drosophila (fruit fly), the gene CG12866 encodes a putative lactate transporter, and characterization of gene expression throughout development suggests that it may be testis-specific. This transporter could be active during spermatogenesis or may be necessary during some aspect of fertilization. We will compare expression of the gene in males versus females to confirm whether the gene is male-specific, and if so, determine if the gene is expressed in either the testis or other male specific tissues. The Drosophila gene disruption project has isolated two putative mutants, and we will analyze these to ascertain mutant phenotypes. This will help lay the groundwork for future research into lactate transport in Drosophila.

Student Author: Elizabeth Hughes
Faculty Mentor: Mark Hiller
Goucher College

4. Differential Gene Expression of Yersinia Ruckeri Putative LuxI and luxR Homologue Mutant Strains
Yersinia ruckeri, a gram-negative bacterium, is the main cause of Enteric Red-mouth disease (ERM) in salmonid aquaculture, including farmed rainbow trout, worldwide. Due to the large economic losses generated by this fish pathogen, novel ways to control or prevent infection would prove beneficial. In this study, we explore a mechanism of bacterial communication known as quorum sensing and how it changes the behavior of Yersinia ruckeri. Past work in our lab found that putative quorum sensing genes yruI and yruR2, responsible for communication signal production and transcriptional regulation respectively, influence central metabolism. Here, we further characterize the role of these genes by performing RNA expression studies on loci within glycolysis and the TCA cycle and comparing wild-type and mutant yruI and yruR2 strains. Expected results for yruR2 should demonstrate higher expression in glycolysis and lower expression in the TCA cycle, as the regulation of glucose metabolism is blocked due to the specific gene knockout. Meanwhile, yruI would show higher expression of the genes within the TCA and glycolytic pathway, because the bacterium cannot control/downregulate the nutrient consumption. This research provides insights on the basic biology of Y. ruckeri and may lead to new disease-control mechanisms in aquaculture.

Student Author: Rebecca Hallameyer
Faculty Mentor: Anna Jozwick
Goucher College

5. Identification of Quorum Sensing Molecules from the fish pathogen Y. ruckeri
Y. ruckeri is a bacterium that cause enteric redmouth disease (EDM) in salmonid fish. This pathogenic bacterium using quorum sensing as their form of communication. This process is facilitated by the production and detection of Acylated homoserine lactones (AHLs).These AHLs are important for many functions such as expressing genes for growth, virulence, and other cell functions. Agrobacterium tumefaciens NT1(pZLR4) is a bioindicator used for observing the presence of quorum sensing molecules within a solution or extract. In this experiment Y. ruckeri, in which two strains are being used, the Wild type with quorum sensing molecules expected, and Mutant form with the genes for quorum sensing molecules knocked out, were grown and AHLs were extracted in order to run a Reverse phase C18 TLC where an overlay containing Agrobacterium tumefaciens NT1(pZLR4) was poured on the TLC plate in order to determine where and if the extracts from Y. ruckeri contained any quorum sensing molecules. Given the two variants of Y. ruckeri it is expected that the wild type will show presence of quorum sensing molecules and the mutant will yield no quorum sensing molecules.

Student Author: Zach Brumbalow
Faculty Mentors: Anna Jozwick and George Greco
Goucher College

6. Keystone Microtrack: Mapping Microbes and Pathogens in the Susquehanna River Basin
Salmonella species represent a significant environmental health problem due to their diversity, presence of human, animal, and aquatic reservoir states, plus the lack of coordinated programs for risk prioritization and control. Current revolutions in DNA sequencing technology have enabled scientists for the first time to perform affordable, yet deep surveys of microbial genomics. This proposal leverages a combination of the latest technological developments in Salmonella typing (CRISPR-SeroSeq) and total bacterial community profiling (metagenomics) to measure and map the distribution of microbial organisms in the Susquehanna River Basin. Sampling sites within the basin will be selected based on our partnership with the Pennsylvania Fish and Boat Commission, where smallmouth bass populations have been continuously monitored. The major outcome of this proposal will be the development of an open access interactive tool, Keystone MicroTrack, where Salmonella populations, bacterial community profiles, physio-chemical data, and smallmouth bass population data will be integrated and visualized. Our proposal directly supports the Ecosystem Resiliency priority area, as our technology will integrate abiotic and biotic information within the Susquehanna River Basin to help prioritize areas of risk within the basin and to optimize the maintenance, resilience, and services this watershed offers.

Student Authors: Eduardo Almaraz, Avery Lee and Abigail Deaven
Faculty Mentors: Regina Lamendella, Nikki Shariat and Neil Pelkey
Juniata College

7. The Yeast ORFan Gene Project
Course-based undergraduate research experiences (CUREs) have numerous positive impacts on students, including increased knowledge of course content, independence, and interest in related subject matter. We describe the development, preliminary assessment, and propagation of an easily transferable, collaborative CURE that aims to determine the function of as yet uncharacterized Saccharomyces cerevisiae genes. More than 20 years after the sequencing of the budding yeast genome, nearly 10% of open reading frames (ORFs) are still considered uncharacterized. We hypothesize that CURE modules for study of yeast genes of unknown function can be effective tools to teach undergraduates basic bioinformatics, gene discovery tools and experimental design. Thus, we formed and are growing a consortium of undergraduate researchers and faculty at primarily undergraduate institutions (PUIs) to collaborate in assigning functions to these orphan genes (ORFans). Summer workshops for faculty and students introduce attendees to the ORFan bioinformatics work-flow and basic laboratory techniques, and provide faculty with the knowledge and materials to incorporate the modules into courses at their home institution. Pre- and post-test assessments provide data on the effectiveness of the modules. Assessment results (n>300) confirm that students gained an understanding of the Gene Ontology (GO) system for describing gene function and knowledge in the use of bioinformatics to assign gene function.

Faculty Authors: Tammy Tobin, Susquehanna University
Jill Keeney, Juniata College

8. Effects of Percolation on Superconducting Transitions
Nanoscale superconducting films are the basis of novel technologies that are likely to change the world: from quantum computing devices that will enable protein folding simulations for medical advances, to ultrasensitive light sensors that can detect distant galaxies. Understanding the phase transitions in the films is a crucial step towards developing these applications. This work aims to study the nature of superconducting transition in nanostructured films of niobium and gold. We will fabricate the samples using electron beam lithography and measure the resistance as a function of temperature and magnetic field at liquid helium temperatures. By comparing the results to the percolation theory and the universal theory of quantum phase transitions, we will elucidate the nature of the superconducting transitions in these films.

Student Authors: Kristine Ung, Robert Lynn and Samuel Shapiro
Faculty Mentor: Nina Markovic
Goucher College

9. The Effect of Intensity of Visual (Light/Dark) Cues in Drosophila melanogaster Larval Learning and Memory
Researchers have shown that larvae of the fruit fly Drosophila melanogaster can learn and remember associations between different stimuli (odors, light/dark) and rewards (sugar, low salt) or punishments (quinine, high salt). This project is examining the effect of light intensity on the ability of larvae to learn and remember these associations, using wild-type larvae as well as those with mutations that may affect this ability (e.g. amnesiac, dunce, Presenilin).

Student Author: Setareh Alipour
Faculty Mentor: Christopher Jones
Moravian College

10. Will an Antioxidant Decrease Bacterial Burden in an Infection Model?
Our lab studies the bacterial pathogen, Burkholderia thailandensis and its ability to invade a white blood cell in the immune system—the white blood cells that are typically involved in eliminating bacterial threats. B. thailandensis, which is easy to work with within a lab and does not cause severe infections, serves as a model organism for studying its very close relative, Burkholderia pseudomallei, which can cause severe, life-threatening disease. Our previous work has identified a certain combination of antibiotics and immune system activators that work well to clear the bacterial infection in this cell culture model, and we are starting to understand the mechanism behind that effect. We have extensive data showing that a particular dietary antioxidant can help clear bacterial infections, but we have very little data (from the early, preliminary studies) that show that a particular cellular antioxidant could impose the opposite effect and interfere with bacterial killing. Therefore we are collecting and analyzing data to determine the effects of N-acetylcysteine (NAC), a cellular antioxidant, on the bacterial infection model. No one has yet studied the role of this antioxidant to alter the bacteria in this infection model, and if our findings confirm now a second antioxidant that can help to reduce the bacteria in our infection model, then we would have a good basis for trying to determine if antioxidants, in general, all have a similar broad effect.

Student Author: Kaitlyn Nemes
Faculty Mentor: Kara Mosovsky
Moravian College

11. Interactions Between Asian Shore Crabs and Juvenile Blue Crabs
With introduction of the Asian shore crabs, Hemigrapsus sanguineus, to the east coast, many different species have been influenced by the invasive species. Rocky beach areas are dominated by the H. sanguineus, taking up most of the area under rocks. The blue crab, Callinectes sapidus, is a crucial species in estuaries across the east coast, serving as both predators and prey, especially to humans for the food industry. While the adult blue crab is much larger than an adult Asian shore crab, juvenile blue crabs are roughly the same size and compete with Asian shore crabs for both food and shelter. Lab experiments testing interactions between C. sapidus and H. sanguineus of equal carapace width were recorded and examined for agonistic behaviors when competing for food and shelter. Every video was watched back and analyzed to quantify the number of agonistic behaviors between the two crabs. The data was then used to determine the aggressive patterns exhibited between the two species, which was then used to determine which is the better competitor. This can then be applied to see how populations of both species are likely to change in the future, which will have large impacts both on the ecosystem and economy of areas along the east coast.

Student Author: Matthew Anderson
Faculty Mentor: Josh Lord
Moravian College

12. Examining Viable Options for Wetland Restoration on a Historic Property in a Key Urban Watershed
Camel's Hump Farm is part of the historic 135-acre Archibald Johnston estate (originating back to 1722) and is located less than 5 miles from the campus of Moravian College (founded in 1742). The farm was the country home of the first mayor of Bethlehem, Pennsylvania who also served as president of Bethlehem Steel Company and first vice president of the Bethlehem Steel Corporation until his retirement in 1927. The farm property was purchased in 2015 by the Friends of Johnston, Inc., an all-volunteer charitable non-profit organization. One key objective of the organization is to ensure the long-term sustainability of the former Archibald Johnston Estate through preservation, restoration, and adaptive reuse of all lands, physical features and outbuildings located on this historic property. My project focuses on wetland rehabilitation and invasive species management. The wetland was drained by previous owners and filled with non-native meadow plants. Our first goal is to test different non-chemical methods to control invasive plant species such as Microstegium vimineum (Japanese stiltgrass) and Rosa multiflora (Multiflora rose). We will also consider ways to restor the original spring channel that was diverted into a stormwater channel in order to drain the wetland by the former owners. Once restored, this wetland area could play an important role in controlling and filtering stormwater runoff into the Monocacy Creek which flows through campus and
Bethlehem's historic Colonial District which are prone to severe flooding.

Student Authors: Dalton Hornberger, Natalia Triscari and Cade Brandon
Faculty Mentors: Diane Husic and Vicky Bastidas
Moravian College

13. Detection of Heavy Metals by Colorimetric Polymer Nanoparticles
In the United States there are 6.1 million lead water service lines. This fact leaves many Americans in a precarious situation, as slight changes in the properties of their water supply (ex. pH), could result in the leaching of lead into their drinking water. Unfortunately, the average person does not have the ability to test for lead in water. This problem exists because current technologies for lead detection are expensive and require trained personnel. To address this issue, we propose a simple and inexpensive paper test for lead(II) in drinking water. This test will utilize polymer nanoparticles, which encapsulate a molecular probe that has a colorimetric response to lead(II), to produce a signal that can be visually observed by the user. In this work, a phenanthroline-based probe is synthesized and its colorimetric response to lead(II) assessed by UV-Vis spectroscopy. The probe is then incorporated into a polymer nanoparticle for increased stability in aqueous environments. Additionally, to ensure the test is reliable, a control is incorporated to confirm the test is working properly. To this end, polymer nanoparticles that encapsulate bromocresol green, a pH responsive dye, are also synthesized. These nanoparticles will produce a colorimetric signal when exposed to the pH of drinking water. Future work will look to incorporate these two nanoparticle systems into a paper lateral flow assay for simple and sensitive detection of lead(II).

