



8<sup>th</sup> Annual

# Summer Research Symposium

July 28, 2016

Hosted by



MORAVIAN  
COLLEGE

## Schedule of Events

Time	Event	Location
11:30am – 12:50pm	Registration & Lunch	Pavillion of the HUB** (building <a href="#">#11 on map</a> ) Registrants are also encouraged to lunch outside on the PPHAC* patio (weather permitting)
12:50pm – 1:00pm	Welcome & Opening Remarks <i>Dr. Diane Husic</i> , Dean of School of Natural & Health Sciences <i>Dr. Shari Dunham</i> , conference co-coordinator	Prosser Auditorium in the HUB** (building <a href="#">#11 on map</a> )
1:10pm-4:30pm	Oral & Poster Presentations	PPHAC*, 1 <sup>st</sup> Floor (building <a href="#">#36 on map</a> )
<u><i>All Posters in PPHAC* 1<sup>st</sup> Floor Atrium</i></u>		<u><i>PPHAC* 116 &amp; 117</i></u>
<b>Poster Session 1</b> 1:10 – 2:40pm		<b>Oral Sessions 1&amp;2</b> 1:10-2:10pm
<b>Poster Session 2</b> 3:00 – 4:30pm		<b>Oral Sessions 3&amp;4</b> 2:20-3:20pm
		<b>Oral Sessions 5&amp;6</b> 3:30-4:30pm
4:00pm-5:00pm	Light Refreshments (Ice Cream!)	PPHAC* Atrium/Patio

\*PPHAC = Priscilla Payne Hurd Academic Complex = Hurd building ([#36](#))

\*\* HUB = Hauptert Union Building ([#11](#))

## *Special Thanks To:*

Conference Sponsor: Moravian College Student Opportunities for Academic Research (SOAR), Sarah Johnson, Program Director

Office of Public Relations, Christie Jacobsen, Webmaster

Associate Director of Housing and Event Management, Amanda Merson

Dining Services, David Oren, Catering Director

## Symposium History:



2009  
2013



2010  
2014



2011  
2015



2012  
2016

Welcome to our new participants!



**Oral Session 1 Hurd 116 1:10 – 2:10 pm**

**O1-1: Catalytic Properties of Novel Dirhodium Compounds**

**Student:** Ian Painton Moravian College

**O1-2: Synthesis of Rhodium-DNA Model Complexes**

**Student:** Austin Mates Moravian College

**O1-3: Spectroscopic Studies of the  $4^3\Pi$  Electronic State of NaCs**

**Student:** Andrew Steely Susquehanna University

**O1-4: Ozone Uptake on Kaolinite as a Function of Relative Humidity and VOC**

**Coating**

**Student:** Zoe Coates Fuentes Drew University

**Oral Session 2 Hurd 117 1:10 - 2:10 pm**

**O2-1: Moravian Music: Creating Performance Editions for Anthems and Choral Works**

**Student:** Matthew Obszarny Moravian College

**O2-2: The Sparks Farm: An Environmental, Social, and Cultural History**

**Student:** Ryan Bologna Juniata College

**O2-3: Work-Life Balance in Media Newsrooms**

**Student:** Irene Snyder Elizabethtown College

**O2-4: Friendship, Victimization, and Peer Interactions Among School Aged Children**

**Student:** Emily Miller Moravian College

**Oral Session 3 Hurd 116 2:20 - 3:20 pm**

**03-1: Heterogeneous Reactions Involving Kaolinite Clay and ( $\alpha$ )-(+)-Pinene**

**Student: Jed-Joan Edziah** Drew University

**03-2: Pesticide monitoring of local watersheds**

**Student: Matthew Little** Moravian College

**03-3: Manipulating Signal Hydrophobicity to Alter Quorum Sensing in *Streptococcus pneumoniae***

**Student: Erin Tiwold** Moravian College

**03-4: Nickel catalyzed [4+4] Cycloaddition**

**Student: Elton Kativhu** Goucher College

**Oral Session 4 Hurd 117 2:20 - 3:20 pm**

**04-1: The Role of Scale in Ecological Studies: Benthic Macroinvertebrate Community Structure**

**Student: Richard Buffone** Moravian College

**04-2: Metatranscriptomic Profiles of Dichloromethane Degrading Communities**

**Student: Dallas Hamlin** Juniata College

**04-3: Turtle Population Dynamics in Three Ponds at the Lehigh Gap Nature Center**

**Student: Rob McKinley, Shelby Does** Moravian College

**Oral Session 5 Hurd 116 3:30 – 4:30 pm**

**05-1: Petrology of the Edmonds Ultramafic Body in the Ashe Metamorphic Suite of North Carolina**

**Student: Sam Zucker** Juniata College

**05-2: The Characteristic Study of 6,7-diphenyl- 2(1H)-thioxo-4(3H)-7,8-dihydropteridinone**

**Student: Shannara Bauer** Goucher College

**05-3: An Algebraic Investigation of Restricted Movement Rubik's Cubes**

**Student: Bryan Harvey** Moravian College

**05-4: Open Access 3D Printed Raman Spectrometer**

**Student: Eric Adams** Goucher College

**Oral Session 6 Hurd 117 3:30 – 4:30 pm**

**06-1: DNA Cross-linking by Antitumor Active Rhodium Compounds**

**Student: Swathi Kanakamedala** Moravian College

**06-2: Comparative genomics of *Mycobacterium chimaera***

**Student: Vasily Tokarev** Juniata College

**06-3: How Do Sand Boas Capture Prey They Cannot See?**

**Student: Michelle Pomposello** Moravian College

**06-4: Effect of Bang-sensitive Mutations on Memory in *Drosophila melanogaster***

**Student: Kayli Silimperi** Moravian College

**Poster Session 1 Hurd Atrium 1:10 – 2:40 pm**

**P1-1: Methods Development for the Analysis of Viral Content in the Gut**

**Student:** Madison Abbott Juniata College

**P1-2: Interaction between bacterial and fungal communities in *Clostridium difficile* infected individuals**

**Student:** Rebecca Drucker Juniata College

**P1-3: Indoor 3D Reconstruction with Google Project Tango**

**Student:** Yihe Chen Susquehanna University

**P1-4: Segmentation of the Left Ventricle using Isotropic 4D MRI**

**Student:** Samantha Salazar Susquehanna University

**P1-5: Reconstruction with Flags: An Experiment in Computer Vision Using Tracking to Develop Three Dimensional Models**

**Student:** Christiana Straub Susquehanna University

**P1-6: Stressing Interdisciplinarity in order to Mold the Undergraduate Experience**

**Student:** Britney E Bridges Juniata College

**P1-7: Nano-Printing Organic Semiconducting Electronics**

**Student:** Jacob Brazeau Goucher College

**P1-8: Synthesis of a thienylquinoxaline fluorescent probe for biological applications**

**Student:** Olivia Dickert Goucher College

**P1-9: Synthesis of a light-activated nitroxyl donor containing fulvene**

**Student:** Hannah Kimball Goucher College

**P1-10: Establishing preliminary relationships between peptide structure and quorum sensing activity in *Bacillus cereus***

**Student:** Jessica Lynch Moravian College

**P1-11: Synthesis and Characterization of an Iron(III) Amine Triphenolate Coordination Complex**

**Student:** Kerry C. Casey Juniata College

**P1-12: Reactions of triosmium decacarbonyl bisethoxide with amides**

**Student:** Katherine Marak Drew University

**P1-13: Synthesis of a Pentadentate Ligand for Coordination with Manganese**

**Student:** Yvonne Wojciechowski Juniata College

**P1-14: Water Quality Index Analysis of Five Penns Creek Headwater Streams, Bald Eagle State Park, PA**

**Student:** Michelle Turnbach Susquehanna University

- P1-15: Pesticide Quantification in Central Pennsylvania**  
Student: Bridget Kiely Juniata College
- P1-16: Polyproline Folding: Effect of Chain Length and Interactions**  
Student: Amanda Miller Moravian College
- P1-17: Ca<sup>2+</sup> catalyzed cleavage of RNA phosphorodithioate linkages**  
Student: Arline Tarazona Drew University
- P1-18: Effect of Downstream DNA Sequence and Structure on Pausing by *E. coli* RNA Polymerase**  
Student: Tiffany Chao Goucher College
- P1-19: Antibiotic Tolerance: Distinguishing between Classical Resistance and Persistence in a Macrophage Infection Model**  
Student: Crystal Collins Moravian College
- P1-20: Intergenic effects of bang-sensitive mutations in *Drosophila melanogaster***  
Student: Gautam Kanakamedala Moravian College
- P1-21: A Structural and Functional Fungal Assembly and Annotation Pipeline**  
Student: Collin Kessler Juniata College
- P1-22: Effects of Tgf $\beta$  signaling on differentiation and proliferation in developing zebrafish retina**  
Student: Michael Koropsak Goucher College
- P1-23: A possible role for eIF5A post-translational modification in yeast Ty1 retrotransposition**  
Student: Alexis Morrissey Juniata College
- P1-24: Transcriptomic analysis of Brook trout (*Salvelinus fontinalis*) within headwater stream ecosystems**  
Student: Christopher McLimans Juniata College
- P1-25: Establishing physical interactions between testis-specific TFIIA subunits and transcription machinery in *Drosophila melanogaster***  
Student: Joseph Mohammadi Goucher College
- P1-26: Analyzing Gene Expression Following Perturbations of the PCP and Hippo Signaling Pathways During Sea Urchin Embryogenesis**  
Student: Alyssa Bolger Susquehanna University
- P1-27: Testing the Temperature-Size Rule in Two Sexually Dimorphic Crustaceans**  
Student: Ethan Habbershon Juniata College
- P1-28: The Chemical Defense of *Phragmites australis* subspecies *australis* against the Periwinkle Snail, *Littoraria irrorata*, and other Small Herbivores**  
Student: Brianna Hite Goucher College



**P1-29: Extreme kinesis: a comparative study of prey handling in snakes**  
**Student: Raymond Morales** Moravian College

**P1-30: A Study of Diatom Communities in the Upper Main Stem of the Susquehanna River During Various Discharge Regimes**  
**Student: Amir Alwali** Susquehanna University

**P1-31: The Neuroprotective Potential of Curcumin in the 6-Hydroxydopamine Model of Parkinson's Disease**  
**Student: Loukya Kanakamedala** Moravian College

**P1-32: Affects of Prenatal Food Deprivation on Offspring Microglial Morphology**  
**Student: Elizabeth Jones** Susquehanna University

**Poster Session 2 Hurd Atrium 3:00 - 4:30 pm with cold stuff!**

**P2-1: Expression profiles of microbial communities associated with 1,4-dioxane degradation**

**Student: William Bernard** Juniata College

**P2-2: An assessment of knowledge and opinions regarding societal implications of prenatal genetic testing**

**Student: Aaron Kulig** Juniata College

**P2-3: Machine Learning With Brain-Inspired Architecture**

**Student: Anton Soloviev** Susquehanna University

**P2-4: Application of Supervised Deep Learning to Hyperspectral Bathymetry Problem with TensorFlow**

**Student: Aviel Stein** Susquehanna University

**P2-5: Synthesis and fluorescent properties of a thienylquinoxaline**

**Student: Jeremy Silver** Goucher College

**P2-6: Phthalocyanine derivatives for use in photodynamic therapy**

**Student: Mivaih Murray** Goucher College

**P2-7: Developing a Copper-Catalyzed Asymmetric Reduction of 2H-Azirines**

**Student: Melvin Thomas** Juniata College, Mahatma Gandhi University Kerala

**P2-8: DIY Raman Pi Spectrometer**

**Student: Rebecca Haber** Goucher College

**P2-9: Glycoalkaloids & False Potato Beetle Eggs**

**Student: Meeghan Rossi** Moravian College

**P2-10: Community-Based Learning on Campus: A Partnership Between the Department of Chemistry and Biochemistry and Dining Services**

**Student: Kayla Hess** Elizabethtown College

**P2-11: Development of Luminescent Metal-Organic Frameworks for Use as Oxygen Sensors**

**Student: Sitara Ramjit** Elizabethtown College

**P2-12: A Transversal and Longitudinal Study of Four Headwater Streams Using WQI and Hydro-geochemical Analysis**

**Student: Andrew Dutton Van Woert** Susquehanna University

**P2-13: Electrical Resistivity Tomography and Seismic Refraction Tomography To Determine Subsurface Composition**

**Student: Michael Sharer** Susquehanna University

**P2-14: Mapping Groundwater Seepage Flux in Relation to Susquehanna Smallmouth Bass *Micropterus dolomieu* Nesting Sites**