Student Authors: Rachel Molino and Michael Perzel
Faculty Mentor: Lauren Toote
Elizabethtown College

14. Synthesis of a Turn on Mercury Fluorophore
The synthesis of fluorophores that exhibit extremely large Stokes' shifts play a key role in making the molecule fluorescence better and in darker backgrounds, avoiding self-quenching and scattered lights of dyes for biological imaging and chemo sensors. The use of molecular systems containing thiophene-quinoxaline as a donor-acceptor moiety respectively, has shown promise at producing mega Stokes' shifts. These molecules together create a push-pull charge transfer system resulting in the very large stoke shift. The further derivation of this system containing an ion binding site could allow for a fluorescent chemo sensor. Herein we describe the synthesis and photophysical studies of a dithienyl quinoxaline based fluorophore that showed selectivity bound to the mercury dication and exhibit a dramatic increase in fluorescence due to an ICT.

Student Author: Madeline Shore
Faculty Mentor: Kevin Schultz
Goucher College

15. Synthesis and Characterization of a Tris(phenolate)amine Ligand for the Production of an Iron(III)-centered Catalyst
Iron(III)-based catalysts that include tris(phenolate)amine ligands have been shown to be effective in the production of semi-aromatic polymers with high glass transition states from epoxides and cyclic anhydrides. In order to better understand the role of the ligand in catalysts of this type, we have set out to synthesize and characterize a series of iron(III) tris(phenolate)amine compounds. The goal of this project is to optimize the synthesis of one of these ligands, tris(2-hydroxy-4,6-dimethylbenzyl)amine, and to use it to synthesize the iron(III)-centered compound, (ArMeO)3NFe(DMAP). We have evaluated synthetic conditions including the atmosphere, temperature, stir rate, and stoichiometric ratio, and we have also attempted several purification methods. This presentation will describe reaction routes that lead to the isolation of tris(2-hydroxy-4,6-dimethylbenzyl)amine in improved purity and yield compared to literature methods.

Student Author: Caden Pensak
Faculty Mentor: Ursula Williams
Juniata College

16. Crosslinking Studies of diRhodium Complexes to Macromolecules
The goal of this project is to develop the chemistry that will allow dirhodium complexes to form selective crosslinks with proteins, peptides, or other biological polymers to make a drug delivery system to kill cancer cells. Dirhodium complexes have a variety of unique chemical properties including cellular toxicity. Macromolecules have unique transport properties across cell membranes, and because of their large size, they can react with multiple crosslinkers. Crosslinking chemistry will join together chemical properties of rhodium toxicity with macromolecular targeting and capacity to prepare a new type of dirhodium antitumor complex.

Student Author: Cole Carey
Faculty Mentor: Stephen U. Dunham
Moravian College

17. The Histone H2B Repression (HBR) Domain Regulates Cell Cycle Progression and DNA Damage Response in the Yeast Saccharomyces Cerevisiae
In eukaryotic genomes, DNA is packaged with a group of proteins called histones to form chromatin. The basic repeating subunit of chromatin, the nucleosome core particle (NCP), is made up of two copies each of the canonical histones H2A, H2B, H3, and H4. Though compaction allows large amounts of DNA to fit into the relatively small space of the nucleus, it establishes a physical barrier to the DNA template. Because of their close association with DNA, histones play integral roles in DNA-templated processes (e.g. transcription, DNA repair, and DNA replication). The N-terminal domain of histones H2B has been shown to repress the transcription of a large set of genes in the yeast genome. Indeed, the relevant residues on H2B comprise a small portion of the N-terminal 'tail' (amino acids 30-37). This domain is termed the histone H2B repression (HBR) domain. Previous studies have implicated these domains in regulating transcription as well as the cellular response to DNA damage. Here we define a novel role for this domain in regulating cellular division, DNA replication, and DNA double-strand break repair.

Student Authors: Kaitlyn Galliher
Faculty Mentor: Michael Parra
Susquehanna University

18. Interrogating the Roles of the Histone H2A and H2B Repression Domains in Regulating Cell Cycle Progression
In eukaryotic genomes, DNA is packaged with a group of proteins called histones to form chromatin. The basic repeating subunit of chromatin, the nucleosome core particle (NCP), is made up of two copies each of the canonical histones H2A, H2B, H3, and H4. Though compaction allows large amounts of DNA to fit into the relatively small space of the nucleus, it establishes a physical barrier to the DNA template. Because of their close association with DNA, histones play integral roles in DNA-templated processes (e.g. transcription, DNA repair, and DNA replication). The N-terminal domains of both histones H2A and H2B have been shown to repress the transcription of a large set of genes in the yeast genome. Indeed, the relevant residues on both histones comprise a small portion of the N-terminal 'tails' of these histones. These domains are termed the so-called histone H2A repression (HAR) and H2B repression (HBR) domains. Previous studies have implicated these domains in regulating transcription as well as the cellular response to DNA damage. Here we define a novel role for these domains in regulating DNA replication.

Student Author: Emily Harling and Olivia Geesaman
Faculty Mentor: Michael Parra
Susquehanna University

19. Salamander Diversity and Ecology at the Deputy Field Center and Monocacy Creek
The Deputy Field Center located in Northampton County, PA, is a 65-acre wooded property owned by Moravian College. It is a prime site for studying biodiversity of this region of PA. Biodiversity is an important indicator of the health and stability of an ecosystem. Additionally, salamanders are an important species that control insect populations, such as mosquitoes. This project will assess the diversity of salamander populations at this site. This diversity will be compared to populations along the Monocacy Creek and Lehigh River, located in the more urban environment of Bethlehem, PA. We expect to find that there is a higher diversity of salamanders at the rural Deputy Field Center compared to the city of Bethlehem. Additionally, we will be testing several salamanders for infection by the fungus Batrachochytrium dendrobatidis (Bd) which has been detrimental to many populations of amphibians across the globe.

Student Author: Carly Danoski
Faculty Mentor: Daniel Proud
Moravian College

20. Machine Learning Based Encrypted Network Traffic Analysis on Multicore Processors
The landscape of network analysis is ever-evolving as the fields of technology and business progress. While the landscape of the analysis may change, at the core of network analysis is the detection of malicious activity. In real-time traffic flow, it is non-trivial to determine whether a particular flow is malicious in nature. Most malicious software (malware) analysis is done after the flow has already reached its end target, and is analyzed in the form of network traffic captures. For any network analysis system, it is important that the privacy of the data being transmitted it not compromised in the process. Using network contextual flow data, it is possible to analyze and classify network traffic without compromising the encrypted data being transported.
In this project, we analyzed the impact of using the Intel Data Analytics Acceleration Library (DAAL) to expedite the analysis and inference of encrypted network traffic for the presence of malware. The DAAL package enables the acceleration of analytics through its design to target Intel hardware, being developed in a combination of C and assembly language for their architecture. With its streamlined design, using the library allows for analysis to take place many times faster than using the typical python framework and data analysis libraries, such as scikit-learn. Using these tools developed by Intel, our team designed an inference system that is capable of performing real-time analysis of network flows to detect malicious activity.

Student Author: Derek Manning
Faculty Mentor: Peilong Li
Elizabethtown College

21. Towards Project-Based Citizen Science: Environmental Education and Community Action at Lehigh Valley Summer-bridge

The goal of this project is to develop an inquiry-based science curriculum framework that combines elements of project-based learning environmental education and citizen science to provide learners in a summer enrichment program opportunities to apply science towards community activism. This project will also draw from the framework of Youth Participatory Action Research, or YPAR, which highlights the efficacy of positioning students as agents of social and environmental change in their communities. This framework, like project-based learning, emphasizes the importance of having student voice and interest inform the learning process. Accordingly, the curriculum framework will begin with a set of lessons that introduce students to concepts and methods in environmental science, before helping students design and implement projects based on their own unique interests. Students will learn how to assess water and soil quality, map ecosystems, and document the distribution, density, and diversity of biotic components. After students learn these methods, they will develop and implement projects that use these techniques to address issues environmental issues that matter to them and their communities. Finally, these students will have an opportunity to share the results of their inquiries with other members of their community.

Student Author: Erin Anagnost
Faculty Mentor: Tristan Gleason
Moravian College

22. Renditions of a Changing Environment in Lancaster County

There are many ways in which human culture and society interact with its natural environment. This may take the form of farming for corn or developing land for a community, but regardless of how or why, these actions change and manipulate the land in some way. The farmer and the developer clear cut forests, electric companies and the entrepreneurs dam rivers—the Susquehanna—and pollute the air and water with sulfides and carbon dioxide, all the while socio-economic stratification widens the gap between the wealthy, the shrinking middle class, and the impoverished. Looking specifically at Lancaster county, research through painting will examine and depict the effects of human activity on the landscape by employing contrasting themes in composition and subject matter. Locations to be examined include Brunner Island Power Station, Three Mile Island, the Susquehanna River, Lancaster and Columbia, and Bainbridge—all industrial sites that evoke the post-impressionist drive to capture how change in society causes change in nature, and in keeping with this painting tradition, all work will be completed en plein air, or on location.

Student Author: Tanner Simon
Faculty Mentor: Kristi Arnold
Elizabethtown College

23. Marietta Pennsylvania Historic District & The Susquehanna National Heritage Area Designation ArcGIS Story Map

In the spring semester 2019, Honors students enrolled in HON 201 Elizabethtown History: Campus and Community, conducted National Historic Preservation Act Section 106 Reviews documenting historic properties in the National Historic District of Marietta, PA. Kyle Cappucci, a student in the class, built on this research and expanded the scope of the project for SCARP. Cappucci utilized primary sources found in archival collections and historic collection libraries, conducted oral history interviews, worked with government documents, consulted with professional historians in academia, state, and federal agencies. The repositories for sources used in his research was a mixture of print and digital records in libraries, archives, museums, historic sites, and private collections. Cappucci worked carefully with representatives from the Marietta Restoration Associates, Inc., Marietta Historic District, Marietta Borough Council, Social Enterprise Institute at Elizabethtown College, and the consortium RiverStewards and Susquehanna Riverlands. Cappucci created a digital ArcGIS map to publish his research findings. The Marietta Historic District is part of the Susquehanna Pennsylvania Heritage Area. The Pennsylvania Department of Conservation and Natural Resources administers twelve Heritage Areas. Heritage PA is a multi-region asset-based economic development program rooted in Pennsylvania's natural, cultural, and industrial history. Heritage Areas create cross-sector partnerships enhancing a region's sense of place and strengthens regional economies. These partnerships create livable communities along the Susquehanna River attracting private investment and housing the products and places driving Pennsylvania's tourism industry. Cappucci's research about the historical significance of Marietta is contributing to the work of Susquehanna Heritage. This nonprofit organization collaborates with local, state, and national partners advancing the vision for the Susquehanna Riverlands as a national destination. A National Heritage Area designation will give the state Susquehanna Heritage Area access to federal funding and assistance from the National Park Service.

Student Author: Kyle Cappucci
Faculty Mentor: Jean-Paul Benowitz
Elizabethtown College

24. Hitched and Ditched: Northumberland County Divorces, 1910-1940
Using trial transcripts from divorce proceedings, newspaper accounts, and census records, this project studies the collapse of marriages in Northumberland County, Pennsylvania, in the first half of the twentieth century. The project pays particular attention to three aspects: (1) the gender roles at play in divorce cases, (2) the economic characteristics that drove couples apart, and (3) the prevalence of domestic abuse.

Student Author: Veronica E. Polyniak
Faculty Mentor: Edward Slavishak
Susquehanna University

25. Promoting Access to Health Care: The Role and Effectiveness of Obamacare Navigators
Inacted in 2010, the Affordable Care Act (ACA) aims to increase access of health care for individuals in the United States. Because the ACA established marketplaces in each state for the purchase of health care plans, it increased the level of difficulty for individuals to navigate the health care system. This is where the role of the health care navigator becomes a vital aspect of the ACA. Health care navigators are individuals, who are often part of a larger organization, that guide consumers through the process of acquiring health care. Recent actions by the Trump administration have attempted to reduce or even eliminate the navigator program. The goal of this research is to understand the effectiveness of the ACA navigator network in Lancaster County by looking at the ability for those living in the surrounding area to access, comprehend, and make good decisions in the health insurance marketplace. The research seeks to understand the legal framework in place, analyze the role of the health insurance marketplace navigator, and take into account changes in administrative policy from Obama to Trump. Ultimately, this research will show how much of an impact the health insurance marketplace navigator has on ensuring ACA coverage for those living in Lancaster County.

Student Author: Abigail Evans
Faculty Mentor: Fletcher McClellan
Elizabethtown College

26. Signs of Peer Conformity and Anchoring
Pressure to conform to peers has been a constant in society, especially in uncertain situations in which people tend to anchor themselves to the thoughts or beliefs of others. This theory of peer conformity was explored through standard and control versions of the bat and ball problem coupled with ratings for confidence in accuracy. The first part of this experiment was part of a direct replication that aimed to test whether participants (N = 246) are aware of substitution when solving variations of the bat and ball problem by comparing correct and incorrect (biased) answers with the confidence levels for each question. The study was extended to test whether peer performance influenced participants' confidence- this is the main focus of the present report. The extension question was tested using a standard version of the bat and ball problem followed by a fabricated statistic that either declared a 30% peer accuracy or 90% peer accuracy when answering the previous question. It was hypothesized that seeing the fabricated statistic about the percentage of peers who answered correctly would cause participants to anchor their confidence levels to that of the statistic, either 30% or 90%. Data supported the hypothesis in that, on average, those who saw the 90% fabricated statistic reported a higher confidence level than those who saw the 30% fabricated statistic.

Student Author: Chloe Mondok
Faculty Mentor: Dietlinde Heilmayr
Moravian College

27. Substitution Sensitivity, Confidence, and Role Models: A Replication-Plus-Extension of the De Neys Study
People have a tendency to unconsciously replace difficult questions with easier ones to reduce their cognitive effort (De Neys et al., 2013). In the present study, we set out to replicate this finding, as well as extend upon past research. The extension examined whether the sex of the participant and the number of same-sex role models a participant has was related to confidence in answers to questions that prompt substitution. We predicted that females with fewer than average role models would report the lowest confidence ratings. The study had a total of 242 participants (59.8% female). The average number of same-sex role models were calculated for both males and females, then the participants were dichotomized as '1' if they reported a greater number of same-sex role models than the mean and a '2' if they reported a fewer number of same-sex role models than the mean. While we replicated the substitution effect successfully, the 2 (role models) x 2 (gender) between-groups ANOVA displayed that there is no interaction between number of same-sex role models (above or below the mean) and gender (male or female) on confidence ratings; thus our hypothesis was not supported. Further research on this topic should be conducted as gender roles and careers adjust with changing societal norms. As more women tend to gravitate towards STEM careers today compared with past decades, (National Girls Collaborative Project, 2018), it is important to understand the role of same-sex role models in promoting confidence in women in areas that are historically male-dominated.

Student Author: Meghan Bauer
Faculty Mentor: Dietlinde Heilmayr
Moravian College

Oral Presentations - Hoover 211

1. Producing a Video Series for the Book Beyond the Dynamical Universe
Theoretical physics and foundations of physics have not made much progress in the last few decades. Whether we are talking about unifying general relativity and quantum field theory (quantum gravity), explaining so-called dark energy and dark matter (cosmology), or the interpretation and implications of quantum mechanics and relativity, there is no consensus in sight. In addition, both enterprises are deeply puzzled about various facets of time including above all, time as experienced. The authors argue that, across the board, this impasse is the result of the "dynamical universe paradigm," the idea that reality is fundamentally made up of physical entities that evolve in time from some initial state according to dynamical laws. Thus, in the dynamical universe, the initial conditions plus the dynamical laws explain everything else going exclusively forward in time. In cosmology, for example, the initial conditions reside in the Big Bang and the dynamical law is supplied by general relativity. Accordingly, the present state of the universe is explained exclusively by its past. This book offers a completely new paradigm (called Relational Blockworld), whereby the past, present and future co-determine each other via "adynamical global constraints," such as the least action principle. Accordingly, the future is just as important for explaining the present as is the past. Most of the book is devoted to showing how Relational Blockworld resolves many of the current conundrums of both theoretical physics and foundations of physics, including the mystery of time as experienced and how that experience relates to the block universe.

Student Authors: Alex Pecher and Tuyen Le
Faculty Mentor: William Stuckey
Elizabethtown College

2. Eclipsing Binary Star Systems with δ Scuti Components
Eclipsing binary star systems contain two stars that rotate around each other, which changes the light from the systems that is measurable from Earth. Some eclipsing binaries contain δ Scuti stars, which are stars that pulsate. These systems are interesting because they are doubly variable and there are less than 100 known systems. We have been studying these systems using telescopes at Lowell Observatory and Juniata College equipped with CCD cameras with two goals; to determine if some systems contain a δ Scuti component and to find a method to determine candidates for this type of system. Results of ongoing investigations will be presented.

Student Author: Sarah Coffman
Faculty Mentor: Matthew Beaky
Juniata College

3. Experimental Analysis of Standing Wave Patterns in a Microwave Oven Cavity
We want to experimentally verify the standing wave patterns in our microwave oven cavity. We have used various techniques in order to visualize the patterns. I will present some initial results from our study so far.

Student Authors: Sami Zain and Sana Ahmed
Faculty Mentor: Samya Zain
Susquehanna University

4. Thermographical Analysis of Standing Wave Patterns in a Microwave Oven Cavity
We will report on the thermographical analysis of standing wave patterns in our microwave cavity. We also plan to make computer simulations to reproduce experimental data, which will allow us to better visualize the standing waves.

Student Authors: Sana Ahmed and Sami Zain
Faculty Mentor: Samya Zain
Susquehanna University

Oral Presentations - Hoover 212

1. Assessing the Effects of Selective Serotonin Reuptake Inhibitors on Agonistic Behavior of the Invasive Crayfish *Orconectes rusticus*
The use of medication by humans has had unintended consequences for aquatic organisms. The excreted metabolites end up in the water, where they are absorbed by amphibians, fish and various invertebrates, altering their physiology and possibly behavior. Sertraline, a selective serotonin re-uptake inhibitor, is a widely prescribed antidepressant and has been shown to enter wastewater treatment through human excretion or direct disposal of unused drugs in toilets. Sertraline increases serotonin levels by blocking serotonin reuptake inhibitors. Studies have shown that increased serotonin levels in crayfish after a period of isolation increase aggression by decreasing the animal's willingness to retreat during agonistic encounters. Social experience is essential for modifying future interactions and can modify individual aggression. Individuals that win agonistic encounters can often become dominant, while losers become subordinate. It is unclear how social experience affects and is affected by changes in serotonin levels and potentially increased exposure to serotonin reuptake inhibitors that might be present in the surrounding environment. The aim of our study was to compare how serotonin and sertraline alter agonistic behavior of subordinate individuals. Following a 7-day social isolation period, pairs of same-sex, Orconectes rusticus were placed in a 10 gallon tank for a status establishment interaction. Once dominant and subordinate individuals were determined, opponents were placed in separate container. The subordinate individuals were randomly assigned to one of three treatment groups, 1) serotonin, 2) sertraline, or 3) saline. All dominant individuals were injected with saline to control for handling effects. Following injections, the same opponents were placed in the tank and allowed to interact again. All interactions were video-taped. We compared the quantity of offensive and defensive behaviors performed by subordinate individuals during the status establishment fights and the post-treatment fights. Also, agonistic behaviors between the pharmacological treatments were also compared. Here we present our preliminary findings.

Student Author: Amal Ismail
Faculty Mentor: Anya Goldina
Elizabethtown College

2. Assessing chemical communication in the invasive crayfish *Orconectes rusticus*.
Orconectes rusticus is an invasive crayfish species that has disrupted ecosystems in the Northern Eastern United States. Eradication methods have been ineffective. Because crayfish communicate chemically by secreting pheromones, understanding what information these pheromones carry can help develop baited traps that will improve trapping efficiency. The aim of this study was to determine how *Orconectes rusticus* respond to chemical signals produced by conspecifics of the same and opposite sex. Previous studies in our lab have shown that female *O. rusticus* are attracted to pheromones produced by males, but don't exhibit avoidance or attraction to signals produced by females. Males, on the other hand, avoid signals produced by conspecific males, but do not exhibit a differential response towards female signals. However, in these studies, all individuals were presented with a same or opposite sex pheromone vs. a no pheromone control using a Y-maze. In our study, we examine how *O. rusticus* respond to same and opposite-sex pheromones when presented with these signals simultaneously. We collected pheromones by socially isolating male and female *O. rusticus* for 7-9 days in small 1.5 liter containers. At the end of isolation period, the water in the containers was filtered and combined with water from other same-sex individuals to create a pheromone stock. The resulting pheromone stocks were pumped through the arms of the Y-maze. The pheromone assignment to a given arm of the maze was randomized. The behavior of the crayfish at the base of the Y-maze was videotaped and individuals were believed to make a choice when they moved towards or away from one of the arms. In this study we present our preliminary findings.

Student Author: Elizabeth Luscavage
Faculty Mentor: Anya Goldina
Elizabethtown College

3. Application of Next-Generation Sequencing Techniques to Identify Biomarkers of Prosthetic Joint Infections
Prosthetic joint infections (PJIs) are one of the most severe complications of joint replacement surgeries as they are difficult to diagnose and often diagnosed late due to current tests lacking sensitivity and specificity. This project aims to optimize the extraction of microbial DNA and RNA from knee and hip joint synovial fluid to identify potential microbial biomarkers of PJIs and benchmark this next generation sequencing approach as a potential detection method. Synovial fluid samples were collected from patients with primary joints, aseptic joints, and infected joints at the Rothman Orthopaedic Institute (Philadelphia, PA). DNA and RNA were extracted from each sample, then library prepared for 16S rRNA, metagenomic (MG), and metatranscriptomic (MT) sequencing. Beta diversity analysis of MT and MG synovial fluid data showed statistically significant ($p=0.001$) clustering of primary, aseptic, and infected samples, revealing distinct microbial community compositions. Comparatively, less significant clustering ($p=0.025$) between the three cohorts is observed in 16S rRNA synovial fluid data compared to MT and MG. Within the MT dataset, E. coli were found to be most significantly enriched ($LDA = 4.04$, $p = 0.00094$), in infected samples, with C. acnes, S. epidermidis, and S. aureus also being observed in high abundance. Concordance of MT and MG data with synovial fluid culture results was 87%, with six out of seven bacterial taxa detected, while 16S rRNA data yielded 0% concordance. Antibiotic resistance gene (ARG) screening of MT synovial fluid samples yielded a total of three unique ARGs, blaTEM-171, aph(3')-IIa, and catA1, while only one ARG (aph(3')-IIa) was identified in the MG dataset. Overall, this study illustrates the ability to use next generation sequencing to profile the microbial communities in joint synovial fluid and identify potential biomarkers for PJIs. Moreover, it has potential to inform and improve PJI diagnosis and treatment. Future work will involve using this data to track common contaminants, to develop predictive modelling tools for PJIs, and to better understand how microbial interactions are driving pathogenicity.

Student Author: Lavinia Unverdorben
Faculty Mentor: Regina Lamendella
Juniata College

4. Regulation of Healthy Aging through Symbiosis with Gut Bacteria
The gut microbiome, which is formed by the accumulation of consumed bacteria, holds great influence over the host, including host processes such as immune responses, development, nutrient and lipid metabolism, and lifespan. The exact methods by which a host and its resident microbes interact have yet to be fully understood. Defining and elucidating the relationship between the host and its gut microbiome can lead to a better understanding of the influence each holds over the other. Here we use the tractable genetic model organism Caenorhabditis elegans, a transparent roundworm whose genetic and metabolic processes are well defined, to study the effects of host environment on bacterial metabolics. The evolutionarily conserved IIS pathway in C. elegans has direct interaction with bacterial colonizers by integrating insulin and insulin-like signaling (IIS) molecules of the intestine into metabolic and behavioral responses. We sought to understand the relationships between aging, the IIS pathway, and microbial stressors by comparing the transcriptomic profiles of E. coli fed to hosts with different genetic backgrounds, including the long-lived daf-2/insulin like growth factor receptor mutants and short lived daf-16/FOXO transcription factor mutants, finding 167 and 133 enriched genes respectively when compared to E. coli fed to N2/wild-type worms. We thus demonstrate that host genetics influence bacterial metabolic processes, including those involved in environmental adaptation and biofilm formation. This will be further tested with continued transcriptomic profiling and fluorescent imaging. Additionally, the effect of biofilm-formation in gut bacteria on host longevity, which has been found to be a positive host lifespan regulator, will be tested through lifespan assays involving the commensal biofilm-forming bacteria B. subtilis, and additional transcriptomic assays involving B. subtilis will follow. Since composition, behavior, and over-proliferation of gut microbiota has been linked to both adverse and beneficial health implications in the host, further examination can elucidate genes involved in the role of intestinal microbiota in healthy host aging.