**Student: Dylan Kutz** Susquehanna University

**P2-15: Ca<sup>2+</sup> as a model system for the role of metals in cyclic nucleotide phosphodiesterases**

**Student: Julie Alex** Drew University

**P2-16: Characterization of 1-amino-9,10-Anthraquinone in the A1 Site of PS I Complexes of the Plastoquinone-containing Mutants of *Synechocystis* sp. PCC 6803**

**Student: Alvaro Montoya** Susquehanna University

**P2-17: Locating Genes in Bacterial Soil with Primers NRPS, PKS1, and PKS2**

**Student: Alexandra Evans** Susquehanna University

**P2-18: Recapitulating Immune-Antimicrobial Synergy Against *Escherichia coli* Infections**

**Student: Paige Hart** Moravian College

**P2-19: Creation of Clb2-YFP and Nap1-YFP to be used with Elm1-CFP to analyze protein interaction and Budding Yeast**

**Student: Yilan Miao** Susquehanna University

**P2-20: Evaluating the effects of TGF $\beta$  signaling on glial scarring in zebrafish (*Danio rerio*)**

**Student: Gillian Cooper** Goucher College

**P2-21: The *tflia-s-2* gene of *Drosophila melanogaster* encodes a testis-specific homolog of a subunit of the general transcription factor TFIIA**

**Student: Helen Shapiro-Albert** Goucher College

**P2-22: Morphological Identification of the Central Pennsylvania Rat Snake**

**Student: John Donlan** Juniata College

**P2-23: Influence of introgressive hybridization on morphology and color of coyotes, *Canis latrans*.**

**Student: Kelsey Barth** Juniata College

**P2-24: A Comparison of the Effectiveness of siRNA and Long Hairpin dsRNA in Knocking Down Pnt RNAi**

**Student: Joneisha Moore** Susquehanna University

**P2-25: Genomic Assay of Breast Cancer SNPs in Premodern Populations**

**Student: Jillian Loomis** Juniata College

**P2-26: Ecological Consequences of the Late Paleozoic Ice Age**

**Student: Ian-Michael Taylor-Benjamin** Juniata College

**P2-27: Environmental Factors Affecting the Chemical Defense of an Invasive Marsh Grass, *Phragmites australis* subspecies *australis***

**Student:** Sierra Duca Goucher College

**P2-28: Using Vegetation Surveys to Guide Future Land Use**

**Student:** Emma Johnson Juniata College

**P2-29: Variation in total mercury content among riparian and non-riparian wolf spiders**

**Student:** Hailey Shannon Susquehanna University

**P2-30: A Longitudinal Study of Diatom Communities in the Lower West Branch and Upper Main Stem of the Susquehanna River**

**Student:** Josh Levesque Susquehanna University

**P2-31: Examination of Microglial Morphology in Acute Ethanol Intoxication Mouse Model**

**Student:** Jordan Zezza Susquehanna University

**P2-32: Submersion Tolerance among Riparian and Non-riparian Spiders**

**Student:** Tara Barbarich Susquehanna University

**P2-33: VOC Detection using GC-MS**

**Student:** Daniel Scalley Goucher College

## Abstracts for Oral Presentations

### O1-1 Catalytic Properties of Novel Dirhodium Compounds

Previous studies of dirhodium complexes with bridging acetate or amidate ligands have been found to be efficient catalysts for several reactions including cyclopropanation and cycloaddition. This research focuses on determining any changes in catalytic activity that occur when a dirhodium catalyst has a mixture of acetate and amidate ligands  $[\text{Rh}(\text{acetate})_{4-n}(\text{amidate})_n]$ . Catalytic cyclopropanation reactions have been followed using a mixture of alkenes and ethyldiazoacetate. Cyclopropane products from these reactions have been analyzed by NMR and GCMS in order to compare yields and stereoselectivity for the different Rh catalysts.

Ian Painton, Dr. Stephen Dunham Moravian College

### O1-2 Synthesis of Rhodium-DNA Model Complexes

Two dirhodium complexes were previously synthesized,  $\text{cis-Rh}_2(\text{OAc})_2(\text{OCOF}_3)_2$  and  $\text{trans-Rh}_2(\text{OAc})_2(\text{OCOF}_3)_2$ , these were studied for their ability to catalyze chemical transformations. This research primarily focuses on optimizing the procedure used to synthesize these dirhodium (Rh) complexes and to test their ability to bind to model DNA complexes. In order to confirm that these dirhodium complexes were synthesized in the reported percent yield various methods of analysis have been utilized including; nuclear magnetic radiation (NMR), high performance liquid chromatography (HPLC), and mass spectrometry (MS). Previous research has shown that  $\text{cis-Rh}_2(\text{OAc})_2(\text{OCOF}_3)_2$  can bind with model DNA complexes, but the ability of  $\text{trans-Rh}_2(\text{OAc})_2(\text{OCOF}_3)_2$  to bind DNA is largely unexplored. The model DNA complex that will be used in these reactions is 9-ethylguanine, a model DNA base for deoxyguanosine. To study the result of this binding reaction we will isolate the Rh-DNA compounds by HPLC and study their structures via NMR and MS spectroscopies.

Austin Mates, Dr. Stephen Dunham [staam06@moravian.edu](mailto:staam06@moravian.edu) Moravian College

### O1-3 Spectroscopic Studies of the $4^3\Pi$ Electronic State of NaCs

We present results from experimental studies of the  $4^3\Pi$  electronic state of the NaCs molecule. Sodium and cesium metal are loaded into a five-armed heat pipe oven and heated to a temperature of  $300^\circ\text{C}$ . Two narrow-band, tunable cw lasers are used in a pump-probe scheme to induce transitions in the molecule. Observations of fluorescence from discrete rotational and vibrational levels associated with the  $4^3\Pi$  electronic state display unique patterns due to a double minimum in the potential energy curve. Collisions with other species present in the heat pipe allowed a larger range of rotational levels to be excited and entered into the dataset. Simulations of resolved bound-free fluorescence spectra using the BCONT program were used for identification and preliminary adjustment of the theoretical potential energy curve. Spectroscopic constants describing the observed rotational and vibrational levels of the  $4^3\Pi$  electronic state are presented as a preliminary step toward an experimentally accurate potential energy curve for this state.

Andrew Steely, Hannah Cooper, Hareem Zain, Carl Faust

[faust@susqu.edu](mailto:faust@susqu.edu) Susquehanna University

### O1-4 Ozone Uptake on Kaolinite as a Function of Relative Humidity and VOC Coating

Mineral dust aerosols are ubiquitous particulates that exist within the atmosphere due primarily to dust storms in arid regions. Given their high abundance, mineral dust aerosols have significant impacts on atmospheric chemistry, human health, climate, and biogeochemical cycles. Furthermore, these mineral dusts may serve as a sink for atmospheric ozone, which is closely associated with high levels of pollution in the troposphere. While previous studies evaluated the reactivity of ozone on mineral dust surfaces, there is limited understanding of the effects of relative humidity and volatile organic compounds (VOCs) on atmospheric ozone uptake on these clay surfaces. Using a laminar flow reactor, we measured ozone uptake on kaolinite, an aluminosilicate clay, as a function of relative humidity and VOC pre-coating. Steady state reactive uptake coefficient calculations suggest a decrease in ozone uptake at higher relative humidity, whereas reactions where the kaolinite surface was pre-coated with limonene and alpha-pinene displayed an increase in ozone uptake in comparison to the non-coated surface.

Zoe Coates Fuentes, Dr. Ryan Hinrichs [rhinrichs@drew.edu](mailto:rhinrichs@drew.edu) Drew University

**O2-1 Moravian Music: Creating Performance Editions for Anthems and Choral Works**

Moravian Music: Creating Performance Editions for Anthems and Choral Works describes both the research activity and experiential nature of my summer project, undertaken in collaboration between the Moravian College Music Department and the Moravian Music Foundation. I am obtaining invaluable experience in cataloging and preparing modern performance editions of choral works from manuscript copies in the archival collections of the Moravian Music Foundation, custodian of some 10,000 manuscripts and early imprints of music composed, copied, and collected by the early Moravian settlers in Pennsylvania and North Carolina.

One of the pieces I'm focusing on is the Doxology "*Herr unser Gott! der du uns gemacht*", by the Moravian composer Jeremias Dencke. It is one of the earliest choral works composed in America and was prepared for the American Provincial Synod in Bethlehem in 1766. This piece is written for SSAB voices with organ and string accompaniment.

**Matthew Obszarny** [stmao08@moravian.edu](mailto:stmao08@moravian.edu) Moravian College

**O2-2 The Sparks Farm: An Environmental, Social, and Cultural History**

Juniata College recently received a large gift, a 378-acre farm located in Bedford County, Pennsylvania. This presentation analyzes the changes that took place on the Sparks Farm over a 220-year period, in the context of regional and national factors. Factors such as World War II, iron furnaces, and changes in farm technology and equipment have shaped farm activities over its existence. The expansion of the farm to include a summer camp for children widened its uses outside just agriculture. The farm would be used to educate youth on different environmental factors and skills. Agricultural census manuscripts, historic newspapers, oral history interviews and aerial photos show that the Sparks Farm had much in common with neighboring farms in terms of land and water use.

**Ryan Bologna** [bologrc13@juniata.edu](mailto:bologrc13@juniata.edu) Juniata College

**O2-3 Work-Life Balance in Media Newsrooms**

Due to the increasing number of dual-earner couples and single parents in the paid workforce, a growing body of research has examined the concept of work-life balance. Previous research has found that women experience more difficulty than men in balancing work and life. Additionally, those who work at home have also been found to experience more work-family conflict than those who do not work at home. Few studies have examined work-life balance within a particular occupation. This research examined work-life balance within media newsrooms. The data were obtained from over 30 semi-structured in-depth interviews with individuals currently employed in television and print media newsrooms. Preliminary results suggest that those working in print newsrooms work more hours at home than those employed in television newsrooms. As expected, the often unpredictable schedules of both television and print newsrooms were found to decrease the employees' ability to balance the two roles.

**Irene Snyder** [snyderi@etown.edu](mailto:snyderi@etown.edu) Elizabethtown College

**O2-4 Friendship, Victimization, and Peer Interactions Among School Aged Children**

The current study explores how a child's home life, classroom behavior, and mental health can possibly impact how an individual may be victimized, be an aggressor or possibly be both. Specifically, we examined data from fourth graders in the Bethlehem Area School District as well as from their parents and teachers. Much of the children in this sample are considered "at risk" meaning most are minorities that live in low socioeconomic status, single parent households. The data came from various surveys, questionnaires as well as report cards. Findings indicate that there are indeed relationships between a child's home life, classroom conduct, their mental health and his or her social role (bully, victim, or bully-victim). Additional analyses will further examine how location and socioeconomic level may influence how a child may fall into these roles. Specific findings and implications will be discussed.

**Emily Miller, Dr. Michelle Schmidt** [stelm11@moravian.edu](mailto:stelm11@moravian.edu) Moravian College

### O3-1 Heterogeneous Reactions Involving Kaolinite Clay and ( $\alpha$ )-(+)-Pinene

The heterogeneous reactions of volatile organic compounds on mineral dust aerosols may form secondary organic matter, which can have significant atmospheric implications. Diffuse reflectance infrared Fourier transform spectroscopy monitored the formation of organic products on kaolinite clay surfaces after exposing them to gaseous ( $\alpha$ )-(+)-pinene at various relative humidity levels. Reactions were performed both with and without HNO<sub>3</sub>. Using gas chromatography and mass spectrometry,  $\alpha$ -terpineol, fenchol and endo-borneol were identified as the major organic products for reactions with and without HNO<sub>3</sub>. The rate at which organic products were formed decreased with increasing humidity, indicating an inversely proportional relationship between relative humidity and reactivity. At a relative humidity of 30%, the rate of product formation was 3 times higher after exposure to HNO<sub>3</sub>, while the concentration of HNO<sub>3</sub> remained relatively constant. These results insinuate that HNO<sub>3</sub> functions as a catalyst in reactions between kaolinite and ( $\alpha$ )-(+)-pinene. These findings suggest that reactions between kaolinite and ( $\alpha$ )-(+)-pinene lead to the formation of secondary organic matter in the atmosphere.