Student Authors: Cade Emlet and Josh Brycki
Faculty Mentors: Jason Chan and Regina Lamendella
Juniata College

Oral Presentations - Hoover 213

1. Environmental Justice and Food Ethics: A Look into the FDA Organic Label Movement and its Effects on Local Communities

Organic agriculture is an emerging market sector in USDA agricultural business. The majority of those who take organic labeling into consideration when they are purchasing their food products from stores have some idea about the USDA certified organic label on the product's packaging, however, there is also much left unknown. What is this label and how does one get an organic certification? In this project, I am researching the organic certification process and larger ethical questions regarding the human relationship with nature and foodstuffs. In particular, I will be exploring the erosion of local ecological knowledge and how this can impact understanding of the "organic" standard. Organic certification currently is limited by the USDA to those farmers and producers who can produce a specific quantity of goods to sell and neglects those who are serving their communities in farmers markets and other local communities. In order to fix this, ensuring the resources of the USDA are actually reaching these communities is vital for the expansion of organic certification and labeling and the maintenance of local ecological knowledge in the United States. This project will explore the tensions between economic, social, and environmental well-being in the context of organic food and management practices for sustainability.

Student Author: Caitlin Olivas
Faculty Mentor: Alexandria Poole
Elizabethtown College

2. The Need for a Culture of Sustainable Agricultural Ethics as a Response to Biocultural Homogenization, Food Shortages, and Environmental Degradation

This project explores the ways that permaculture, agroforestry, silvopasture, and other sustainable agricultural practices and approaches can positively contribute to solving issues related to global climate change and the environment. It specifically focuses on the benefits produced in regard to resolving environmental degradation, mitigating food shortage issues, and decreasing the loss of biocultural, linguistic, and cultural diversity (biocultural homogenization). Environmental health has the potential to be drastically improved with the use of these methods, exemplified by increased carbon sequestering capabilities, higher soil water retention rates, greater biodiversity and support for wildlife, and many other factors relating to ecological well-being. Food availability could be expanded through access to local foods and a greater knowledge base of edible native species. The deep connection to one's local environment as well as the environmentally-conscious values and lifestyle habits embedded within permaculture and the like provide crucial tools that encourage a transition to a more sustainable society. Exploration of how tending the land holistically in ways more aligned with Earth's natural systems can shift the human-nature relationship into one built out of care and reciprocity could offer the paradigm shift necessary to combat anthropogenic effects on climate change.

Student Author: Georgia Grimm
Faculty Mentor: Alexandria Poole
Elizabethtown College

3. Effect of Community Gardens on Enjoyment in Reminiscing and Emotional Response to Past Events in Refugees

As a refugee, assimilating into the United States poses many challenges. Refugee-run community gardens have been shown to be an aid in the transition process, providing socialization and safety for individuals of similar backgrounds. For the present study, 18 refugee community gardeners completed surveys and were interviewed about their lives as refugees as well as about the time they have spent in the United States thus far, specifically relating to their time in the garden. The goal of this study is to determine the degree to which themes that arose in the interviews relate to assimilation in the United States. The interviews were coded for two themes: enjoyment in reminiscing (on a scale from 1-3) and emotional response to past events (on a scale from 1-5). We calculated Pearson r correlation coefficients between these two themes, as well as between the themes and certain scales in the quantitative survey (i.e., interest in one's own heritage, interest in American heritage, and length of time living in the United States). Statistically significant correlations were only found between the two individual themes; however, correlations between the other concepts had interesting directional characteristics. Overall, participants were positive about the community gardens as an aid in transition for refugees suggesting that gardens for refugees warrant more research on how and why they aid in the transition process.

Student Author: Meghan Lazarchak
Faculty Mentor: Dietlinde Heilmayr
Moravian College

4. Sustainability and Social Return on Investment of Medical Legal Partnerships
Innovative research approaches have demonstrated that civil justice and socio-legal needs have an influence on health outcomes through the interplay of the social determinants of health. For example, medical-legal partnerships have emerged in the United States as a mechanism to reduce health disparities by alleviating the social and environmental factors that contribute to acute and chronic disease burden. Moreover, there is an emerging research base that documents the statistical association between civil justice and health at an individual and ecological level. Following a logical progression, inequities in access to the civil justice system have a role in driving health disparities. According to the 2018 World Justice Project's Rule of Law Index, the United States ranks 99th out of 126 countries in access and affordability to civil justice, in a five-way tie with Mozambique, Tanzania, Uzbekistan, and Zambia.Medical legal partnerships have been used across the country since 1993 to bridge this health and justice gap. By integrating lawyers and healthcare providers, medical legal partnerships (MLP's) work to alleviate upstream variables that are negatively impacting health. MLP's require a complex integration of disciplines and cooperation between stakeholders. MLP's have the unique ability to benefit the financial interests of the hospital and the medical interests of the patient. Financial and social return on investment arguments support that healthcare organizations benefit from providing civil legal assistance to their most vulnerable and disadvantaged patients. Additionally, using the Program Sustainability Assessment Tool, MLP's can be analyzed across eight dimensions (strategic planning, funding stability, partnerships, organizational capacity, program evaluation, program adaption, communications and environmental support) to identify both positive and negative aspects of MLP sustainability. Using data from the Lehigh Valley Health Network's Medical Legal Partnership, along with data from a national assessment of MLP sustainability arguments are presented on the strengths, weakness, opportunities, and threats for MLP sustainability.

Student Author: William Pelletiers
Faculty Mentor: James Teufel MPH, PhD
Moravian College

Oral Presentations - Hoover 214

1. Synthesis and Characterization of Tris(phenol)amine Ligands and their Corresponding Tripodal Iron Complexes
The synthesis of tripodal iron complexes can mimic the function of enzymes. They been studied for a wide-range of applications including as models for the intradiol-cleaving dioxygenase process or as catalysts in the CO2-reduction process. Our goal in this research project is to synthesize tris(phenol)amine ligands with different steric and electronic properties and to compare their effects on the formation and properties of the resulting complexes. We predict that different ligand environments will affect properties that relate to their catalytic behavior, including the availability of the metal ion for substrate binding and the Lewis acidity of the metal ion. To synthesize a family of tris(phenol)amine ligands, we have reacted differently functionalized phenols with hexamethylenetetramine using p-toluene sulfonic acid as a catalyst for this reaction. To synthesize metalated complexes, we react iron(II) acetate with the isolated ligands in the presence of an oxidant and dimethylaminopyridine. This presentation will describe progress toward the isolation of several iron coordination complexes of interest.

Student Author: Marie Heidler
Faculty Mentor: Ursula J. Williams
Juniata College

2. Synthesis and Anti-mitotic Studies of Cannabichromene-based Oxime Ester Derivatives
Cannabichromene (CBC) is a cannabinoid present in Cannabis sativa that does not cause the psychoactive effects that are associated with the more common cannabinoid, THC. The dialkyl chromene moiety present in CBC is present in a number of biologically active compounds, such as antibacterial and anticancer agents. Oxime esters are also biologically relevant molecules, showing antimicrobial, antioxidant, anticancer and anti-inflammatory properties. In this study, hybrid molecules incorporating both CBC-based chromene and oxime ester moieties were synthesized in three steps: chromenylation of 2,4-dihydroxybenzaldehyde, followed by oxime formation and esterification using a variety of aromatic acid chlorides. The products were purified by silica gel chromatography, and characterized using IR and NMR spectroscopic techniques. The oxime and an oxime ester derivative were evaluated for anti-mitotic activity using sea urchin embryos.

Student Author: Eden Parks
Faculty Mentor: Geneive Henry and Peggy Peeler
Susquehanna University

3. Nanoparticles from Green Sources: Synthesis, Characterization and Singlet Oxygen Generation
Gold and silver nanoparticles have been synthesized using conventional and green methods. Green sources include green tea, lemongrass and raspberry extracts. The nanoparticles were characterized using UV-vis spectroscopy, light scattering and SEM, and their ability to generate singlet oxygen upon laser irradiation was investigated.

Student Author: Rebekah Klock
Faculty Mentor: Swarna Basu
Susquehanna University

4. Size, Shape and Source-Specific Properties of Nanoparticles: Raman Signal Enhancement and Dye Deactivation
Iron and gold nanoparticles have been synthesized using conventional and green (ex. Eucalyptus, rosemary) sources and characterized using UV-vis spectroscopy, particle size analysis and SEM. The ability of nanoparticles of different shapes and sizes to serve as Raman signal enhancers, and their ability to deactivate common food dyes has been investigated in this study.

Student Author: Carissa Wolfe
Faculty Mentor: Swarna Basu
Susquehanna University

Concurrent Session # 2

Poster Presentations

1. Examining Preservation Methods for Long-Term Fecal Matter Storage
Fecal Matter Transplants (FMT) are often used as a last resort treatment for patients who have a C. diff infection. Clostridium difficile (C. diff) is a common hospital-acquired pathogen which replaces healthy bacteria in the GI tract and disrupts their normal function. Due to antibiotic overuse, C. diff often resurfaces after antibiotic treatment. In order to more effectively treat C. diff and other bacterial diseases or infections, other methods of treatment should be utilized. FMT's use stool samples from healthy individuals to reestablish the microbiota in the gut after an infection occurs. Because of U.S. Food and Drug Administration regulations and social stigma, antibiotic treatments are the preferred method to treat C. diff. In order to reduce the social stigma surrounding FMT's, research of further methods of fecal matter preservation could lead to a more personalized stool banking process. Utilization of personally banked stool samples could more effectively reintroduce naturally growing bacteria in the gut and decrease the chance of illness after treatment. Previous data verifies the preservation of DNA in samples that have been stored. However, the viability of the cells was unknown. The focus of the conducted research this summer was to test the viability of cells using stool samples donated by dogs. Samples were stored at -80oC in four different conditions for three weeks to determine the best method for cell preservation. Our goal was to identify the method that best retains cell function. To measure the metabolic activity of living cells after storage, BioLOG plates were used. Analysis of the data collected from the BioLOG plates will help to determine cell viability and assist in supporting further preservation methods in the future.

Student Authors: Celeste Workman and Caroline (Veronica) Ruiz
Faculty Mentor: Debra Wohl
Elizabethtown College

2. Increasing Awareness of Natural Areas on the Elizabethtown College Campus through Digital Story Maps and Ecological Restoration
The campus of Elizabethtown College includes multiple types of ecosystem—forests, meadows, wetlands, streams, and ponds. These areas can serve as outdoor extensions of the classroom, presenting convenient settings for research projects. They are also a valuable recreational resource. To increase student awareness of the natural areas of the campus, we are utilizing ArcGIS technology to create a story map of trails on campus, to be used for self-guided tours or tours guided by student volunteers. Story maps define the path and draw attention to notable or ecologically interesting locations along the path. Photos and detailed descriptions in the story map act as a starting place for students who want to know more about features of campus related to sustainability. We are creating two mapped versions of the trail—they vary in length, type of terrain, difficulty, and intended audience. The more basic trail, which only covers paved and packed gravel terrain, will be accessible to prospective students and families interested in learning about Etown's natural lands and the learning opportunities they offer. The second trail is a more rigorous hike through densely wooded areas, best suited for those with a desire to learn and a willingness to make the more challenging trek. In addition, we are planning ecological restoration of a section of forest. Restoration will involve removal of invasive plants and planting with selected native species, with the objective of increasing plant and animal biodiversity of the restored area. Our goal is for the area we restore and the process we follow to serve as a model for future student restoration projects.

Student Authors: Aprille Mohn and Janelle Hessler
Faculty Mentor: Diane Bridge
Elizabethtown College

3. The Quantification of Microplastics Sampled from Fresh Water, Sediment, and Various Organisms on Goucher College's Campus

Microplastics (MP) are plastic particles which are less than 5 mm in length and have varying colors, sizes, and chemical compositions. MP are found globally and transported via water and atmospheric deposition. They are typically created by the degradation of larger plastics but can also be produced commercially, i.e. microbeads in cosmetics and fibers shed from washing synthetic clothing. Surface water samples, sediment samples, and various organisms were collected from 3 bodies of water (2 ponds and a stream) on Goucher College's campus. The quantity and physical characteristics of MP in these samples were examined through brightfield and fluorescence microscopy using a Nile Red solution to stain the MP.