**Jed-Joan Edziah, Dr. Ryan Hinrichs** [rhinrich@drew.edu](mailto:rhinrich@drew.edu) Drew University

### O3-2 Pesticide monitoring of local watersheds

Water is a vital resource to humans and animals. If the resource that we rely on to live is contaminated with pesticides we are potentially contaminating all life that relies on water. Using pure atrazine and S-metolachlor, I made different concentrations of pesticide solutions and ran them on the Gas Chromatography – Mass Spectrometry instrument to determine the detection limit and to make a calibration curve. I also made a calibration curve for terbuthylazine (the internal standard). I concentrated water samples using a C-18 cartridge to extract the pesticides and internal standard. Looking at local watersheds, so far I have not found any detectable pesticides in the Fry's Run watershed but pesticides were found in Pohatcong Creek watershed. We choose these local watersheds because of the large amount of agricultural land in their vicinity.

**Matthew Little** [stmr106@moravian.edu](mailto:stmr106@moravian.edu) Moravian College

### O3-3 Manipulating Signal Hydrophobicity to Alter Quorum Sensing in *Streptococcus pneumoniae*

*Streptococcus pneumoniae* is a bacterial species responsible for 900,000 bacterial pneumonia infections per year in Americans. *S. pneumoniae* utilizes a process known as quorum sensing to communicate through a signaling molecule, CSP1, to coordinate group gene expression based on the number of neighboring cells. We utilized Fmoc solid phase peptide synthesis to make a library of CSP1 derivatives, focusing on modification at a uniquely hydrophobic region of the peptide that was hypothesized to be critical for receptor binding and initiating gene expression. We purified the derivatives through high performance liquid chromatography. Using the purified and identified CSP1 derivatives we will determine experimentally the anti-quorum sensing activity of *S. pneumoniae* by screening in live cultures. These derivatives will not only allow us to study how the peptide binds to the receptor, but may also serve as inhibitors of the native peptide.

**Erin Tiwold, Dr. Michael Bertucci** [stekt02@moravian.edu](mailto:stekt02@moravian.edu) Moravian College

### O3-4 Nickel catalyzed [4+4] cycloaddition

This project involves examining intramolecular cycloaddition of dienes using nickel catalysts. We are investigating nitrogen based substrates with the aim of getting more [4+4] product versus the easier formed [4+2] Diels-Alder product. Different substrates were made each having a bis(2,4-pentadienyl) tertiary amine with different substituents on the nitrogen. Examples of substituents used were t-butyl, methoxy, isopropyl and benzyl groups. By understanding the reaction fully using different substrates our goals were to:

1. Find a Ni starting material that is more user friendly than Ni(COD)<sub>2</sub>
2. Demonstrate different conditions that have the best [4+4] yield.
3. Demonstrate the reaction across a wide range of different ligands starting with different phosphines.
4. Investigate different ligand:metal ratios for the reaction.

So far, we have found that triphenylphosphine continues to be the optimal ligand for the reaction, and the reaction works best with a 2:1 ligand metal ratio.

**Elton Kativhu** [elkat001@mail.goucher.edu](mailto:elkat001@mail.goucher.edu) Goucher College

#### **O4-1                    The Role of Scale in Ecological Studies: Benthic Macroinvertebrate Community Structure**

Ecological research spans multiple geographical scales, from small microhabitats to landscapes. Moravian College students and faculty have been conducting studies on stream sites within the Lehigh River watershed since 2009 in order to determine the effects of human land use on stream water quality. The Hilsenhoff Biotic Index (HBI) provides an estimate of the habitat for macroinvertebrate communities inhabiting stream bottoms. In general, values indicate that sites in the Upper Lehigh score better than those in the Lower Lehigh, and that upstream sites within a single stream score better than downstream sites. On a local scale, however, exceptions to these generalizations occur. In our study we examined two Upper Lehigh sites, Irishtown Run and Weir Creek, in which human land use negatively affected the HBI at the latter site. Moreover, a small dam on the Monocacy Creek had a similar negative effect on the HBI. These results confirm that human impacts have significant effects on biological communities in these watersheds.

**Richard Buffone, Josh Toth**                    [streb05@moravian.edu](mailto:streb05@moravian.edu) Moravian College

#### **O4-2                    Metatranscriptomic Profiles of Dichloromethane Degrading Communities**

Due to the continued development of high through-put sequencing (HTS), metagenomics has matured into a robust field of study, but metatranscriptomics is still undergoing rapid development. While metagenomics can accurately determine genes present in a sample, metatranscriptomics can quantify transcripts present in a sample to assay gene expression within a given microbial community. Here we present a pipeline designed from open-source tools that can process raw RNA-Seq reads and determine genes that are significantly differentially expressed between samples. As a benchmark for this pipeline, metatranscriptomic data were obtained from 11 dichloromethane (DCM)-contaminated groundwater samples and probed for differentially expressed genes related to chloroalkane and chloroalkene degradation. Results indicate that the expression profiles of the microbial communities are correlated to sample location and DCM concentration. These data will be useful for assessing the in situ activity of these groundwater microbial communities and their ability to contribute towards degradation of dichloromethane.

**Dallas Hamlin, Justin Wright, William Bernard, Veronica Kirchner, Nikea Ulrich, Tamzen Macbeth, David Marabello, Jacob McDermott, Rachel Mackelprang, Regina Lamendella**  
hamlidw13@juniata.edu                    Juniata College

#### **O4-3                    Turtle Population Dynamics in Three Ponds at the Lehigh Gap Nature Center**

Globally, 45% of freshwater turtle species are listed as threatened on the 2000 IUCN Red List of Threatened Species. By studying the turtle populations at the Lehigh Gap Nature Center this project aims to contribute to an increased understanding of how anthropogenic changes in landscape can affect turtle populations. Using a mark-recapture method estimates of painted turtle (*Chrysemys picta*) numbers at Mallard, Kingfisher and Wood Duck Ponds were approximately 189, 242 and 130, respectively. Males accounted for ~52% of the population. Evidence suggests that a small, but significant number of the turtles migrate between these three ponds. Future studies will explore the degree of hybridization between individuals of the Eastern (*Chrysemys picta picta*) and the Midland (*Chrysemys picta marginata*) subspecies and examine potential predation on these turtles' nests.

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### **O5-1 Petrology Of The Edmonds Ultramafic Body In The Ashe Metamorphic Suite Of North Carolina**

During a mountain building event, oceanic crust and underlying mantle may be uplifted and emplaced on top of less dense continental crust. The Ashe Metamorphic Suite (AMS) in the Eastern Blue Ridge Mountains contains metamorphic rocks that were formed and reworked during the formation of the Appalachian Mountain range. The AMS includes multiple ultramafic (high magnesium, low silica) bodies with varying mineralogy and texture. A team from Juniata College sampled an 11 km by 1.5 km ultramafic body near Galax, Virginia in May 2016. I analyzed samples by optical and electron microscope to determine metamorphic conditions and timing. This body is mineralogically zoned: near the center olivine grains are more abundant and larger, whereas olivine breaks down into tremolite, talc, anthophyllite, and chlorite near the edges of the body. The minerals and textures near the edges indicate a retrograde (decreasing temperature) metamorphic reaction: the interior zone quenched a higher temperature assemblage with lower fluid content while the outer zone, in contact with cooler and more fluid-rich rock, was altered by retrograde metamorphism. This relationship could imply that the peridotite was emplaced into colder crust while still hot, and only the edges were fully retrograded, assisted by fluids.

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### **O5-2 The Characteristic Study of 6,7-diphenyl- 2(1H)-thioxo-4(3H)- 7,8-dihydropteridinone**

The monomer and dimer forms of compound 6,7-diphenyl- 2(1H)-thioxo-4(3H)- 7,8-dihydropteridinone were studied using spectroscopy techniques. The influence of acid and base were studied to see their effect on the monomer or dimer form. Through UV-Vis spectroscopy it was determined that acid causes the compound to shift more toward its dimer form and have a peak absorbance of around 398nm, while adding base shifted it to its monomer form with a peak at 418nm in DMSO solution. Interaction with a soda lime glass pipet has similar effects to treatment with base. The monomeric form is highly fluorescent with a quantum yield of 0.54 in DMSO. The compound in dimer form is much less fluorescent. Solvent studies were also conducted to determine the effect on fluorescence. Spectra were recorded in ethanol, methanol, ethyl acetate, acetonitrile, and acetone as well as different mixtures of DMSO with these solvents. The monomer/dimer equilibrium is solvent dependent, which affects the fluorescence intensity.

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### **O5-3 An Algebraic Investigation of Restricted Movement Rubik's Cubes**

It is well known that Rubik's Cubes can be modeled using permutation groups. These Rubik's groups have been thoroughly studied by mathematicians since the puzzle was originally invented in 1974. Over the past several decades, a number of variants of the cube have been created that do not all fit in a permutation group model like the original puzzle. Two such variants are called Bandaged Cubes and Constrained Cubes, which both conditionally restrict the movement of the Rubik's Cube. In this talk I will discuss how we can generalize the notion of the group to build a groupoid model for these puzzles. Groupoids have been studied since 1927 in algebra, differential geometry and category theory. We will use them to analyze specific puzzles and find new kinds of properties of Rubik's Cube variants.

**Bryan Harvey**      Moravian College

### **O5-4 Open Access 3D Printed Raman Spectrometer**

The practicality and effectiveness of an open access scientific instrument design is analyzed through the assembly of an open access design Raman spectrometer, called RamanPi. The Raman spectrometer parts were 3D printed and assembled together with commercially available components. The spectrometer housing and the majority of moving parts are 3D printed. The spectrometer itself is made with commercial optics and a tiny camera, a CCD (Charged -Coupled Device Camera). The excitation light source is a 200 mw green laser (532 nm). The electronics are assembled from a variety of hobbyist components and the central processing of spectral data is performed by a tiny multipurpose computer, a RaspberryPi. The capabilities and claims of the open access RamanPi project and preliminary results will be discussed.

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### **O6-1 DNA Cross-linking by Antitumor Active Rhodium Compounds**

When it comes to pharmaceutical use, transition metal elements have been underexplored. One successful anticancer drug, cisplatin, has been used in the clinic to treat testicular cancer and has a platinum atom at its center. Cisplatin is capable of killing cancer cells because it is able to bind to and damage DNA, triggering apoptosis (programmed cell death). Dirhodium compounds affect DNA in a similar way by forming damaging cross-links on the duplex including interstrand cross-links. Our goal is to determine the extent of interstrand cross-links formed by each of the dirhodium compounds in a series. We will gather these data by performing denaturing agarose and polyacrylamide gels and then determine if there is a correlation between the composition and/or structure of the dirhodium compounds and the amount of interstrand cross-links that they form on DNA.

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### **O6-2 Comparative genomics of *Mycobacterium chimaera***

**Aims:** *Mycobacterium chimaera* is a pathogenic species of nontuberculous mycobacteria that can cause cardiovascular and pulmonary infections in humans. An unknown mycobacterium strain, assumed to be *M. chimaera*, was isolated from a patient presenting with bronchiectasis. Here we sequenced the whole genome of the unknown mycobacterium strain and compared it to three previously sequenced *M. chimaera* strains.

**Methods:** Total genomic DNA was extracted from a slant culture, prepared for sequencing using the Nextera library preparation kit, and sequenced using 150 bp paired end Illumina Hiseq chemistry. It was compared to the three known *M. chimaera* genomes. Each genome was assembled and then annotated using online annotation tools such as JGI IMG, RAST and KBASE.

**Results:** Several unique virulence genes were identified within the unknown strain of mycobacterium. We have established a reference point for comparison of environmental *M. chimaera* isolates whole genomes for purposes of identifying sources of human exposure.

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### **O6-3 How Do Sand Boas Capture Prey They Cannot See?**

*Eryx colubrinus*, the Kenyan Sand Boa, is known to ambush prey from beneath the soil surface. Previous studies using a bare filming box suggest that during prey capture, the upper jaws are depressed and rotated, maximizing tooth exposure for snagging prey. This study asks how *E. colubrinus* capture prey in a more naturalistic setting where visual cues may be obstructed. Eleven specimens were recorded burrowing and capturing live mice in a ten-gallon aquarium with sand substrate. Snakes sat buried with the head partially exposed, but appeared to strike in response to touch rather than sight. We then asked if *E. colubrinus* prefers to wait in prey-scented areas. Control snakes, exposed to unscented sand, moved about throughout each trial. In contrast, experimental snakes remained stationary near an eleven-centimeter circle previously scented by a mouse, supporting our hypothesis that *E. colubrinus* position themselves near prey-scented regions of sand.

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### **O6-4 Effect of Bang-sensitive Mutations on Memory in *Drosophila melanogaster***

*Drosophila melanogaster* has long been used as a model organism for the study of genetics, one reason being the relative ease with which they are mutated. Bang-sensitive flies are one such category of mutants, which will experience seizures upon physical agitation. Many of the genes responsible for these seizures have homologs in humans, making the fruit fly an ideal organism to model this disease.

The purpose of this project was to evaluate the memory capabilities of various bang-sensitive mutants, and see whether the bang-sensitive gene(s) resulted in a negative effect. This is an area of research which has not yet received a lot of attention. If results indicated that the seizures resultant from the bang-sensitive genes in flies did indeed harm memory capacity, it is possible similar results could be seen in humans. This could lead to another avenue of study when trying to understand the ramifications of human seizures.

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## Abstracts for Poster Presentations

### **P1-1 Methods Development for the Analysis of Viral Content in the Gut**

The microbiome, or bacteria that colonizes the large intestine, plays a large role in controlling human health. Very little is known about how the virome, or viruses present in the large intestine, impact the microbiome and therefore the host organism. Bacteriophages, or viruses that infect bacterial cells, have the greatest potential to alter the microbiome and therefore are the focus of this study. In this study we are developing a method to separate viruses from fecal samples, isolate their nucleic acids and perform shotgun sequencing. To analyze the sequence data, MetaVir has been modified to use Juniata College's cluster computer in order to accommodate the large sets of data. The data will be compared to known viral genomes and a phylogenetic tree will yield abundance and the type of virus. These data will also be run against a bacterial database in order to determine the degree of phage interaction with the bacteria. Studying the virome will enable us to better understand the role of viruses within a complex ecosystem such as the gut.

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### **P1-2 Interaction between bacterial and fungal communities in *Clostridium difficile* infected individuals**

Our previous work described the bacterial and fungal microbiota changes that differentiate *Clostridium difficile* infections from other forms of diarrhea. Here we investigated the ecological relationships between the bacterial and fungal communities within this cohort. We used co-occurrence network models to analyze the relationship between bacterial and fungal assemblages. After genus level summary in QIIME 1.9.1, these samples were run through the CoNet software to generate bipartite co-occurrence networks showing interaction between bacteria and fungi in infected and uninfected individuals. A preliminary result of the network analysis is that *Penicillium* is negatively correlated with a number of known gut bacteria, while *Nectria*, *Trichoderma*, and other fungi are positively correlated with these same bacteria. These network analyses are beginning to shed light on the ecological underpinnings of complex environments such as the gut.

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### **P1-3 Indoor 3D Reconstruction with Google Project Tango**

The goal of my project is to design a low-cost portable 3D scanning device with a Project Tango tablet and a custom platform. The Project Tango is equipped with an area scanner to acquire point clouds with depth information. The custom platform holds the tablet and rotates it around horizontal (X) and vertical (Y) axes. Two step motors powered by an Arduino is used to provide rotation at 90° increment in the Y-axis and 30° increment in the X-axis. A custom app reads in the point clouds, triangulates them into a 3D surface, and generates a concise 3D model, which would provide further possibility to 3D space related works. A brief demonstration of the device will be given at the conference.

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### **P1-4 Segmentation of the Left Ventricle using Isotropic 4D MRI**

Magnetic Resonance Imaging (MRI) is used to obtain images of the body using magnetic fields and radio waves. The use of this technique is effective in diagnosing cardiovascular diseases.

In this project, our goal is to segment the left ventricle from the isotropic 4D MRI images. We are interested in the health of the left ventricle since its main function is the pumping of oxygenated blood to the entire body, and its malfunction causes most cardiac pathologies. Our algorithm takes the 4D images and a click point placed inside the left ventricle, and attempts to segment it at the beginning of the systolic phase. We tested our algorithm with the data set and used Jaccard similarity measure to evaluate the performance quantitatively. The average similarity measure across four data sets and five different click points was 73%. Future works include extraction of the right ventricle of the heart.

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**P1-5 Reconstruction with Flags: An Experiment in Computer Vision Using Tracking to Develop Three Dimensional Models**

The goal of this project is to automatically track flags outside with an uncalibrated and unconstrained video camera so that the distance between these flags is accurately reflected in three dimensional space. In this part of the project, we use a hand-held camera to record a scene comprised of different colored flags laid out in a field. We will use a custom program made with OpenCV to detect and track these flags from video clips automatically. Afterwards we will use a tool, VisualSFM, to compute the 3D coordinates of the tracked flags. Then we will compare the accuracy of this approach to a software called Blender. As of this writing, the data is being collected and therefore any results along with performance comparisons will be presented at the conference. In the future we would like to obtain fully automated implementation of the application where reconstruction is done in real time.

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**P1-6 Stressing Interdisciplinarity in order to Mold the Undergraduate Experience**

Liberal arts education emphasizes interdisciplinary exploration. Many students, however, spend their early academic years taking discipline-specific courses, leaving non-disciplinary electives for later years. Juniata College's pilot freshman seminar, "From Lab to World," will shape how freshmen approach their college career by stressing the need for interdisciplinarity in scientific research and in addressing the local and global problems we face as citizens. Problem-based learning, guest speakers and supplementary sources engage students in active learning about genetic modification and infectious disease as they develop the skills necessary to think critically and constructively about social issues. Using their own experiences, the student co-developers of the course have joined with faculty to argue that interdisciplinary courses, when taken in the first year, have the power to mold a powerfully different undergraduate experience.

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**P1-7 Nano-Printing Organic Semiconducting Electronics**

The process of dynamic stencil deposition (DSD) makes it possible to make wires just nanometers wide. In order to carry out DSD, we use a device called a "nano-printer". The nano-printer allows us to deposit organic semiconductor solutions through a small hole. By moving the hole with nanoscale precision using a piezoelectric actuator, we can create nanowires on a grid of electrodes that allows for testing of the wires. Using the Atomic Force Microscope (AFM) and a technique called Scanning Gate Microscopy (SGM), we are testing the electrical conductivity of these semiconductors to see if they are viable for use in electronic devices. The tip of the AFM can be used as an electrical gate that scans over the sample to locally affect the current flow in the wire. The purpose of this experiment is to create more efficient and cost effective organic electronic devices.

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**P1-8 Synthesis of a thienylquinoxaline fluorescent probe for biological applications**

Fluorescent probes are useful for biological applications for sensing and imaging techniques. A molecule with a large Stokes shift—the difference between absorbance and fluorescence emission—is ideal for biological applications. Few studies have shown that the combination of thiophene and quinoxaline create a push-pull charge transfer, leading to a mega-Stokes shift. By using a modified Knoevenagel condensation the fluorescent probe—[(E)-2-(2-(2,5-dimethylthiophen-3-yl)vinyl)quinoxaline] (DTVQ)—containing this unique combination was synthesized. This molecule has the potential to be used to estimate enzymatic polarities of protein binding sites.

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**P1-9 Synthesis of a light-activated nitroxyl donor containing fulvene**

A dithienyl fulvene was synthesized in order to provide and further the study of potential photochromic nitroxyl donor molecules. Photochromic donor molecules allow for potential controlled release of the nitroxyl drug, useful as an anti-cancer agent and a positive inotrope. Fulvene is known to undergo lower temperature retro Diels-Alder reactions when used as the diene. A fulvene derivative was investigated, using an acyl nitroso molecule as the dienophile. Previous work has demonstrated that a dithienyl

molecule was a successful nitroxyl donor but at extreme temperatures. The fulvene design of the molecule is hypothesized to decrease the temperature needed for the release of the nitroxyl. This release is dependent on a light-activated retro Diels-Alder reaction. The optimization of conditions for drug release can contribute to the application and investigation of a photochromic nitroxyl donor.

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**P1-10 Establishing preliminary relationships between peptide structure and quorum sensing activity in *Bacillus cereus***

This project focuses on bacterial quorum sensing and its role in bacterial virulence. Bacteria communicate with each other using chemical signals, or autoinducers, resulting in synchronized group behavior. When the density of autoinducers (and therefore bacterial cells) is high, they bind to a receptor in the cells and spark synchronized behavior. If this communication pathway could be interrupted, it could prevent synchronized behaviors such as biofilm production or virulence. Our project's goal is to modify the autoinducer in *Bacillus cereus* to interfere with the communication circuit so that biofilm production cannot occur. The autoinducer responsible for quorum sensing in *B. cereus* is a peptide containing seven amino acids. An alanine scan will be performed to provide insight into which amino acids are most critical for initiating quorum sensing. Ultimately, we would like to test our synthesized peptides in a bacterial plate to determine which modified peptides stop the quorum sensing mechanism.

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**P1-11 Synthesis and Characterization of an Iron(III) Amine Triphenolate Coordination Complex**

Tripodal iron coordination compounds have been studied as model complexes for biological and industrial catalytic processes including small molecule activation reactions. As part of a larger study considering the impact of ligand identity on the redox properties of iron coordination complexes, we set out to synthesize iron coordination complexes using several amine triphenolate ligands. We will describe the synthesis of tri-(2-hydroxybenzyl)amine as well as progress toward the isolation of tris(2-hydroxy-4,6-dimethylbenzyl)amine. Future work will include these ligands' subsequent coordination to iron and characterization using X-ray crystallography and cyclic voltammetry.

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**P1-12 Reactions of triosmium decacarbonyl bisethoxide with amides**

In our investigation of the bridged triosmium cluster,  $\text{Os}_3(\text{CO})_{10}(\mu\text{-OEt})_2$ , reactions with amides were performed. The reactions with acetamide ( $\text{CH}_3\text{CONH}_2$ ) and benzamide ( $\text{C}_6\text{H}_5\text{CONH}_2$ ) were analogous to the reaction of the cluster with carboxylic acids forming a diosmium complex, however there exists the possibility of isomers. Spectroscopic NMR and IR data as well as chromatographic data indicates that both isomers of  $\text{Os}_2(\text{CO})_6(\text{RCONH})_2$  ( $\text{R} = \text{C}_6\text{H}_5, \text{CH}_3$ ) were observed in almost equal amounts.

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**P1-13 Synthesis of a Pentadentate Ligand for Coordination with Manganese**

Manganese complexes with bridging oxo ligands are highly studied due to their role in the biological processes of photosystem II. However, few dimeric complexes that include manganese(III) and manganese(IV) metal centers bridged by a single oxo ligand have been reported. Because of the potential relevance of single oxo bridging Mn(III/IV) units in the chemistry of the oxygen evolving complex, we set out to synthesize a complex of this type and to characterize it by EPR spectroscopy. Current progress toward this goal includes synthesis of several ligand precursors and preliminary attempts to synthesize the ligand of interest. Ongoing research includes the purification of the ligand of interest, its coordination to manganese, and computational and spectroscopic analysis of the complex.

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**P1-14 Water Quality Index Analysis of Five Penns Creek Headwater Streams, Bald Eagle State Park, PA**

Water quality index (WQI) uses many weighted, measurable parameters to give one number to express the quality. The quality of the five Penns Creek headwaters in Bald Eagle State Park, PA were assessed. Data was collected from June 2015 to July 2016. One site from each of the streams was evaluated. The main collection of data was from an Ion Chromatography System and YSI multimeter.

Comparison of two water quality indices using the same equation with slightly different parameters. The first uses 11 parameters while the second uses 16 parameters. The first index gave qualities of Henstep, 76.54, Coral, 81.92, Lick, 84.62, Green Gap, 84.23, Little Weikert, 84.23. The second index gave results of Henstep, 85.45, Coral, 86.45, Lick, 87.88, Green Gap, 88.48, and Little Weikert, 86.67. All of the numbers fall under the category of “good water quality”. All numbers in the second index are greater than the first because the second includes more ion concentrations. From the data collected and other resources, a new WQI was created to more accurately express the true quality.

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#### **P1-15 Pesticide Quantification in Central Pennsylvania**

Pesticide use in Central Pennsylvania is, as of yet, not a highly explored topic of research. Our project involves the quantification of pesticides in river water and sediment through extraction, concentration, and analysis by gas chromatography mass spectrometry (GC/MS). Current work is being done to qualitatively assess what chemicals are present at selected sites that are near agriculture. Future work will focus on derivatization of glyphosate (Roundup(R)) into sarcosine and AMPA for analysis by GC/MS to create a standard curve in order to quantify the prevalence of glyphosate in the environment.