Student Authors: Yazan Alasadi, Miranda Janello and Madison Wester
Faculty Mentors: Cynthia Kicklighter
Goucher College

4. Phenotypic Analysis of Tfiia-S-2 Mutants in Drosophila Melanogaster

During the development of a multicellular eukaryotic organism, there is a complex program of gene expression that causes cells to differentiate into specialized cells. Although each cell in an individual organism contains the same genome, each cell type expresses a different combination of genes that give rise to that unique function. In many cases, the precise mechanisms that control the expression of genetic information are unclear. The first step of the general mechanism is the transcription of DNA code into RNA by RNA Polymerase II (RNAP II). During the initiation of transcription, General Transcription Factors (GTFs) influence RNAP II function. One GTF, TFIID, is composed of a DNA binding protein (TBP) and TBP Associated Factors (TAFs). In Drosophila melanogaster, there are testis-specific versions (homologs) of the TAF genes (tTAFs). Male flies with mutations in tTAF encoding genes do not express spermatid differentiation genes normally and are sterile. TFIIA, another GTF, is made of the subunits alpha, beta, and gamma. TFIIA functions by associating with TBP, TAFs ,and DNA to help position RNAP II on DNA.The gamma subunit of TFIIA is encoded by the tfiia-S gene, of which flies have a homolog that is testis-specific, tfiia-S-2. To determine the role of tfiia-S-2 in spermatogenesis, a mutant was generated using CRISPR technology. Since TFIID and TFIIA physically associate and function at the same stage of transcription, tfiia-S-2 mutant males were expected to be infertile like the tTAFmutants. However, the tfiia-S-2 mutants were fertile. We are now testing the tfiia-S-2 mutants to further characterize the mutant phenotype.

Student Author: Sylvia Beam
Faculty Mentor: Mark Hiller
Goucher College

5. Rescue of Retinal Regeneration in the Tgif1 Mutant Danio Rerio

The nervous system of Danio rerio, the zebrafish, has formidable regenerative capacities as seen in its reacquisition of retinal function following injury. While it is now understood that the proliferation of dedifferentiated Müller glia facilitates this regeneration, the genetic and molecular mechanisms are still being explored. Ascl1a is a proneural transcription factor upregulated by TGFβ signaling that has a significant role in promoting regeneration. Homozygous Tgif1 mutant fish express a truncated Tgif1 protein and have decreased retinal regeneration, likely due to upregulated TGFβ signaling. This increase in signaling causes increased expression of Ascl1a. With too much Ascl1a expression too early in retinal regeneration, it is possible that neural progenitors do not viably proliferate. Therefore, we hypothesize that knockdown of Ascl1a activity should rescue the regeneration phenotype observed in Tgif1 zebrafish mutant.

Student Authors: Zaidel Sanchez and Elizabeth Hannifin
Faculty Mentor: Jenny Lenkowski
Goucher College

6. Identification and Characterization of the Culturable Danio Rerio Skin-Mucus Microbiome

The zebrafish, Danio rerio, serves as a model organism for vertebrate development because their genetic structure is similar to humans. The microbiome is a community of organisms, like bacteria or fungi, that inhabit a particular environment in or on an organism such as the fish or human skin and/or gut. The gut microbiome of the zebrafish is well studied, but there is very little research involving the skin-mucus microbiome. It is widely accepted that the skin-mucus is part of the innate immunity of zebrafish and contains a variety of bacteria. The aim of this study is to culture, identify and characterize gram-negative and gram-positive bacteria that are prominent members of the zebrafish skin mucosa microbiota. Culture-dependent identification was performed by utilizing high-throughput biochemical fingerprinting and classical biochemical assays. From this experiment, we aim to establish a collection of zebrafish-associated bacteria to further explore their functional roles in the health of the fish host.

Student Authors: Gabrielle Blazek, Alyssa Long and Jasmine Wangui
Faculty Mentor: Anna Jozwick
Goucher College

7. Ecology of Metabolic Scaling: Interactive Effects of Temperature and Predation Regime on Amphipod Crustaceans in Freshwater Springs

According to common belief, the body-mass scaling of metabolic rate follows a 3/4-power law that results chiefly from intrinsic body-design constraints. However, several studies have shown that metabolic scaling varies considerably with log-log slopes ranging mostly between 2/3 and 1, and often in response to environmental factors. The mechanistic basis of these ecological effects is largely unknown. Furthermore, nothing is known about whether abiotic and biotic environmental factors have interactive effects on metabolic scaling. To address this question, our laboratory has been studying the interactive effects of temperature and predators on the ontogenetic metabolic scaling of the amphipod crustacean Gammarus minus found in local freshwater springs. We have acclimated amphipods from native spring habitats with and without fish predators to three temperatures (4, 10 and 16oC) in the laboratory. We estimated oxygen consumption rate, a proxy for metabolic rate, in amphipods with different sizes, using a closed respirometry system at controlled temperatures. Temperature interacts significantly with natural predator regime. Our results suggest that metabolic scaling is highly malleable and ecologically sensitive. The interactive effects of temperature and predators also show the importance of studying effects of global warming in realistic ecological contexts.

Student Authors: Natalie E. Donofrio and Jacob M. Owings
Faculty Mentor: Douglas S. Glazier
Juniata College

8. The Interactions between Gut Microbiome-Inflamm-Aging and Risk to Cardiometabolic Diseases

The incidence of cardiometabolic diseases is increasing alarmingly in the USA and world over, specifically in the elderly population. The CDC statistics suggest more than 40% of the population will die from cardiometabolic diseases due to lack of appropriate preventive strategies. Adipose dysfunction increases with age, which dramatically alters fat mass, redistribution and function, leading to metabolic imbalance and increased risk to cardiometabolic diseases. There is also chronic increase in inflammation with aging, also known as 'inflamm-aging' and predisposes one to higher risk of cardiometabolic diseases. Here we investigate the interactions between gut microbiota-inflamm-aging and risk to cardiometabolic diseases. This study investigates the temporal changes in the structure and gut microbiota in the Fischer 344 x Brown Norway hybrid rats (FBN), a model to study aging-related pathologies since these rats develop similar pathologies as humans with advancing age. Our main goal is to correlate inflammatory signatures in plasma/serum of aging rats with specific dynamic changes in the gut microbial community. 16S rRNA gene sequencing will be used to profile the gut microbiome at five time points within FBN rats ages 3-30 months. Glucose, insulin, and lipid profiles, as well as immunological signatures will be correlated with gut microbiome profiles to reveal which bacterial assemblages correlate most strongly to host markers during the onset of insulin resistance. Correlations between bacterial taxa and inflammatory and insulin, glucose, and lipid markers will enable integration of host and microbial signatures associated with disease progression. Exploring fecal microbiome will provide mechanistic insight as to if and how therapeutic interventions might promote restoration of microbial balance.

Student Author: Brooke Shuck
Faculty Mentor: Regina Lamendella
Juniata College

9. Microbial Community Structure and Function in Headwater Stream Ecosystems Proximal to Hydraulic Fracturing Activity

Unconventional oil and gas (UOG) extraction, also known as hydraulic fracturing (HF), is becoming more prevalent with the increasing use and demand for natural gas; however, the full extent of its environmental impacts is still unknown. Hydraulic Fracturing (HF) operations utilize an extraction method consisting of injecting a mixture of water, sand, biocides, and other chemicals into methane-rich shale deposits via horizontally-bored wells to fracture the rock and release gasses for harvest. Recent research has indicated possible contamination of water resources by nascent hydraulic fracturing activities, via produced wastewater that can enter nearby groundwater or surface water via faulty well casings, leaks in holding ponds, or spills. Here we investigate the microbial community structure and function of headwater streams in close proximity to hydraulic fracturing activity. We employed 16S rRNA gene and metatranscriptomics sequencing in samples from 24 sites with varying degrees of HF impacts to assess differential community structure and metabolism. The QIIME and Biobakery pipelines were used to analyze sequence data and assess differences in microbial community structure and function in relation to their proximity to HF operations. Preliminary data revealed differential microbial community structures and elevated antimicrobial resistance gene expression in sites proximal to fracking activity. This research can help to elucidate the potential environmental impacts of HF activities and lead to the development of new diagnostic tools for evaluating environmental impacts related to hydraulic fracturing.

Student Author: Olivia Wright
Faculty Mentor: Regina Lamendella
Juniata College

10. Analysis of Correlated Gene Expressions between C. elegans and E. coli using Weighted Gene Co-Expression Network Analysis (WGCNA)

The interactions between a host and its associated microbiota form complicated networks that can affect host physiology. Disentangling these host-microbe interactions can help scientists better understand the mechanisms by which bacteria affect hosts, while also defining the integral commensal protection that host-associated microbiota offer to promote health. Previously, the relationships between individual host genes and bacterial genes have been studied but the gene network interactions between the host and bacteria have not been understood well. Integrating the complex network interactions between a host and its microorganisms can provide more information about beneficial and antagonistic interactions that exist. Using the eukaryotic model organism, Caenorhabditis elegans as a host and the microbial model organism, E.coli OP50, we analyzed various networks of host-bacterial gene interactions. The sequencing of the host and resident microbe genes was performed using a shotgun RNAseq approach. After annotation of bacterial and host genes, we performed network analysis using Weighted Gene Co-expression Network Analysis (WGCNA). Our goal is to correlate host and bacterial gene expression profile to discover novel co-expressed genes within wildtype, short-lived, and long-lived worms in order to investigate how host-microbial interactions are different within these three worm models. Understanding these relationships will lay the foundation for deeper exploration of host-microbe interactions within the digestive system which may shed light on the role host-microbial interactions in host physiology.

Student Authors: Nathan Heibeck and Jaewoo Kim
Faculty Mentors: Regina Lamendella, Vincent Buonaccorsi and Jason Chan
Juniata College

11. The Role of Ceramide Synthases in the Mediation of Heavy Metal Stress

Cadmium is an extremely toxic heavy metal that is hazardous to human health. Cadmium enters the environment through a variety of sources, including industrial practices, agriculture, and cigarette smoke. It is present in agricultural pesticides, which can lead to the contamination of food. When consumed Cadmium can cause organ damage. Prolonged exposure to Cadmium can result in conditions such as pulmonary edema, renal dysfunction, osteoporosis, bone fracture, and cancer. The toxin has been known to induce stress in organisms by causing a buildup of reactive oxygen species. Stress response is known to be mediated by the sphingolipid pathway. Our goal was to further analyze the effect of Cadmium on animals and determine whether sphingolipids play a role in an animal's response to Cadmium. We utilized the model organism Caenorhabditis elegans. Specifically, we examined the role of one sphingolipid metabolism enzyme, hyl-2/ceramide synthase, in heavy metal stress response. hyl-2/ceramide synthase converts sphingosine to ceramide in the cells. Ceramides regulate reactive oxidative species (ROS) in the body. We found that Cadmium does not have an effect on animal reproduction, but it does affect longevity. We also found that the hyl-2 gene is vital for oxidative stress response mechanisms. These results are important because stress plays a role in aging, and if we better understand how stress is regulated via ceramide signaling, it could become a potential pharmaceutical target to slow the degradative aging process and help to retain function.

Student Author: Margaret Peck
Faculty Mentor: Jason Chan
Juniata College

12. Sptl-1 Knockdown to Test Sphingolipid Function on Adult Physiology

Sphingolipids make up a large portion of somatic cells, 10% to be exact, and they are important for cell signaling which mediates survival of muscle, epithelial, and nervous tissue, as well as provide structural support for lipid membranes. Indeed, inhibition or mutation of the metabolic enzyme, serine palmitoyl transferase (sptl-1 in Caenorhabditis elegans) disrupts lumen formation during development and extends lifespan of sptl-1 mutants. Sptl-1 is the critical enzyme that produces sphingolipids de novo by catalyzing the production of sphinganine from serine and palmitoyl-CoA. Sphinganine, then, is a precursor for the production of more complex sphingolipid metabolites, including ceramides and glucosylceramides, sphingomyelin, and gangliosides. Given that the balance of cellular levels of sphingolipids are part of the stress response mechanisms, a greater understanding of de novo sphingolipid metabolism in adults is important. Here, we aim to determine how the sptl-1 gene contributes to the growth and function of C.elegans by analyzing how adult specific knockdown of sptl-1 alters body size, stress response, and neuromuscular function using RNAi. These experiments will help us determine the role sptl-1 has on sphingolipid synthesis aspects of worm physiology.