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#### **P1-16 Polyproline Folding: Effect of Chain Length and Interactions**

Folding allows a peptide or protein to convert into a more stable form to be used in the body, but on few occasions the protein can fold incorrectly and lead to disease. By better understanding how the protein folds normally, we can learn what is occurring during misfolding. When a polyproline peptide folds from one helix to another, there are several intermediates that form as a result of the transition. My work specifically focuses on observing the intermediates during this transition using capillary electrophoresis (CE), where molecules are separated based on size and charge. The analysis process is done using the Origin program, by fitting peaks based on their position and size to determine how many are present. At this time we have observed a difference in folding based on chain length. The intermediates have been shown to interact differently when introduced to a proline-binding peptide.

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#### **P1-17 Ca<sup>2+</sup> catalyzed cleavage of RNA phosphorodithioate linkages**

Many phosphodiesterases utilize metal ions in their active site. Replacing non-bridging oxygen atoms in the phosphodiester linkage with sulfur atoms is a common experimental technique for studying the roles of metal ions in these reactions. However, the mechanisms of metal ion catalysis, and the effects of sulfur substitution remain an area of investigation. Using a model system of Ca<sup>2+</sup> and a phosphorodithioate analog of the 5'-uridine-guanosine-3' dinucleotide (Ups2G), we have established that Ca<sup>2+</sup> catalyzes Ups2G cleavage in a mechanism that is saturable and involves a single Ca<sup>2+</sup> ion. We find Ca<sup>2+</sup> provides 14 fold catalysis with a dissociation constant of 0.5 M. Comparing these results with previous work with phosphodiesterases (UpG) and phosphoromonothioates (UpsG) indicates that sulfur substitution does not affect binding between the metal ion and dinucleotide. However, the phosphorodithioate engenders a greater catalytic defect than would be predicted from the individual phosphoromonothioate substitutions.

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**P1-18 Effect of Downstream DNA Sequence and Structure on Pausing by *E. coli* RNA Polymerase**

Sequence-specific pausing by RNA polymerase (RNAP) underlies important gene regulatory mechanisms. Pausing involves interactions throughout the enzyme-nucleic acid interface that can allosterically influence the kinetics of nucleotide addition at the active site, through as yet poorly understood mechanisms. Using elongation complexes of *E. coli* RNAP assembled on oligonucleotide scaffolds, we are exploring the effect of downstream DNA sequence and structure on pausing. We find that an A5-tract at positions +3 – +7 relative to the RNA 3'-end increases the efficiency and half-life of pausing at the hisL pause site, relative to the wild-type downstream sequence. Substitution of a GC pair at the central position (+5) of this A-tract, known to obliterate the bent structure associated with A-tracts, diminishes the effect of the A-tract on pausing. The effects of mutations in RNAP at residues in the vicinity of the A-tract may help elucidate the mechanism of its influence on pausing.

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**P1-19 Antibiotic Tolerance: Distinguishing between Classical Resistance and Persistence in a Macrophage Infection Model**

*Burkholderia pseudomallei* is a facultative intracellular bacterial pathogen that causes the deadly disease melioidosis. Melioidosis is difficult to treat because *B. pseudomallei* is inherently antibiotic resistant. In previous studies, we found that a combination of ceftazidime and INF- $\gamma$  synergistically reduced the intracellular bacteria in macrophages infected with either *B. pseudomallei* or the related *B. thailandensis*. However, the remaining bacteria are antibiotic tolerant, which could still pose a threat to the host. Using pre-established methods to distinguish between antibiotic resistance and persistence, we have determined that the remaining bacteria are persister cells. Further characterizing these dormant, slow-growing, antibiotic tolerant cells, can potentially lead to future treatments against this fatal disease.

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**P1-20 Intergenic effects of bang-sensitive mutations in *Drosophila melanogaster***

In *Drosophila melanogaster* a number of mutated genes induce seizures. These genes are known as bang-sensitive genes. The functions of the gene products have been determined, however, it is unclear how they interact with each other. This research focuses on the creation of double bang-sensitive mutants using traditional genetic techniques. After combining existing mutations, the intergenic effects of carrying multiple bang-sensitive genes will be studied.

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**P1-21 A Structural and Functional Fungal Assembly and Annotation Pipeline**

Current eukaryotic genome assembly and annotation tools are applied to a wide variety of organisms to understand their genetic potential. Many currently available tools do not offer robust annotation to discern differences among species or strains. Common annotation approaches rely on structural annotations and then a comparison to a compiled list of genes. Researchers can then browse specific genes of interest and carry out wet lab experiments to validate gene function. However, this approach does not allow for rapid comparisons of complex genomes such as fungal genomes without having a comprehensive list of genes of interest. Here we have benchmarked and implemented the most robust assembly and annotation tools available. This pipeline includes both structural and functional annotations, which uses a comprehensive and updatable database. Here we implement this pipeline to more robustly assemble and annotate a complex fungal genome to shed light on its important unknown metabolic functions.

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**P1-22 Effects of Tgf $\beta$  signaling on differentiation and proliferation in developing zebrafish retina**

A complete understanding of proliferation and differentiation within zebrafish retina (*Danio rerio*), has the capacity to lead to enormous advances in ocular therapy. Zebrafish retinas contain the same neurons and Müller glial cells that humans do and are fully matured by 3 days post fertilization making them an ideal model organism. Like zebrafish, human retinal development involves cell proliferation, early morphogenesis, and cell fate determination. Zebrafish retinal development contains a third stage, unique

to all teleost fish. This stage is life long and allows for continuous and persistent neurogenesis that follows the growth of the retina and other tissues. One pathway influencing these impressive characteristics is the Tgf $\beta$  signaling pathway. It is known that the Tgf $\beta$  signaling pathway inhibits proliferation during retinal regeneration. Tgif1 and six3b are genes that control the regenerative properties of this pathway and allow proliferation to take place. The chemical inhibitors SB4 and SB5 can inhibit Tgf $\beta$  signaling. We used immunohistochemistry on frozen embryo sections to quantify different cell types and compare to fish with tgif1 and six3b mutations. Wild type fish are expected to see the most growth along with fish exposed to SB4 and SB5. Two more genes that we are concerned with are P27 and P57. These genes are involved with entering and exiting the cell cycle and we are examining when and where these genes are expressed during development when we manipulate Tgf $\beta$  signaling.

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**P1-23 A possible role for eIF5A post-translational modification in yeast Ty1 retrotransposition**

Retrotransposons are genetic elements capable of forming a virus-like particle after translation and inserting their sequence into other parts of the genome. Ty1 is the most frequently found retrotransposon in *Saccharomyces cerevisiae*. In our study, we observed an increase in the retrotransposition of Ty1 when the gene FMS1 was overexpressed. FMS1 is an enzyme that catalyzes the reaction that forms spermidine. This molecule is then used for the post-translational modification of the elongation factor eIF5A. This elongation factor has been shown to play an important role in the efficient translation of polyproline motifs, specifically those containing three or more prolines in a row. We hypothesized that the connection between FMS1 and Ty1 retrotransposition is due to the high amount of polyproline motifs in Ty1 transposons. Using bioinformatics and molecular biology techniques, we researched this hypothesis.

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**P1-24 Transcriptomic analysis of Brook trout (*Salvelinus fontinalis*) within headwater stream ecosystems.**

Our understanding of possible environmental impacts of unconventional natural gas extraction in headwater ecosystems has lagged behind the rate of expansion of this industry in Pennsylvania. While some studies and reports by government agencies have been released on the chemical nature of fluid that is collected from wells, few have evaluated possible genetic impacts on organisms living in ecosystems where these wells are located. Evaluating gene expression in brook trout liver tissue from thirteen headwater ecosystems, including those with and without gas extraction, will provide a basis for understanding biochemical responses to gas extraction. Utilizing the SMART protocol for eukaryotic RNA-seq library preparation, samples were prepared for sequencing and analysis. Libraries for 48 samples were prepared and 44 indicated successful preparation by gel electrophoresis and Bioanalyzer analysis. This analysis will ultimately provide insight into the impact of fracking on organisms and provide information to guide future decisions about the industry.

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**P1-25 Establishing physical interactions between testis-specific TFIIA subunits and transcription machinery in *Drosophila melanogaster***

All the cells within a multi-cellular organism contain the same genome. Despite this, cells are able to differentiate and perform specific functions within the organism. This specialization is achieved by activating genes through developmentally regulated gene expression. The first step of gene expression is transcribing genetic information stored in DNA into RNA. General transcription factors, such as TFIIA and TFIID, are needed to situate RNA polymerase on the promoter of a gene in order to begin transcription. TFIIA and TFIID are multi-subunit complexes and, in *Drosophila melanogaster*, there are testis specific versions of several subunits. It is likely that these testis-specific general transcription factors are important for transcribing testis-expressed genes, however, the exact subunit composition of these testis complexes are not known. We are testing whether the TFIIA containing a testis-specific small subunit can physically associate with the TFIID subunit TATA-binding protein (TBP) or its homolog TBP-related factor (TRFII).

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**P1-26 Analyzing Gene Expression Following Perturbations of the PCP and Hippo Signaling Pathways During Sea Urchin Embryogenesis**

Cell differentiation and morphogenesis rely on cell signaling pathways that convey key information to cells about their roles in the developing embryo. We are studying the role of two pathways in the sea urchin: the planar cell polarity (PCP) pathway and the Hippo pathway, using loss-of-function analysis with small molecule inhibitors. We are determining the effects of pathway inhibition on gene expression through in situ hybridization of cell-type specific genes. We have shown that the PCP pathway is required for invagination of the archenteron but certain endoderm and mesoderm specific genes appear to be normally expressed. We are extending those studies by examining additional markers, specifically aa29, myosin, endo16, and hedgehog. We are also examining changes in the expression of these genes in embryos in which the Hippo pathway (required for cell proliferation) has been disrupted. These studies will help link these signaling pathways to specific events in cell differentiation in the sea urchin embryo.

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**P1-27 Testing the Temperature-Size Rule in Two Sexually Dimorphic Crustaceans**

According to the temperature-size rule (TSR) ectothermic organisms grow faster, but reach smaller mature sizes in warm versus cold environments. However, among cold and warm springs within the mid-Appalachian region, we have found that the isopod *Lirceus brachyurus* shows the TSR, whereas the amphipod *Gammarus minus* does not. Our objective has been to test various hypotheses to explain this surprising difference. We are testing the hypothesis that growth and reproductive maturation differ due to thermal sensitivity in the isopod, but not the amphipod by inter-population comparisons of the scaling of brood-plate area (a measure of reproductive maturation) relative to body mass growth. Potential interspecific differences in the thermal sensitivity of oxygen supply and demand (oxygen-limitation hypothesis) are being examined by inter-population comparisons of gill surface area and oxygen consumption rate scaling. We hope that these tests will shed light on what is causing the TSR in general.

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**P1-28 The Chemical Defense of *Phragmites australis* subspecies *australis* against the Periwinkle Snail, *Littoraria irrorata*, and other Small Herbivores**

The marsh grass *Phragmites australis* subspecies *australis*, (common reed), originates from Europe and has invaded the Chesapeake Bay marsh, outcompeting native plants. Periwinkle snails (*Littoraria irrorata*) rarely feed on *Phragmites*, and previous work found that snails are deterred by this plant's chemical defense. Thus, this invader may be successful through the use of a "novel weapon," allowing it to evade herbivory. Using the process of bioassay-guided fractionation and methods to avoid oxidation of *Phragmites'* chemicals, we were able to isolate the defensive compound. The marsh ecosystem is also home to a variety of grasshoppers and katydids (Families *Acrididae* and *Tettigoniidae*), which feed on marsh plants and we conducted feeding assays to determine whether these herbivores are also deterred by *Phragmites*. Preliminary data suggests that these herbivores are also reluctant to feed on

*Phragmites*. Future work includes purifying the chemical defense for structure identification and to expand investigations with insect herbivores.

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**P1-29 Extreme kinesis: a comparative study of prey handling in snakes**

Cranial kinesis (upper jaws and snout movably attached to the skull) allows snakes to swallow large prey whole. The snout, which tracks upper jaw movements, can rotate around a transverse axis (elevate) and a longitudinal axis (twist) during prey capture and swallowing. Preliminary data indicate that mean snout twisting can be as little as 8° in sand boas, which have a snout modified for burrowing, or as much as 38° in boa constrictors. How is snout mobility distributed among other booid species? We recorded prey capture and swallowing in *Boa constrictor* and two other booid species, *Candoia aspera* and *Epicrates maurus*, using a high-speed camera at 500 frames per second and a high-definition camera at 60 fps. One-way analysis of variance indicates that the mean angle of snout twisting (38° in *Boa*, 21° in *Candoia*, and 9° in *Epicrates*) is significantly different among the species we studied ( $p < 0.001$ ).

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**P1-30 A Study Of Diatom Communities In The Upper Main Stem Of The Susquehanna River During Various Discharge Regimes**

The upper main stem of the Susquehanna River is formed by the confluence of the West and North Branches, each of which is chemically and physically distinctive. The upper main stem retains the signatures of the two branches due to weak lateral mixing, and we refer to them as the West Branch plume (WBP) and the North Branch plume (NBP). Thus, characterization of the diatom communities required samples taken from sites that occur in the plumes of both branches. Since 2009, our river monitoring program began on the upper main stem at an established transect that straddles Byers Island near Shamokin Dam, PA and below the Adam T. Bower inflatable dam at Sunbury, PA. During the summers of 2014-2016 the upper main stem experienced different discharge regimes: high (2015), moderate (2014), and low (2016). Attached diatom communities were sampled from stones and prepared for examination by scanning electron microscopy. Proportional Bray-Curtis Similarity analyses of samples from the summers of 2014-2016 showed low to moderate overlap between the diatom communities. We also found that the Pollution Tolerance Index (PTI) values and Shannon Diversity Index (SDI) showed very little variation between WBP and NBP. We identified 69 different species from summer 2016. Habitats of the NBP were dominated by a small centric and biraphid species (e.g. *Discostella pseudostelligera*, *Rhoicosphenia abbreviate*, and *Encyonema appalachianum*) and similar habitats of the WBP were dominated by monoraphid species (e.g. *Achnanthydium deflexum*, *Achnanthydium minutissium*, and *Cocconeis placentula*).

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**P1-31 The Neuroprotective Potential of Curcumin in the 6-Hydroxydopamine Model of Parkinson's Disease**

Parkinson's disease is a progressive neurodegenerative disorder due to the loss of dopamine neurons within the nigrostriatal pathway. The destruction of these neurons through inflammation may be a result of enhanced glial cell responses. Curcumin, a compound derived from turmeric, has shown to not only provide protection to dopamine neurons, but also reduce the inflammatory response of glial cells. This behavior study is investigating the protective and restorative properties that may be provided by curcumin. The study consists of 4 groups: a) protective curcumin, protective control, restorative curcumin, and restorative control. Each experimental animal received an injection (i.p.) of 75 mg/kg curcumin for 5 days/week while the controls received an equal volume of the vehicle, DMSO. The protective groups received their injections prior to a 6-OHDA lesion while restorative groups received their injections post-surgery. Behavioral data using the rotarod, single-pellet reaching task, and foot-fault test are currently being obtained. It is expected that the curcumin treated groups will perform these motor tasks better when compared to the DMSO treated animals.

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**P1-32                    Affects of Prenatal Food Deprivation on Offspring Microglial Morphology**

Prenatal stress is shown to have adverse effects on various aspects of the developing brain, such as alterations in neuroendocrine functioning and neuroinflammatory processes. Previous animal models and human studies have shown a clear link between prenatal stress and psychiatric disorders such as depression and schizophrenia, both of which include abnormal neuroimmune functioning. Prenatal stress leads to altered behavioral outcomes in rodent offspring, as well as changes in the morphology of microglia, the immune cells, in the offspring. Microglial morphology is indicative of their activation state and inflammatory profile of the brain tissue; cell that are relatively active will have a larger soma area, and increased densities of microglia suggest increased inflammation. To model prenatal stress, we used a food deprivation model (FD50) that involved food restriction in the second half of pregnancy of rats. Female offspring were selected for immunohistochemical analysis of the microglia in the hippocampus and prefrontal cortex, regions associated with behavioral changes that have been observed in this, and other, prenatal stress models. Using immunohistochemistry and confocal microscopy, we evaluated microglia soma area and cell density in the regions of interest. Ongoing analysis suggests that offspring of food restricted dams have increased soma area in the prefrontal cortex. Correlating neuroimmune dysfunction with behavioral and molecular changes in prenatal stress models may help us better understand developmental disorders, as well as better ways to treat them.

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**P2-1 Expression profiles of microbial communities associated with 1,4-dioxane degradation.**

1,4-Dioxane is a carcinogenic solvent commonly used as a stabilizer and has affected groundwater supplies in many areas however very little is known about the biodegradation of this compound in the environment. Here we sought to investigate the metatranscriptomic profiles of microbial communities from five groundwater samples contaminated with varying concentrations of 1,4-dioxane to highlight which if any biodegradation pathways were being utilized by groundwater microbial communities. Groundwater samples were filtered and total RNA was extracted. RNA was converted into double-stranded cDNA and sequenced using the Illumina HiSeq 100 bp single end chemistry. Preliminary results showed high expression of biomarker genes associated with 1,4-dioxane degradation, including, aldehyde dehydrogenase and methane monooxygenase. Metabolic pathway maps revealed the expression of genes involved in glyoxylate and glycolate metabolism, two byproducts of 1,4-dioxane degradation, further indicating that degradation may be occurring. Altogether these data indicate a robust microbial community capable of biodegradation of 1,4-dioxane within these contaminated groundwater environments.

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**P2-2 An assessment of knowledge and opinions regarding societal implications of prenatal genetic testing**

The advent of noninvasive prenatal genetic testing (NIPT) has enabled access to genomic information from a maternal blood sample at an earlier point in gestation than other imaging or testing. Unlike other testing, NIPT holds no direct risk to the fetus. The increasing ability to gather greater amounts of fetal genetic data has led to concerns about ethical, legal, and social dilemmas regarding NIPT's usage. An in-depth interview instrument was used to sample a small population of pregnant women and health care practitioners as the knowledge and opinions of these populations on the topic are unknown. Emergent trends in population attitudes have been examined and used to design a survey instrument for distribution. Through this research we have acquired a more complete understanding of attitudes toward NIPT, evaluated the influence of demographics on opinions, and have discovered significant differences between practitioner and patient concerns.

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**P2-3 Machine Learning With Brain-Inspired Architecture**

Numenta Platform for Intelligent Computing (NuPIC) is an open source project designed to allow its users to experiment with an unsupervised machine learning model. Its main purpose is to detect patterns in data. It does not require any labeled data for training, thus is more amiable to human-like learning than supervised models. The platform is still evolving and changing, which makes adopting the technology for custom applications challenging. The goal of our project is to investigate the strengths and weaknesses of NuPIC by applying it to a specific pattern detection problem, namely EKG anomaly detection. The application is important in its own right because it can be used to help diagnose various kinds of heart disease. Furthermore, EKG anomaly detection is a challenging problem because the data that is being analyzed is biological, meaning it is not consistent and the patterns are hard for current machines to predict.

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**P2-4 Application of Supervised Deep Learning to Hyperspectral Bathymetry Problem with TensorFlow**

Estimating the depth of shallow water via remote sensing is an important task for maritime navigation and environmental monitoring. Hyperspectral imaging has been shown effective for the purpose, yet estimates by state-of-the-art analytical methods can be off by as much as a meter. In this work, we investigate if supervised deep learning can improve the state-of-the-art. We approached this problem by using different styles and depths of neural network. We have access to seven transects work of data, each with about 500 depths measured and associated hyperspectral data at 61 wavelengths. Our initial work with convolutional neural nets showed significant promise: 0.195 meters of error on average, down from the average of 0.340 meters by a state-of-the-art analytical model. More data is currently being

collected from a wider variety of networks. Each network will be evaluated by comparing its runtime and average error to identify important parameters.

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#### **P2-5                    Synthesis and fluorescent properties of a thienylquinoxaline**

Fluorescence has a variety of biomedical applications, and all benefit from compounds that have a mega Stokes Shift, or a large separation between absorbance and emission wavelengths. Previous research yielded the compound 2,3-bis(2,5-dimethylthiophen-3-yl)quinoxaline, with two thiophene groups capable of twisting. Comparisons to a similar compound with rigid groups—keeping the molecule planar—yielded a greater Stokes shift, indicating that the emission is dependent on free thiophenes. Research currently focused on synthesizing a mono(thienyl)quinoxaline. A two step synthesis produced the desired compound, 2-(2,5-dimethyl-3-thienyl)quinoxaline, in 25% yield in high purity. The fluorescence acquisition is ongoing, but initial readings give a Stokes Shift less than that of the original molecule but greater than the locked molecule, indicating that the ability of the thiophene to rotate is essential for such large Stokes shifts.

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#### **P2-6                    Phthalocyanine derivatives for use in photodynamic therapy**

Photodynamic therapy is a process that forms singlet oxygen within the body to kill nearby cancer cells with the use of light. In order for the photodynamic therapy to be efficient the solubility of the compound should be high and the aggregation of the compound should be low. The target molecule was designed to have multiple t-butyl groups. These bulky substituents should help prevent aggregation and increase solubility in organic solvents, ultimately increasing the singlet oxygen generation efficiency. Several syntheses were attempted to produce a phthalonitrile precursor containing t-butyl groups. A modified synthesis using a double Friedel–Crafts reaction is being carried out to provide a phthalocyanine with the desired characteristics.

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#### **P2-7                    Developing a Copper-Catalyzed Asymmetric Reduction of 2H-Azirines**

Although several strategies exist that allow researchers access to chiral aziridines, one method that remains largely unexplored is the stereoselective reduction of prochiral 2H-azirines. This body of research is focused on the development and optimization of a catalytic asymmetric 2H-azirine reduction method that employs non-racemically ligated copper hydride. The synthetic route used to generate 2H-azirine starting materials, and the methods explored for derivatization and resolution of chiral aziridine products will be reported along with the reaction development and optimization.

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#### **P2-8                    DIY Raman Pi Spectrometer**

We are constructing and evaluating the feasibility and function of a RamanPi instrument. The Raman Pi is an open source Raman spectrometer designed by a group of hackers and tinkerers around a Raspberry Pi computer.<sup>1</sup> It is made of readily available components and simple 3D printed parts. Raman spectroscopy is a technique that can be used to analyze the molecular vibrations of chemicals, and subsequently, identify the chemical composition of a sample. A Raspberry Pi is a miniaturized computer- This project uses it as a central processing system to create spectral graphs from data! Most analytical techniques chemically alter or destroy the sample under observation. Raman spectroscopy, however, is non-destructive; the technique merely shines a laser on a solid, liquid, or gas being observed. This is very useful in both a lab and field setting- with applications in biology, art conservation, analytical chemistry, and more! The cost of Raman instruments can be prohibitive for many smaller colleges and research groups, however the construction of a DIY instrument could put Raman spectroscopy within reach even for 'citizen scientists.'

References<sup>1</sup>. <https://hackaday.io/project/1279/logs?page=6>

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**P2-9 Glycoalkaloids & False Potato Beetle Eggs**

False Potato Beetles lay two different color eggs and the darker ones are less eaten by predators. Glycoalkaloids are toxic chemical compounds to mammals. They are found in certain solanaceous plants, which is what the False Potato Beetle eats. This study analyzes the eggs to see if any glycoalkaloids can be found in them. After optimization of the method, I extracted the eggs using maceration in ethyl acetate. Analysis is being done using High Performance Liquid Chromatography (HPLC). After separation, glycoalkaloids can be detected using UV/Vis. If they are found in the eggs, it could explain why they are not eaten by predators.

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**P2-10 Community-Based Learning on Campus: A Partnership Between the Department of Chemistry and Biochemistry and Dining Services**

The Elizabethtown College Department of Chemistry & Biochemistry, Dining Services, and Brubaker Farms have established a collaboration to address two research questions of significance to the campus community. Analytical chemistry students devised an appropriate soil sampling plan and employed gravimetric, titrimetric, and spectrometric analyses of soil in an effort to discern why a particular college garden plot is underperforming. Students in introductory laboratories measured titratable acidity of the food waste processed in the dining hall in order to determine variability based on time of day and menu. The College has experienced numerous issues with corrosion within the processing system. Results from this project could inform the development of a food waste neutralization plan, thus protecting pipes and storage vessels from degradation and reducing replacement costs. Significant results, findings, and recommendations stemming from each project will be shared, as will ideas for further investigations and outcomes related to student learning.

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**P2-11 Development of Luminescent Metal-Organic Frameworks for Use as Oxygen Sensors**

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 prototype LMOFs for oxygen sensing which incorporate Zn(II) cations and luminescent ruthenium or osmium complexes. Photophysical characterization of the LMOFs includes acquisition of luminescence excitation and emission spectra and Stern-Volmer oxygen quenching plots. The potential for applications of LMOFs beyond oxygen-based sensing is also assessed.