Student Author: Julia Witkowski
Faculty Mentor: Jason Chan
Juniata College

13. Sex Differences in the effect of acute alcohol treatment on tyrosine hydroxylase immunoreactivity in the mesolimbocortical dopamine pathway in mice

There is a notable sex difference in how alcohol effects physiology and behavior. Females require less alcohol to become intoxicated and may have an enhanced susceptibility to addiction. Alcohol increases dopamine signaling in the mesolimbocortical dopamine reward pathway, but this could occur in a variety of ways, such as increased release, increased receptor density or decreased reuptake transport. In addition, alcohol stimulates GABA signaling, which indirectly affects dopaminergic signaling in the reward pathway. Another possible way that alcohol could stimulate dopaminergic signaling in the reward pathway is by increasing in the production of tyrosine hydroxylase, the rate-limiting enzyme for dopamine synthesis. Therefore, we hypothesized that acute alcohol intoxication increases tyrosine hydroxylase protein expression to stimulate dopaminergic signaling in the reward pathway in a sex-dependent manner. To test this hypothesis, male (n=16) and female (n=16) wild-type Swiss Webster mice were injected intraperitoneally with 2g/kg ethanol or saline. Two hours postinjection animals were sacrificed by overdose with sodium pentobarbital and perfused with saline followed by 4% paraformaldehyde. Brains were removed and post-fixed in 4% paraformaldehyde followed by a 30% sucrose sink. 35 micron thick brain sections were processed for immunohistochemical staining for tyrosine hydroxylase (Anti-TH, 1:3000, EMD Millipore). In female mice, ethanol treatment increased tyrosine hydroxylase positive cells in the ventral tegmental area (139 + 20 vs. 191 + 25 cell number, $p<0.05$) and increased tyrosine hydroxylase fiber immunoreactivity in the nucleus accumbens (19 + 9 vs. 56 + 15, A.U., $p<0.05$). Tyrosine hydroxylase expression in the reward pathway was unaffected by ethanol treatment in males. The results of this study indicate that the reward pathways in the brain respond differently to acute ethanol intoxication in males and females, and it has further implications for understanding mechanisms underlying alcohol addiction.

Student Authors: Hannah Kelly-Quigley, Kiarah Leonard, Josh Betz and Sam Stea
Faculty Mentors: Erin Rhinehart and Judy Grisel
Susquehanna University

14. Ten Years on the Upper Main Stem of the Susquehanna River

The upper main stem of the Susquehanna River is formed by the confluence of the North Branch, impacted by abandoned mine drainage, and the West Branch, which is impacted by agriculture, at Sunbury, PA. The plumes of the branches remain chemically and physically distinct through the upper main stem and allow a transect below the confluence to integrate conditions of both branches. For the past decade (2009-2018) field measurements (using a YSI 556 multimeter) and laboratory analyses (using an ICS Dionex-2100) have documented chemical and physical parameters through the summer and fall seasons when not impacted by major flood events. Biological samples (benthic macroinvertebrates and diatom periphyton) were taken during the same periods at established sites across the river near the USGS Sunbury gage, which allows insight on the dynamic nature of the river and the influence of discharge on the chemistry and biology of the river.

Student Authors: Kendra Dietrich, Stephanie Reyes Munoz and Jackson Long
Faculty Mentors: Jack Holt and Ahmed Lachhab
Susquehanna University

15. Optimization of a one-pot allylation and Claisen rearrangement of acetaminophen by applying microwave radiation

The Claisen rearrangement is a widely applicable organic reaction that involves the shift of a sigma bond across the pi-system of an allyl vinyl ether to produce allylated phenols. In this project, we aim to develop a microwave assisted allylylation of a phenol, followed by a subsequent Claisen rearrangement in one pot. The goals of this project are three fold. First, we aim to accelerate these reactions using microwave assisted organic synthesis because to date, microwave technology has been sparsely used in Claisen chemistry. Second, we aim to perform these reactions in a single pot, enhancing the simplicity and elegance of the reaction. Finally, our research group has an interest in allylated phenols given the allyl group can be used to attach the ring to other molecules. Acetaminophen was chosen as a model phenol to test the chemistry. As a result, this also affords derivatives which like acetaminophen, could have analgesic properties. Initial studies reveal that the Claisen rearrangement of allylated acetaminophen requires a reaction time of under ten minutes in the microwave compared to hours when performed under reflux. Further optimization of other components of the reaction are ongoing.

Student Author: Brandon Tessier
Faculty Mentor: James MacKay
Elizabethtown College

16. Synthesis of an Amide-based Extended Heterocyclic System Capable of Hydrogen Bonding to Both the Adenine and Uracil in dsRNA for RNA Recognition using PNA

The majority of information known about RNA is centered around coding RNA for its role in synthesizing proteins from DNA. However, noncoding RNA is also biologically relevant, showing importance in gene expression and catalyzing reactions. Peptide Nucleic Acids, or PNAs, are a promising tool that can be used to study noncoding RNA. PNAs can bind to double-stranded RNA forming a triple helix and are highly selective for specific sequences of dsRNA. A current limitation of PNA as a ligand is that traditional nucleobases only bind with high affinity to single purine residues on the RNA, as triplex formation relies on the two hydrogen bonding sites offered by purines as opposed to only one offered by pyrimidines. More recent developments in our group and others have shown that synthetic nucleobases may be used to increase both affinity and selectivity. We have synthesized a uracil nucleobase modified to bind both the adenine and the uracil of the A-U base pair by adding a benzamide moiety to isoorotic acid. Computations suggest that this will increase the affinity of binding and make PNA relevant for use in dsRNA sequences containing both purine and
pyrimidine bases.

Student Author: John Talbott
Faculty Mentor: James MacKay
Elizabethtown College

17. Computational and Synthetic Approach to the Design of Imidazole based PNA Nucleobases for the Recognition of AU Watson-Crick Base Pairs

The central dogma of molecular biology characterized RNA as a passive messenger in the translation of genetic information. It is now understood that RNA transcripts execute a variety of biological functions, including gene expression, catalysis, and post-transcriptional modification. As more transcripts are discovered, the ability to identify and regulate them will become crucial to their understanding. Peptide Nucleic Acids (PNA) are promising due to their sequence-selective recognition of dsRNA. PNA is a synthetic analog of nucleic acids that contains a nonionic peptide backbone rather than the traditional highly charged phosphodiester backbone. This neutral charge and PNA's easily modifiable sequence promote effective binding with strands of dsRNA through triple helical formation. This project utilizes computational analysis to guide the design of modified PNA nucleobases that recognize the AU base pair in dsRNA. These computations, performed at the PM6 and Hartree-Fock levels, revealed crude binding energies, molecular geometry, and hydrogen bond lengths in a variety of modified scaffolds containing two 5-membered ring heterocycles extended from the uracil nucleobase. Computational data introduced the design of a 1,2,3-triazole scaffold attached to an imidazole that promised a more favorable binding energy than an isolated uracil nucleobase due to the additional hydrogen bond on the pyrimidine base of the dsRNA. Additionally, this structure's planarity makes it suitable for pi-stacking, further promoting triple helical stability. Efforts are underway to produce this modified triazole scaffold and extended imidazole base via organic synthesis. This monomer can then be utilized in polymeric form to promote sequence-selective
recognition and regulation of double-helical RNA.

Student Author: Emily Kagarise
Faculty Mentor: James MacKay
Elizabethtown College

18. Luminescent Metal-Organic Frameworks

Metal-organic frameworks (MOFs), porous materials composed of metal ions and organic linkers, have broad applications in separation, small molecule storage, and catalysis. Luminescent metal-organic frameworks (LMOFs) hold great potential in the development of sensors, and, with their relatively straightforward syntheses that produce predictable, homogeneous, extended structures, should result in good sensor-to-sensor reproducibility and uniform response. In addition, subtle differences in overall LMOF structure, metal ion coordination, pore surfaces, and host-guest interactions within pores should have significant impact on observed photoluminescence and provide numerous strategies for analyte detection. Highlighted here is the development of LMOFs composed of zinc or zirconium ions that incorporate luminescent osmium or rhenium complexes into the framework structure and the excitation and emission spectra of these materials in the presence of small molecules of varying polarity.

Student Authors: Lucas Stehle and Kaitlyn Mercando
Faculty Mentors: Jeffrey Rood and Kristi Kneas
Elizabethtown College

19. Development of an Immunoassay to Detect Leptin, a Hormone Associated to Fat Metabolism, in American black bears.
Determining body condition in the American black bear (Ursus americanus) is challenging due to their physiological strategies such as hibernation. Interestingly, the hormone leptin, which is highly associated to fat metabolism, is indicative of body condition and adiposity (body fat stores) in black bears. An immunoassay technique measuring leptin in serum samples was previously employed in black bears. Individuals with higher body fat content exhibit greater concentrations of serum leptin. However, the commercial form of this technique, referenced by previous work, is no longer available for bears (i.e. the manufacturer no longer produces it), and other commercially available leptin assays designed for humans, dogs, pigs, or multispecies have produced subpar results for black bears. Therefore, we aim to develop and validate a double-antibody enzyme-linked immunosorbent assay (ELISA) to measure serum leptin in black bears. We have identified an antibody with characteristics that increases our changes to bind bear leptin. Checkerboard titration tests to optimize immunoassay dynamics are underway, and lastly, we will perform immunoassay validation (parallelism tests and accuracy recovery checks) for bear serum. Our ultimate goal is to use this ELISA to assess how changes in the environment influence maternal and litter aspects related to age, body condition, date of parturition, litter size, and cub growth rates, as possible factors influencing black bear reproductive parameters in the Eastern United States.

Student Author: Alexander Russo
Faculty Mentor: Jose Mesa Cruz
Elizabethtown College

20. Synthesis of a Phthalocyanine as a Photodynamic Therapeutic Agent
Photodynamic therapy (PDT) is primarily used for treatment of cancer cells through the generation of a high-energy singlet oxygen. This generation of singlet oxygens is possible through the collision of molecular oxygen and an excited photosensitizer. Photosensitizers are molecules that absorb light of a particular frequency and enter an excited state and in the presence of molecular oxygen can generate radicals in the form singlet oxygens. Singlet oxygen can cause cell injury/death which is optimal for treatment of tumors, psoriasis, and potentially even blood-borne viruses such as AIDS/HIV. This research aims to synthesize a new phthalocyanine photosensitizer containing a thiophene-quinoxaline donor-acceptor system. Such a system should shift the absorption to very low energy, optimizing the photophysical properties for PDT. Further derivatization will be accomplished to increase solubility and to incorporate a metal center to increase efficiency of singlet oxygen generation.

Student Authors: Souleymane Traore and Amadou Mbye
Faculty Mentor: Kevin Schultz
Goucher College

21. Photochromic Drug Delivery of HNO via Diels-Alder reaction
Photochromic drug delivery is a branch of photopharmacology that utilizes light to initiate a chemical reaction that allows for drug release. Nitroxyl (HNO) is a small molecule which is known to have beneficial biological properties including being an anti-cancer. In this research, an efficient and safe method of delivering HNO to a target site is investigated. The target HNO donor can lock and unlock for the drug release with different wavelengths of light, allowing for precise spatial and temporal control. The synthesis involves a Suzuki coupling to produce a furan derivative, which is then coupled with the nitroxyl donor via Diels-Alder reaction. Upon coupling, the molecule becomes photochromic and the locking and unlocking properties will be investigated.

Student Author: Lucas Muya
Faculty Mentor: Kevin Schultz
Goucher College

22. Stream Channel Sediments as Indicators of Stream Restoration Progress
Stream restoration is used where aquatic habitats are degraded by land use activities like farming, urbanization and mining to re-establish pools and riffles for aquatic wildlife. Changes to water flow affect the transportation and deposition of sediments, so we propose using sediment characteristics as an indicator of restoration effectiveness. Twenty-eight sites are being monitored for stream sediment changes both before and after stream restoration work is completed to determine the changes in sediment size and organic matter fraction. Sample collection is underway and sediment size, organic matter fraction, and carbon: nitrogen ratios will be analyzed.

Student Authors: Ali Binder, Kaitlyn Gardineer and Abby Sieg
Faculty Mentors: Dan Ressler
Susquehanna University

23. Exploring the Applications of Virtual Reality in Elementary Science Education

Developing technologies have a long and varied history in teaching and learning. Many technologies that were touted as revolutionary eventually fell to the wayside in favor of more traditional, less technologically sophisticated modes of education. Virtual Reality (VR) technologies have recently been considered for application in multiple educational contexts (i.e. schools) and informal learning environments (i.e. science museums). VR technology is being applied in many ways across multiple domains, such as science and mathematics, and across varied educational levels. While there is a somewhat broad range of VR application, some domains and educational levels are currently unexplored. As such, our project focuses on the process of constructing an early childhood/elementary level science curriculum utilizing user-produced VR images. In order to achieve this goal, we: 1) conducted a review of extant literature on VR applications, specific to education, 2) explored VR hardware (cameras and VR viewers) and software (applications and programs), 3) constructed our own VR learning tour, and 4) constructed a science curricular unit utilizing VR technology. This project represents a collaboration between several Elizabethtown College departments and the North Museum of Nature and Science. We will present a review of relevant literature, demonstrate our constructed VR experience, and discuss the accompanying science curriculum.

Student Author: Celia Martone
Faculty Mentor: Peter Licona
Elizabethtown College

24. Using VR to Improve 3D Spatial Abilities in the Geosciences

From looking at a surface, can you visualize what's going on below? Research from the past few decades has proven that it is possible to train our brains and spatial abilities in order to improve our potential to think about concepts in 3D. In geology, spatial abilities play a major role in understanding everything from strike and dip to the movement of tectonic plates and the effect that they have on Earth's topography. Middle and high school classrooms also face these challenges in learning about earth science and other sciences. The goal of our research is to test whether virtual reality programs improve learning in earth science and geology classrooms. Recent authors have used a general framework to explain the relationships present in describing the cognitive processes that occur in spatial thinking. Intrinsic properties are applied to the object itself, whereas extrinsic properties refer to the object in relation to the surrounding world. Static properties are those that can be used to describe an object, such as shape or color, and dynamic properties are those that can be used to explain the motion or movement of an object (Chatterjee 2008). We propose to implement Google Earth VR using the HTC VIVE headset. During the Fall 2019 semester, the Environmental Geology of 40 expected students will be split into the control and experimental groups for a portion of the semester. The control group will complete a pen-and-paper assignment teaching the concept, while the experimental group will complete a virtual reality assignment on the same concept. We hypothesize that the students who participated in the experimental group will show greater improvement in scores from the pre-test to the post-test. By also collecting data on demographics and prior experiences, we will investigate whether students with specific backgrounds perform better. If our hypothesis is confirmed, we can conclude that virtual reality lessons are an effective method to teach 3D concepts in geology classrooms and should be implemented more often. If the results show that the experiment did not work, then we would need to investigate why it does not align with previous data from the literature. We need to answer the question: are there other factors that are involved in the improvement of spatial abilities? Whatever that answer may be, it can certainly be helpful in teaching students complex concepts in the field of geology, as well as many other disciplines.

References:

Chatterjee, A. (2008, August). The neural organization of spatial thought and language. In Seminars in Speech and Language (Vol. 29, No. 03, pp. 226-238). © Thieme Medical Publishers.

Student Author: Sarah Alexander
Faculty Mentor: Katharine Johanesen
Juniata College

25. Investigating Host-Microbial Interactions Through RT-qPCR of E. coli Gene Expression in Models of Ag-ing C. elegans
The gut microbiome has the potential to impact the health of its host through both positive and negative interac-tions. Research has found that the microbiome often stabilizes in an organisms' adulthood but may change with advanced age, such as the development of biofilms by gut bacteria in late life hosts. Preliminary data shows that shorter lifespans in C. elegans are correlated with increased expression of gut bacterial genes relating to biofilm formation. Yet, the depth of the relationship between the microbiome and aging is not fully understood. We will investigate the relationship between aging and biofilm formation using the model organ-ism, C. elegans. To do this, we will track the expression profile of biofilm formation genes in host bacteria utilizing the method of quantitative reverse transcription PCR (RT-qPCR). We hypothesize that the formation of E. coli biofilm in the gut of C. elegans will result in reduced lifespan, and that the host signals also influence biofilm formation. Using RT-qPCR, we can e xamine the expression of genes at specific steps of biofilm formation to gain insight into the progression and maturation of biofilms longitudinally. We expect biofilm gene expression to vary across different C. elegans models of aging that exhibit increased lifespan, such as regulation of insulin signaling, caloric restriction, and mitochondrial respiration. We will also feed C. elegans either normal or biofilm-deficient E. coli to determine the direct effect of biofilm on lifespan. We hope that this work on host-microbiome interactions will inform the scientific community on the development of novel treatment strategies to improve healthy aging via host-microbiota interactions.

Student Authors: Gillian Letson and Lavinia Unverdorben
Faculty Mentors: Jason Chan and Regina Lamendella
Juniata College

26. Energy Measurement of Electron Beams from a Pyroelectric Crystal Accelerator
Pyroelectricity is a property by which certain materials become electrically polarized, causing opposite charges to develop on their two ends when they experience a change in temperature. The large surface charges cause strong electric fields to be produced, and a fine metal tip placed inside the field, can emit an electron beam which will be accelerated. This technology could pave the way to smaller, cheaper particle accelerators. Previous experiments have demonstrated that a pyroelectric crystal, whose temperature is manipulated by a Peltier plate, accelerates electrons emitted by a nano tip needle through a small, hollow channel running through its center. We plan to design and build a magnetic spectrometer to precisely
measure the kinetic energy of the electrons.

Student Authors: Tes DeJaeger and Marcus Montisano
Faculty Mentors: Rodney Yoder
Goucher College

Presentations Session 2 - Hoover 211

1. Running Impact Phase II
In the running community, there exists a widely accepted belief that running on hard surfaces is more impactful and therefore, damaging to the body. With this application in mind, many runners may opt to carry out their workouts on surfaces such as asphalt. This practice can be proven dangerous when accounting for the motor vehicle proximity and exposure that these individuals are experiencing. Various studies about the effects of different running surfaces have been already conducted, finding both support and refutes for the arguments. However, such studies have focused mostly on distance running at lower speeds which may correlate with less serious, recreational running patterns. This study will focus on runners at the competitive level, and the findings can directly be applied to those training at collegiate training levels and beyond.

Student Author: Jorge Tirado
Faculty Mentor: Kurt DeGoede
Elizabethtown College

2. Computational Analysis of Steel Joists at Elevated Temperatures
The landscape of network analysis is ever-evolving as the fields of technology and business progress. While the landscape of the analysis may change, at the core of network analysis is the detection of malicious activity. In real-time traffic flow, it is non-trivial to determine whether a particular flow is malicious in nature. Most malicious software (malware) analysis is done after the flow has already reached its end target, and is analyzed in the form of network traffic captures. For any network analysis system, it is important that the privacy of the data being transmitted it not compromised in the process. Using network contextual flow data, it is possible to analyze and classify network traffic without compromising the encrypted data being transported.
In this project, we analyzed the impact of using the Intel Data Analytics Acceleration Library (DAAL) to expedite the analysis and inference of encrypted network traffic for the presence of malware. The DAAL package enables the acceleration of analytics through its design to target Intel hardware, being developed in a combination of C and assembly language for their architecture. With its streamlined design, using the library allows for analysis to take place many times faster than using the typical python framework and data analysis libraries, such as scikit-learn. Using these tools developed by Intel, our team designed an inference system that is capable of performing real-time analysis of network flows to detect malicious activity

Student Author: Elle E Shatto
Faculty Mentor: Jean Batista Abreu
Elizabethtown College

3. Synthesis of Transition Metal Complexes Containing Oligopyridine Ligands as Catalysts for Oxidation or Hydrolysis Reactions
Our experimental focus is on the design and synthesis of oligopyridine based ligands for the synthesis of metal complexes that will be used to detoxify model compounds of organophosphate-based nerve agents and/or pesticides by hydrolysis or by acting as oxidizing agents.

Student Author: Jeremy Bloch
Faculty Mentor: George Greco
Goucher College

4. Synthesis and Spectroscopic Study of 6,7-disubstituted Dihydropteridinones
6,7-diphenyl- 2(1H)-thioxo-4(3H)- 7,8-dihydropteridinone is highly fluorescent in polar aprotic solvents such as DMSO and DMF. The compound exhibits a monomer-aggregate equilibrium where the monomer absorbs at longer wavelength (418 nm rather than 395), and is much more highly fluorescent. We are currently studying the effect of different solvents on this equilibrium, and the resulting impact of solvent on the fluorescence intensity. We are also synthesizing analogous compounds with hydroxyl groups on the phenyl rings, and different groups at the 6 and 7 positions to investigate how these modifications affect the fluorescence.

Student Author: Arnelle Fonlon
Faculty Mentor: George Greco
Elizabethtown College

5. Effects of Percolation in Superconducting Transitions
Nanoscale superconducting films are the basis of novel technologies that are likely to change the world: from quantum computing devices that will enable protein folding simulations for medical advances, to ultrasensitive light sensors that can detect distant galaxies. Understanding the phase transitions in the films is a crucial step towards developing these applications. This work aims to study the nature of superconducting transition in nanostructured films of niobium and gold. We will fabricate the samples using electron beam lithography and measure the resistance as a function of temperature and magnetic field at liquid helium temperatures. By comparing the results to the percolation theory and the universal theory of quantum phase transitions, we will elucidate the nature of the superconducting transitions in these films.

Student Authors: Kristine Ung, Robert Lynn and Samuel Shapiro
Faculty Mentor: Nina Markovic
Goucher College

Presentations Session 2 - Hoover 212

1. Synthesis of Substituted Porphyrins and their Incorporation into Lamellar Vesicles
A current theme in our research laboratory is the development of low cost methods for the synthesis of lamellar vesicles as models for cell membranes. These vesicles, serving as simplified artificial cells, allow us to examine fundamental properties of the membrane including transport of materials across the membrane. Vesicles of varying size can also be employed as molecule delivery systems for a variety of compounds, including pharmaceuticals. We are especially interested in pharmaceuticals used in photodynamic therapy. This type of medical intervention entails delivery of a prodrug (one which is not initially bio-active). Upon exposure to a specific wavelength of light this prodrug molecule, a photosensitizer, becomes biologically active and elicits a desired biochemical response. Various derivations of the porphyrin class of molecules have been investigated as potential photodynamic molecules. Currently, Photofrin-II, a mixture of polymerized porphyrin molecules is the only FDA-approved porphyrin-based photodynamic therapy. This particular project will merge the synthesis of non-polymerized substituted porphyrins with their integration into lamellar vesicles of varying size. In keeping with our low-cost approach to vesicle formation, we will compare the use of water-in-oil emulsion versus extrusion mode of synthesis for vesicle construction. Of interest is our ability to tailor placement of the porphyrin into the center of the lamellar vesicle, or integrated within the membrane portion of the vesicle. Though outside the scope of the current project, an important question we wish to address is: does placement of a porphyrin photodynamic compound within a lipid or aqueous environment affect its ability to function as an effective photosensitizer. The work submitted under this proposal will bring us closer to conducting experiments which will probe this question.

Student Author: Christina Schnee
Faculty Mentor: Thomas Hagan
Elizabethtown College

2. Interstrand Cross-linking of DNA by Novel Rhodium Complexes
Fluorescently tagged 39-bp DNA is reacted with a variety of novel rhodium compounds with potential anti-cancer activity. These reactions are screened to determine if there is a correlation between the nature of the 4 bridging groups around the rhodium core and the DNA interstrand cross-linking efficiency. Results of dPAGE (denaturing polyacrylamide gel electrophoresis) analysis will be presented and plans for cell studies will be discussed.

Student Author: Megan S. Konrath
Faculty Mentor: Shari U. Dunham
Moravian College

3. Synthesis, characterization, and antioxidant activity of Ni(II) and Zn(II) complexes of chromene-based Schiff bases
The chromene moiety is a heterobicyclic structure that has been shown to possess significant biological activity. Specifically, recent research has found that derivatives of chromene show promising antibacterial, antifungal, and anticancer effects. To create a new library of chromene derivatives, 5-hydroxy-2, 2-dimethyl-2H-chromene-6-carbaldehyde was condensed with thiosemicarbazide and 2-aminophenol to produce two Schiff base ligands. These ligands were combined with zinc (II) and nickel (II) acetate salts to produce metal complexes at metal: ligand ratios of 1:1 and 1:2. The ligands and complexes were characterized by 1H and 13C NMR, IR, and UV-Vis spectroscopy to determine the structure of each compound. The antioxidant activity of each compound will be determined using the DPPH assay method.

Student Author: Andrew Ressler
Faculty Mentor: Geneive Henry and Bill Dougherty
Susquehanna University

4. Interrogating the Functions of the Histone H2A Repression Domain in Saccharomyces Cerevisiae
In eukaryotic cells, DNA is wrapped around histone proteins to form the basic repeating unit of chromatin, the nucleosome core particle. Most nucleosomes consist of two copies each of histones: H2A and H2B in a heterodimer and histones H3 and H4 in a heterotetramer. Because of their intimate association with DNA, histones regulate all DNA-templated processes such as transcription, DNA replication, and DNA damage response and repair. Several studies have identified a small portion of the histone H2A amino terminal domain which regulates global transcription. This domain is responsible for the repression of many genes in the yeast genome. This domain, termed the histone H2A Repression (H.A.R.) domain, consists of a small, conserved portion (amino acids 16-20) of histone H2A. The H.A.R. domain has also been shown to be an important regulator of DNA damage response and repair. In this study, it was determined that the H.A.R. domain also has a role in DNA replication and cellular growth. Using a high-throughput spotting assay, it was found that the deletion of the H.A.R. domain leads to an increased sensitivity to the drug hydroxyurea, indicating a defect with the DNA replication machinery. Additionally, we that deletion of the domain leads to a defect in the galactose metabolism. Taken together, this study identified two novel functions of the H.A.R. domain.