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**P2-12 A Transversal and Longitudinal Study of Four Headwater Streams Using WQI and Hydro-geochemical Analysis**

Headwater streams are an important part of river networks and make up for more than 90 percent of the streams within a major rivers watershed (Leopold *et al.* 1964). Little is known about headwater streams and their impact on larger stream systems. The headwaters of Penn's Creek provide clean water to a large river system and increase Penns creek's volume as it makes its way to the Susquehanna River. To understand the impact of these headwaters a study was conducted, in which four streams at similar elevations and on the same geologic formations was studied transversally and longitudinally. Water samples and physical data was collected using a YSI multimeter while long term data collection was completed using hydrolab sondes, HOB0 pendent data loggers, and Solinct pressure transducers. The geochemical compositions of the streams went into Piper Diagrams, Stiff Diagrams and to identify trends in the data. Data was also used in the Water Quality Index (WQI) to create a numerical representation of the streams health. The streams are high in Bicarbonate, which is explained in the lower pH values and

conductivity. Diagrams were skewed due to the lack of diversity in the Anions yet the streams are high in calcium and Magnesium, which is a characteristic of water within the geologic formations.

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**P2-13 Electrical Resistivity Tomography and Seismic Refraction Tomography To Determine Subsurface Composition**

Baseline electrical and seismic geophysical surveys were performed at Montandon Marsh in Montandon, PA. The marsh is comprised of Pre-Illinoian age sand and silt from glacial deposits, situated on top of the Keyser and Tonoloway formation. It is located on the eastern side of the West branch of the Susquehanna River. The surveys were conducted using electrical resistivity and seismic refraction to determine the subsurface geology. The electrical resistivity survey was over a distance of 220 meters and the seismic refraction survey covered a transect of 208 meters. These tests showed the depth of the bedrock, the water table, and the alluvial aquifer composed of sand and gravel. The baseline surveys successfully determined the depth of the bedrock, and the subsurface sedimentation. The depth of the bedrock varied from 5 meters to 15 meters. The area of alluvial sediment was greatest between 48 and 72 meters as seen on the seismic refraction survey. The 15 profile resistivity survey was able to identify and track the changes in the subsurface composition. These progressions aid in analyzing the subsurface and determining how the subsurface either remains heterogeneous or changes, as well as possible anomalies. Further analysis will be used to monitor a slurry wall that will be placed in the marshland. This analysis will provide new methods for the monitoring of slurry walls.

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**P2-14 Mapping Groundwater Seepage Flux in Relation to Susquehanna Smallmouth Bass *Micropterus dolomieu* Nesting Sites**

Smallmouth bass (*Micropterus dolomieu*) in the Susquehanna river basin are prized both in their value economically in sport fishing and in the ecological niche smallmouth bass fill. Since 2005, smallmouth bass have experienced disease and decline in the river basin. A summary of research released by the PA DEP known as C.A.D.D.I.S. in 2015 suggested further studies are necessary to fully understand the impact of groundwater seepage flux on smallmouth bass nesting sites. Using streambed temperature loggers over the course of the smallmouth bass spawning period, smallmouth nests located in areas of groundwater flux in two agriculturally impacted streams were outfitted with embedded piezometers to facilitate groundwater collection. Surface and groundwater samples were taken to determine total estrogenicity, phytoestrogenicity, and pesticide levels at these sites. Young-of-the-year (YOY) smallmouth bass were also collected and assayed for myxozoan parasites and other ailments. Progress on results of said assays is ongoing.

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**P2-15  $\text{Ca}^{2+}$  as a model system for the role of metals in cyclic nucleotide phosphodiesterases**

The second messenger 3'-5' cyclic adenosine monophosphate (cAMP) plays important role in signaling biological functions such as carbohydrate and lipid metabolism. Signaling by cAMP is terminated in part by hydrolysis of cAMP to 5'-AMP by various cyclic nucleotide phosphodiesterases (PDEs). PDEs utilize metal cofactors to activate a solvent nucleophile. To establish an aqueous model system for catalysis by metal ions, we treated cAMP with concentrations of  $\text{CaCl}_2$  ranging from 0 M to 0.33 M at a constant ionic strength of 1.0, pH of 11.5, and temperature of 47° C. We find that  $\text{Ca}^{2+}$  markedly increases the rate of cAMP relative to  $\text{Na}^+$ , producing both 5'-AMP and 3'AMP, as confirmed by mass spectrometry and HPLC of standards. The 3'-AMP is the preferred product, formed 7 times as much as 5'-AMP. Preliminary analysis of the rate constant dependence on the  $\text{Ca}^{2+}$  concentration indicates two metal ions can participate in catalysis.

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**P2-16 Characterization of 1-amino-9,10-Anthraquinone in the A1 Site of PS I Complexes of the Plastoquinone-containing Mutants of *Synechocystis* sp. PCC 6803**

In photosystem I of higher plants and cyanobacteria, phylloquinone (PhQ) acts as the secondary electron acceptor (A1) between A0 and the Fe-S clusters. Phylloquinone-less mutants, menA and menB,

of the cyanobacterium *Synechocystis sp.* PCC 6803 contain plastoquinone (PQ). The growth medium of the mutant cells was supplemented with highly reducing 9,10-anthraquinones (AQ) with potentials significantly more reducing than either PhQ and PQ. The quinones may approach or exceed the potential of the primary acceptor, A0, and lead to unusual electron transition behaviors.

The function of quinone molecule was monitored pump probe laser system, measuring the electron recombination in PSI (e.g. P700+/F<sub>A/B</sub>-). The P700 back reaction kinetic lifetime is a function of quinone (PQ, 3ms; 1-NH<sub>2</sub>-AQ, ~100ms). In decreasing the temperature, lifetimes change as a function of electron transfer pathways options. Low temperature experiments with 1-NH<sub>2</sub>-AQ in various glycerol concentration showed an altered lifetime. We are currently characterizing and exploring these observations to develop a hypothesis on the effect.

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**P2-17                      Locating Genes in Bacterial Soil with Primers NRPS, PKS1, and PKS2**

Centralia, Pennsylvania, is an abandoned mining town due to the mine fire that has been continuously burning underneath it for over 60 years. In 1962, employees were burning trash in a landfill, and when the trash fire was not fully extinguished it ignited an unsealed entryway to a nearby coal mine. Because the fire is a low intensity underground fire, it has been able to burn since then and will do so for years to come. Due to the fire's high temperatures and duration, the surface environment and resident microorganisms have been seriously altered. In order to determine if bacterial changes include the ability to produce novel antibiotics, DNA was extracted from 0.5 g of surface soils that were collected from various fire-affected (as determined by elevated temperatures), recovering (previously-affected), and unaffected sites. DNA that was high in concentration and of sufficient quality was used for PCR with primers for genes involved in antibiotic production. Currently, we have shown the presence of non-ribosomal peptide synthase genes in Centralia soils and are optimizing PCR conditions for polyketide synthase I and II gene primers so their presence or absence in the soil samples can be analyzed. Ultimately, sequence analysis of the amplified genes will determine if they could produce new antibiotics.

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**P2-18                      Recapitulating Immune-Antimicrobial Synergy Against *Escherichia coli* Infections**

*Burkholderia pseudomallei* is an inherently antibiotic resistant gram-negative bacterium that causes the deadly disease melioidosis. Studies have shown that combination of the antibiotic, ceftazidime, and the cytokine, interferon-gamma, results in synergistic killing of *Burkholderia pseudomallei* within infected macrophages. Now, we are using *Escherichia coli* infected macrophages to determine if other intracellular bacteria can be synergistically killed by the same combination treatment. First, we titrated the concentrations of ceftazidime and interferon-gamma independently, to optimize their individual killing contributions. Now we are combining the drugs to elucidate whether immuno-antimicrobial synergy occurs in *E.coli* infected macrophages. Observing this phenomenon with a second intracellular pathogen will broaden the potential of this treatment to serve as a therapy for other more common infections by intracellular pathogens.

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**P2-19                      Creation of Clb2-YFP and Nap1-YFP to be used with Elm1-CFP to analyze protein interaction and Budding Yeast**

Proteins located at the bud neck structure coordinate the cell morphology and nuclear division in *Saccharomyces cerevisiae*. The serine/threonine-protein kinase Elm1 is required for coordination of cell growth and cell division in a budding yeast. Previous work showed that Gin4p, Nap1p and Clb2p were found to co-purify with Elm1p. To verify these interactions, fluorescence resonance energy transfer (FRET) could be used. Plasmids which code for a cyan fluorescent protein (CFP) and yellow fluorescent protein (YFP) were used as a template for polymerase chain reaction (PCR). The amplified cassettes could be used to transform *Saccharomyces cerevisiae*. During this work, yeast strains expressing Clb2-YFP and Nap1-YFP were created. These strains will be used to verify the co-purification results via FRET.

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**P2-20                    Evaluating the effects of TGF $\beta$  signaling on glial scarring in zebrafish (*Danio rerio*)**

If neurons in the mammalian CNS are damaged, intermediate filament proteins are upregulated to create a glial scar, which prevents axon regeneration. However, in the zebrafish retina (*Danio rerio*), Müller glial cells act as tissue-specific stem cells and regenerate lost photoreceptor neurons after dedifferentiation and reentering the cell cycle in response to damage. This ability to regenerate neurons in zebrafish is due to the downregulation of TGF $\beta$  signaling, and when the TGF $\beta$  signaling pathway is upregulated, regeneration is prevented. We expect that this inhibitory effect of the signaling pathway on photoreceptor neurogenesis is due to the formation of a glial scar, which is characterized by the upregulation of the intermediate filaments glial fibrillary acidic protein (GFAP), vimentin, and nestin. We are establishing a time course of intermediate filament expression in the Müller glial cells using immunofluorescence. Preliminary studies are being performed on adult fish with mutations in the TGF $\beta$  pathway, and have shown that in the unlesioned fish there is nestin expression in the nerve fiber layer as well as in glial processes. We continue to examine the expression of intermediate filaments in response to injury and the effect of upregulating the TGF $\beta$  pathway on glial scarring.

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**P2-21                    The *tfiia-s-2* gene of *Drosophila melanogaster* encodes a testis-specific homolog of a subunit of the general transcription factor TFIIA**

All cells in an organism contain the same genome, however, tissue-specific gene expression produces cells with distinct structures and functions. *Drosophila melanogaster* (fruit flies) spermatogenesis is an excellent model for studying how each cell expresses the correct genes as they differentiate. The first step in gene expression, transcription, requires two important protein complexes, TFIIA and TFIID. The TFIIA and TFIID complexes bind to promoter regions of the DNA and physically interact with other transcription machinery. TFIIA is composed of a large and small subunit, while TFIID is composed of TATA-binding protein (TBP) and 14 TBP associated factors (TAFs). The small subunit of TFIIA has a testis specific homolog, *tfiia-s-2*, and several testis-specific homologs of TAFs (tTAFs) are identified. We propose that the testis-specific subunits associate with each other to bring about testis-specific transcription. We are testing this hypothesis by co-immunoprecipitation techniques using the generally expressed and testis-specific TFIIA and TAFs.

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**P2-22                    Morphological Identification of the Central Pennsylvania Rat Snake**

Recent phylogenetic analysis has identified three clades of ratsnakes across the northern tier of the United States. 1) Eastern ratsnakes (*Pantherophis alleghaniensis*), 2) Gray ratsnakes (*P. spiloides*) and 3) Western ratsnakes (*P. obsoletus*) have been differentiated based on mtDNA sequence data. Black ratsnakes from central Pennsylvania have been identified as *P. spiloides* by some authorities. Incomplete local sampling in this assessment has led to this assignment being uncertain. With this in mind, samples of local ratsnakes have been collected for morphological data that has been used for comparison with reference data for the currently-recognized ratsnake species. Data has been collected through direct and indirect measurements in a non-invasive manner. Results to date have been inconclusive and may point to hybridization between two species of ratsnakes. Further research, including a larger sample size and the use of genetic analysis, will be used to attempt to gain more resolution into this problem.