Student Author: Taylor Nattress
Faculty Mentor: Michael Parra
Susquehanna University

5. Detection of DNA by Nanoparticles
Gold nanoparticles have been synthesized using a variety of conventional and green methods and their selectivity towards specific DNA sequences investigated using spectroscopy. Examples of DNA sequences are quadruplex (ex. human telomeric DNA and thrombin-binding aptamer) and duplex. The goal of this work is to find biocompatible probes capable of detecting low concentrations of specific DNA sequences.

Student Author: Callie Rohrer
Faculty Mentor: Swarna Basu
Susquehanna University

Presentations Session 2 - Hoover 213

1. Anatomy in Art: Exploring Anatomy in Everyday Life
Since 2015, Dr. Anya Goldina has offered students in Biology 201 and 202: Human Anatomy and Physiology the unique opportunity to earn extra credit by creating artwork centered around systems and organs discussed in the class. Hundreds of pieces of art later, her students have demonstrated the continual presence of anatomy in everyday life through their projects. This research project aims to show 1) the learning outcomes of the student researchers through research and web design, 2) artwork by the students in physical and virtual settings, and 3) why an understanding of anatomy is important and useful in everyday life. The artwork will be compiled and displayed in the Fall of 2019 in the Lyet Gallery of Elizabethtown College, allowing students and community members to learn about anatomy in a hands-on capacity. The student researchers have also created a website to digitally showcase the artwork, provide educational resources for students and educators, and inspire learning in others. This project lays the foundation for continuous digitization of future art projects and will serve as an important resource for science teachers and the community.

Student Authors: Aubrey Mitchell and Rebecca Kruse
Faculty Mentors: Anya Goldina and Carol Costa Ouimet
Elizabethtown College

2. Digital Curation of Puffenberger Collection Part II
In 2012, Dr. William Puffenberger, a retired Professor of Religious Studies at Elizabethtown College, donated his collection of artifacts, gathered over the course of his teaching career, to the school for professors to use in teaching as he had previously. These artifacts have since been on display in Nicarry 228 where they are being utilized by professors teaching in that classroom. In 2018, Dr. Richard Newton and Carol Costa Ouimet, along with students Amal Ismail and Hannah Ciocco, began the process of creating a digital archive of the Puffenberger collection. In 2019, students Mahmood Mohammad and Tyler Gamble, under the mentorship of Dr. Jeffery Long and Carol Costa Ouimet, have continued this project of photographing, researching, creating a website, and uploading these religious artifacts for the use of the larger student population, and all who would like to use or view the collection.

Student Authors: Tyler Gamble and Moh Mohammad
Faculty Mentors: Jeffery Long and Carol Costa Ouimet
Elizabethtown College

3. Emotional Intelligence and Disordered Eating: Efficacy of Analysis Via Ecological Momentary Assessment
The proposed presentation will provide background information on and preliminary baseline data from an ongoing pilot study of the use of EMA to assess the association between emotional intelligence and disordered eating. Participants will complete baseline surveys inquiring about disordered eating behaviors, emotional intelligence, and daily stressors, and receive text message prompts over two weeks asking about eating behaviors, stressors, and emotional intelligence. The study will ultimately address the following questions: does emotional intelligence predict occurrences of disordered eating symptoms and other eating behaviors over a subsequent two-week period and is ecological momentary assessment technology a feasible means of assessing day-to-day fluctuations in the presentation of disordered eating symptoms?

Student Author: Sarah Kaden
Faculty Mentor: Elizabeth Dalton
Elizabethtown College

4. The Cry of the Children: Immigration, Trauma, and the Deterioration of True "American" Values
The doleful and anguished cries of children rise above the general dim of the crowd, echoing off the metal roof and concrete floor of the immigrant detention center. The palpable terror and exhaustion in their sobbing voices, in their pleas for their families, bears such witness to their trauma that would wrench at the very heart of Lady Liberty herself. This is a scenario that many have become numb to, while our national television has been flooded with the images and footage from the U.S. and Mexican border, and of the concentration style detention camps where families are separated, herded into overcrowded chain-link cages, and detained for indefinite lengths of time, many U.S. citizens remain withdrawn, unmoved, and unconcerned about the humanitarian atrocities being committed against immigrants and asylum seekers at our southern border. The current administrations' zero-tolerance immigration policy is one that affronts the very values and principles that this country was so proudly founded on by perpetuating fear, animosity, intolerance, and the destruction of the social pillar of family unit. The trauma that is enacted against immigrant families, and especially immigrant children who are torn away from their parents, is a brutal and immoral offense against humanity and one that must be promptly rectified. In this research paper, I will analyze the psychology of the various levels of trauma these people, especially children face while being detained and sometimes forced to stand trial by themselves as young as 3 years old, as well as look at some ways artists and humanists have expressed themselves through various media to attempt to raise awareness.

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Presentations Session 2 - Hoover 214

1. The Effects of the Chemotherapeutic Drug Cisplatin on Human Diploid Fibroblast Cells Expressing the Oncoprotein SV40 T-antigen
Cancer is most commonly thought of as the result of accumulation of cellular DNA mutations that inhibit tumor suppressor proteins or activate oncogenes. However a large body of evidence also shows that the wild type gene transcripts are alternatively spliced to create oncogenic protein isoforms or induce nonsense mediated decay of the RNA. To combat the cancerous cell growth, chemotherapy targets cellular activities such as DNA replication, spindle formation, receptor signaling, and metabolism. Knowing the protein profile of the tumor is relevant to finding an effective chemotherapeutic. For instance, cisplatin is used to treat a variety of cancers but has been shown to have reduced efficacy if the cell lacks the protein BIN1 or if it is alternatively spliced to the BIN1+12A isoform. Cisplatin forms platinum-DNA adducts that create single stranded breaks, and if not repaired can later become double stranded breaks following DNA replication. Unlike other tumor suppressors, BIN1 appears to induce cell death by increasing genomic instability. BIN1 is proposed to function by binding to the transcription factor E2F1, and preventing the activation of the DNA repair mechanism by ATM. This allows the breaks produced by cisplatin to disrupt cellular processes, such as DNA replication and transcription, and ultimately results in cell death (Folk 2019). While studying the mechanism of cellular transformation by the simian virus 40 (SV40) T-antigen oncoprotein, our lab has discovered a novel RNA isoform of BIN1. This transcript retains exon 11 yet deletes exons 12-18. Concomitant with characterizing the protein structure, this study is investigating the functional characteristic of this BIN1 isoform as it relates to cisplatin resistance. Human diploid fibroblasts immortalized with telomerase HDF (HDF(tert)) and HDF(tert) cells expressing the viral oncoprotein SV40 T antigen (HDF(tert)+T) will be used as the experimental model. A dose curve of cisplatin from 0-2ug/ml will be used to assess cellular sensitivity. Determining the function of this novel BIN1 isoform is essential to the chemotherapeutic success in cancer treatment.

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2. The Correlation of a Novel BIN1 Isoform and the Expression of SV40 T Antigen in Human Diploid Fibroblasts
The BIN1 gene product, Amphiphysin 2, has been shown to act as a tumor suppressor (Prokic, et al., 2014) working to stop uncontrolled cell growth. It accomplishes this by several mechanisms most notably the MYC-dependent pathway (Prokic, et al., 2014). BIN1 contains several protein domains: BIN-amphiphysin/Rvs (N-BAR), phosphoinositide (PI), clathrin and AP2 (CLAP), Myc-binding domain (MBD), and Src homology 3(SH3). In non-malignant cells normal levels of BIN1 can activate Programed Cell Death, and it can inhibit excessive growth by binding to N-Myc and blocking its ability to activate the cell cycle genes. (Prokic, 2014). However in many cancers, BIN1 is deleted, or alternatively spliced to to knock out these protective functions. Alternative splicing to include exon 12A in BIN1 has been found in several tumors and inclusion of this exon is thought to disable the BIN1 protein from binding to Myc. Our lab has been investigating the cellular mechanisms of transformation by the simian virus 40 (SV40) large T-antigen and we hypothesized that this oncoprotein would cause the production of the Bin1+12A isoform in human diploid fibroblast (HDF). Our preliminary results have detected a new RNA transcript in HDF cells expressing T antigen (HDF+T) that has been spliced to remove exons 12-18. We are currently confirming if this transcript creates a stable protein by Western blot analysis and if sufficient levels of BIN1 are detected then immunofluorescence will determine the cellular location. This data will help elucidate the role of BIN1 in tumor progression.

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3. Relationship between SV40 T Antigen, SAM68 and p53 and the Effects on Alternative Splicing
Alternative splicing is the cellular process where gene transcripts (hnRNA) are pieced together in different ways in order to yield unique proteins, each with its own function. Through this process, the approximate 20,000 genes of the human genome can produce the millions of proteins needed for cell survival (Moraes and Goes, 2016). Sam68 is one such protein that directs the process of alternative splicing. Sam68 splices many hnRNA to form the template to create proteins involved in endocytosis, cell morphology, cell cycle regulation and apoptosis (Sanchez-Jimenez and Sanchez-Margalet, 2013). Sam68 has been shown to be upregulated in prostate, breast, and lung cancers, indicating that its function may be related to excessive growth characteristics (Frisone et. al., 2015). We hypothesize that Sam68 causes aggressive growth characteristics via the alternative splicing of SRSF1. Interestingly, SRSF1 is also an alternative splicing protein that targets the hnRNA of genes involved in cell cycle regulation and apoptosis. One transcript spliced by SRSF1 is the BIN1 message, resulting in several known protein (Amphiphysin 1) isoforms, each with related, yet unique functions (Anczukow et. al., 2012). Depending on the isoform of Amphiphysin 2 created, cell growth and apoptosis are altered possibly leading to excessive cell growth and division. This research used human diploid fibroblast cells (HDF) transformed with SV40 T-antigen, a viral oncoprotein that inhibits cellular processes related to apoptosis and induces the cell cycle. Using these cells, we compared the isoforms of SRSF1 and BIN1 present in the T-antigen expressing cells (HDF+T) and wildtype (HDF) cells. Currently, we will create new cell lines by introducing T-antigen encoding plasmid into Sam68 knockout cell lines (HCT116 Sam68-/-) to determine if T-antigen does indeed alter BIN1 isoform choice through a Sam68/SRSF1 pathway. This will enable us to elucidate further, how T-antigen influences cell growth and RNA metabolism.

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4. Bacterial Colonization of C. elegans and Lifespan Extension by Biofilm Formation

Intestinal bacteria establish symbioses within hosts which can be commensal, pathogenic, or mutualistic depending on the type of bacteria and host's genetic background. We utilized transcriptomics to understand these interactions in a life-span extension model of C. elegans that has high stress resistance to bacterial pathogenesis, namely the insulin/IGF-1 signaling (IIS) pathway mutant type daf-2. The evolutionarily conserved IIS pathway has direct interaction with bacterial colonizers by integrating insulin and insulin-like signaling molecules of the intestine into metabolic and behavioral responses, including bacterial pathogen resistance, oxidative stress resistance, and heat resistance. Our lab previously sought to understand the relationships between aging, the IIS pathway, and the microbiome by performing bacterial transcriptomics on up and downregulated IIS pathway elegans mutants fed a diet of E. coli OP50. Our lab previously found that bacterial biofilm formation genes are expressed higher when the IIS pathway is downregulated, and this fits into previous literature that indicates biofilm formation has a key role in lifespan extension and that this is through an interaction with the C. elegans IIS pathway. However there a debate in literature as to what the bacterial product is that causes this lifespan extension. To further elucidate this mechanism of lifespan extension, I investigated the development of the biofilm in a C elegans host through a Wheat Germ Agglutinin (WGA) assay for exopolysaccharides found in biofilms and a colonization assay quantifying intestinal bacterial load over time. These physical interactions, paired with previously collected transcriptomic data, is a powerful tool for elucidating the roles of biofilms and host bacterial-interactions with C. elegans and the IIS pathway. While it was previously known the IIS pathway has an impact on the microbiome and vice versa, our data unveils these impacts on a molecular level and informs us on the mechanism by which the IIS pathway and aging interact with bacteria and the ecological interactions in the intestine important for organismal level homeostasis and lifespan.

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