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**P2-23                    Influence of introgressive hybridization on morphology and color of coyotes, *Canis latrans***

This study evaluates the impact of hybridization between coyotes and wolves on the morphometrics and coat color of coyotes, as well as regional variability of these measures across Pennsylvania. Coyotes moved into Pennsylvania in the early 1930s, migrating from the Midwestern USA and Canada. Data was collected from 354 coyotes brought to huntclubs around PA between 2014 and 2016. Morphometric variables were selected based on known differences between coyotes and wolves. Photographs of coyote were taken under controlled light conditions. Color variables were then quantified to indicate redness, absolute slope (measure of overall fur color change) and noise (measures color change between individual hairs). Sixty-three ancestry-informative loci were genotyped from 190 individuals and

the program Structure was used to estimate the proportions of wolf/coyote/dog. Preliminary results indicate a difference in these proportions by size and region. The relationship between coat color and genetics is more noticeable in females.

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**P2-24 A Comparison of the Effectiveness of siRNA and Long Hairpin dsRNA in Knocking Down Pnt RNAi**

The goal of our study is to determine the role of Pointed (Pnt) in the development of specific tissues by using RNAi to knock down pointed mRNA using a UAS-Gal4 System. Pnt functions downstream of the EGFR RTK signaling pathway and is essential in the differentiation and development of many tissues. Pnt is a transcriptional activator and the gene codes for two isoforms, Pointed P1 and Pointed P2. As mutations in Pnt perturb the development of several tissues we wanted to examine the effect and efficacy of using RNAi to target Pnt. We have expressed pointed RNAi in the eyes, oocyte, central nervous system, and heart cells using three different RNAi lines: Valium 20, Valium 10 and VDRC. Val 20 is distinct since it produces siRNA, which is approximately 21-23 bp long. Valium 10 and VDRC on the other hand produce long hairpin loop dsRNA. In each tissue we have found varying phenotypes among the three RNAi lines. By quantifying these data, we are able to compare the severity of the phenotypes for each tissue. We have found that for each tissue Val20 exhibited the strongest phenotype while Val10 and VDRC have produced varying levels of severity.

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**P2-25 Genomic Assay of Breast Cancer SNPs in Premodern Populations**

Breast cancer is a disease that affects over 230,000 women and men every year, and is the second leading cause of cancer death among women. Despite this modern day prevalence, there is little reference to this cancer in texts in premodern eras. This project integrates historical and biological approaches to determine genetic predispositions for breast cancer in premodern (pre-1800) populations, in order to assess the dominant explanations for low incidence of breast cancer in the past. A database was compiled of aDNA (ancient DNA) from publicly available sources and programs such as BLAST and BWA (Burrows-Wheeler Alignment) were used to search for known gene alleles and SNPs that are correlated with predisposition to breast cancer. We expect our results will show that the DNA of these individuals contains these documented SNPs, and will provide us with the knowledge that genetic susceptibility to breast cancer was present in these populations.

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**P2-26 Ecological Consequences of the Late Paleozoic Ice Age**

The Late Paleozoic Ice Age (LPIA) was an interval of glaciation which occurred from the top of the Viséan/bottom of Serpukhovian (~331 Ma) to the Sakmarian (~295 Ma). The resulting climatic changes included, for example, colder average global temperatures and glaciers appearing closer in latitude to the equator. The LPIA, having had such a drastic effect on climate, also inevitably affected ecology and biodiversity on a global scale. To summarize, there was: a noticeable drop in the biodiversity of marine organisms, a period of relatively low speciation rates which lasted until the end of the LPIA, a major shift in terrestrial plant life, etc. Despite the existence of paleoclimatic and paleogeographical data, not much is known about the ecology and ecological effect of the LPIA. So, the purpose of this study is to inquire as to what ecological effects the LPIA had, or, how do species that thrived during the LPIA differ from those who thrived before and after the LPIA. Through analysis of numerically-based ecological modes (which were based on the feeding habits, tiering and mobility of an organism) of organisms before, during, and after the LPIA, we found that not much had changed during the Late Paleozoic Ice Age. The same dominant groups were consistent before, during and after the LPIA, and extinction/origination rates lacked variation during any of the LPIA's stages. There was small change in ecology during the Late Paleozoic ice age however, that is the change in rank of ecological modes. Mobile predators such as ammonoids became more common, and attached suspension-feeders, like brachiopods, became less successful. This small turnover was brief, as the ranks returned to pre-LPIA conditions after the end of the LPIA's glaciation period. This is indication that the rank turnover was related to the climate created by the LPIA. Although cooler temperatures should favor organisms with low mobility, as they would have

lower metabolic rates/requirements, such was not the case for the LPIA's marine environment. Hopefully we will succeed in prescribing more meaning to the observed ecological patterns.

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**P2-27 Environmental Factors Affecting the Chemical Defense of an Invasive Marsh Grass, *Phragmites australis* subspecies *australis***

*Phragmites australis* subspecies *australis* is a non-native marsh grass that has invaded the U.S. and outcompeted many native species. Crucial to the success of this invader is its chemical defense, which can be induced by snail (*Littoraria irrorata*) grazing, and possibly other factors. To address this, we investigated the timeline of the induced chemical defense. In addition, we examined whether nutrient addition impacts *Phragmites*' palatability and chemical defense. In the field, we caged *Phragmites* with and without snails. Shoots were collected weekly for four weeks; however, only week one samples showed an induced defense. Mechanical tissue loss was also investigated as a trigger for the induced defense, but no effect was found. To examine the impact of nutrients, *Phragmites* is currently being grown in high and low nitrogen concentrations. Future work will examine the palatability of these plants to snails, as well as the magnitude of the snail-induced defense.

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**P2-28 Using Vegetation Surveys to Guide Future Land Use**

Jack and Carolyn Sparks recently donated a 400-acre Bedford County property to Juniata College with the promise that its use for education and research continue. In order to inform and address natural resource management opportunities and challenges on the property, we conducted vegetation surveys to establish benchmark floristic data. In conducting our survey we used a combination of directed searches, point surveys (for identity and basal area of woody vegetation), and plot surveys (for presence/absence of common invasive species). Field observations were recorded using iNaturalist, an online open-record mapping application. Our survey suggests that the richness and frequency of invasive species is somewhat lower than is typical of landscapes with similar landuse histories. Careful consideration of changes in existing landuse practices, particularly those that would alter existing disturbance to soil or vegetation, should allow the property to persist in its current excellent condition.

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**P2-29 Variation in total mercury content among riparian and non-riparian wolf spiders**

Mercury is a persistent environmental contaminant that primarily originates from coal-fired power plants. Methylmercury biomagnifies as it moves through food chains, reaching toxic levels in apex predators. Wolf spiders can concentrate mercury at high levels, sometimes exceeding levels found in fish. Since these spiders occupy positions within detrital, terrestrial, and aquatic food chains, the pathway for mercury biomagnification remains unknown. We collected two widespread wolf spiders, *Pardosa milvina* and *P. saxatilis*, at sites along the Susquehanna River near a coal-fired power plant and compared total mercury levels to spiders from an uncontrolled coal fire burn site (Centralia, PA) and reference sites away from the river or point sources of mercury pollution (agricultural fields). We collected 89 *Pardosa milvina* and *P. saxatilis* across the six sites and measured total mercury among individual spiders. We found significant differences in mercury level between these species despite being very similar in size, microhabitat, phenology, and phylogenetic proximity. We also found higher mercury levels among adult male rather than female spiders suggesting either trophic dimorphism or mercury depuration among females during egg production. Total mercury levels varied significantly by site. Spiders from Centralia had total mercury levels up to three times higher than those in riparian zones adjacent to the power plant and about nine times higher than spiders collected from agricultural fields. Significant differences in total mercury across different age classes were also found, indicating significant bioaccumulation. Our results suggest that these species may serve as important bioindicators for mercury bioaccumulation, biomagnification and transport across diverse habitat types. The high levels near Centralia, PA, suggest that, counter to conventional wisdom, aquatic environments are not necessary for significant terrestrial mercury bioaccumulation to occur.

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**P2-30            A Longitudinal Study of Diatom Communities in the Lower West Branch and Upper Main Stem of the Susquehanna River**

We analyzed samples taken in late June from four sites, three on the upper main stem of the Susquehanna River (Shady Nook, Port Trevorton, Liverpool), and one on the lower West Branch (Milton) as part of a multi-community study focused on Young-of-Year smallmouth bass survival. All sites are within the West Branch Plume (WBP) of the river. Due to the utility of diatom communities as indicators of ecological health and water quality, stones with intact biofilms were collected. The stones were chemically cleaned using a standard method of HCl and H<sub>2</sub>O<sub>2</sub>. We counted and identified diatoms in the samples to the species level using a JSM-6010LV SEM and found between 26 and 34 species at each site. We found 75 individual species at all four sites, and using a Proportional Bray-Curtis analysis we determined diatom community similarities. All sites showed low to moderate similarity except for the diatom communities taken from Port Trevorton and Liverpool, which exhibited high similarity. The Pollution Tolerance Index (PTI) and Shannon Diversity Index (SDI) showed little variation (2.8-3.1 and 2.1-2.7, respectively). The Trophic Diatom Index (TDI) was relatively low in the lower West Branch (26.5) but rose following the confluence with the North Branch (35.2-44.068). The Sedimentation Index (SED) was relatively low at the upper two sites (6.6-6.9) and higher at the downstream sites (12.5-16.2).

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**P2-31            Examination of Microglial Morphology in Acute Ethanol Intoxication Mouse Model**

Ethanol use has been shown to have varying and adverse effects on the brain. Alterations in structure and functioning of the hippocampal formation and prefrontal cortex have consistently been observed in various ethanol models, to include changes in microglial activity. Microglia are the innate immune cells of the brain, and their aberrant functioning has been implicated in the development of neurodegenerative and psychiatric disorders, such as depression and addiction. Further, evidence suggests that females are more susceptible to some of these disorders than males. As microglia progress from inactive to active states, there are observable morphological changes. In the current study, the morphology of microglia was analyzed in the hippocampal formation and prefrontal cortices of male and female wild-type mice treated with an acute dose of ethanol (4.0 mg/kg of 20% ethanol). Mice were sacrificed at 8, 24, and 96 hours after treatment. Brains were prepared for immunohistochemical analysis and stained for Iba-1, a microglial marker. Ongoing analysis suggests an increase in soma size of microglia in female mice compared to male mice following ethanol treatment in the regions of interest. Understanding the role of neuroimmune dysfunction in the development of psychiatric disorders may help pave the way to better treatments in the future.

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**P2-32            Submersion Tolerance among Riparian and Non-riparian Spiders**

Terrestrial arthropods that inhabit dynamic boundaries between terrestrial and lotic systems are under constant risk of flooding. Many spiders may have evolved behavioral, physiological, or morphological adaptations to cope with flooding either through avoidance or submersion tolerance. Mechanisms for coping with periodic flooding have important implications for predicting species composition, recolonization, and resilience against flood related disturbance for riparian arthropod communities. We examined submersion tolerance of spiders by taxon, sex, and microhabitat. We compared web-building and cursorial, riparian and non-riparian, and ground-dwelling versus more arboreal species. We submerged individual spiders for three hours in distilled water and recorded survival, activity level immediately after removal, and activity level eight hours after removal (N=1,154). During trials we noted spiders that were in hypoxic comas versus those that formed putative plastrons (breathing bubbles) during submersion. We found large differences in submergence tolerance by taxon and habitat. Web-building spiders and vegetation dwelling cursorial spiders showed poor survival post-submersion, even those that live on overhanging vegetation along rivers and streams. Most ground-dwelling cursorial spiders including wolf spiders and fishing spiders showed no negative effects of submersion and most were active the entire time of submergence. No significant differences were noted in the posture time by sex of the families analyzed, however we found significant differences in submersion tolerance between populations of wolf spiders of the same species within the riparian zone compared to populations from

other habitats, suggesting population-level local adaptation to flooding. Population-level differences in submersion tolerance indicate that riparian ground spiders likely persist during flood events rather than being recolonized by new spider populations.

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### **P2-33 VOC Detection using GC-MS**

Volatile organic compounds (VOCs) are common contaminants in water and air. Many VOCs are known or suspected carcinogens or contribute to respiratory disease, so it is important to monitor them.

However, due to their low boiling points, they only occur at trace levels in surface water and so are hard to detect. Many VOCs are unregulated or unidentified. There are many sources of contamination from VOCs, including fuels, solvents, paints, cosmetics, and water disinfection. These sources produce a complex mixture of VOC contaminants in the environment. We compared the accuracy and sensitivity of different analytical methods using a standard solution designed to be similar to a sample of contaminated water. The test solution contained a selection of VOCs at known trace concentrations. We used GC-MS for all analysis, but we compared various procedures involving either LLE plus evaporation or headspace sampling before injection into the GC. The most effective procedure was then used to analyze water samples from streams near a fracking site.

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