Penn State Behend Sigma Xi 2021

Twenty Ninth Annual
Undergraduate Student Research and
Creative Accomplishment Conference

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BIOCHEMISTRY AND BIOLOGICAL CHEMISTRY

01-01. Possible Presence of Dimethylnaphthalene in Concord Grapes

Sloan Selden, Trevor Sheckler, Abigail Chermack, (Samuel Nutile, Lynne Beaty) - Penn State Behrend - Biochemistry

Dimethylnaphthalene or 1-4 DMN is a volatile plant organic compound that can be applied to plants as a dormancy enhancer. This chemical can stunt growth which can be useful in processes such as preventing sprouting in long term storage of potatoes. If produced naturally in plants, regulatory laws are not as constrained as they are for other synthetically made compounds. Traces of this compound in other crops would result in the same lesser restrictions and could be applied to plants in higher doses for better stunting results. For example, 1-4 DMN could be utilized for stunting early spring growth in grapes to prevent crops from dying from frost in the early season if found present in their tissues. The absence of 1-4 DMN means harder regulations on concord grape crops and their usage than if found in small qualities. It is unknown if 1-4 DMN is produced in concord grapes but can be investigated by extraction of its tissues using GC/MS. Similar studies have been conducted on potatoes, onions, garlic, and strawberries with methods resembling past experiments. Both fruit and leaf tissues will undergo the process with results currently being analyzed and will be discussed further at the Sigma Xi Undergraduate Research Conference.

01-02. Optimization of *Saccharomyces cerevisiae* SRS2 Mutant C-Terminal Domain Protein Expression Factors, Purification Techniques, and Applications

Garrett Hoffman, (Jana Villemain) - Indiana University of Pennsylvania - Biochemistry

The C-Terminal domain (CTD) of the Srs2 helicase is phosphorylated by CDK-1 kinase at multiple sites to attenuate its ability to prevent the initiation of recombination by Rad 51 recombinase. Studies mimicking phosphorylation by mutating Ser to Glu in multiple CDK-1 consensus sites (Ser 879, 893 938,950, and 965) in the Srs2 helicase CTD *in vivo* show abolished anti-recombinase activity, which is accomplished through direct protein interactions with the Rad51 recombinase. To study the protein-protein interactions of the Srs2 helicase CTD with Rad51 *in vitro*, the coding region for the Srs2 CTD (783-1174) and the recently obtained phosphorylation-mimic mutant, Srs2 CTD (783-1174 Ser893Glu) have been cloned into pET 28 of the pET bacterial expression system which also introduces an N-terminal His tag. The CTD 783-1174 protein has been previously expressed and isolated in our lab. The objective of this study is to optimize the expression of the Srs2 CTD 783-1174 Ser893 Glu mutant in the bacterial host BL21 Rosetta2(DE3) induced by addition of Isopropyl β-d-1-thiogalactopyranoside (IPTG). For this purpose, the effects of culture temperature, the IPTG concentration and culture density at the point of induction were assessed. The 783 CTD mutant protein expression was confirmed by observation of a protein band at the expected molecular weight on SDS-PAGE stained with Coomassie blue. The band's identity was confirmed by Western blot probed with the DyLight 800 Mouse Anti-His Tag antibody. The fluorescence was quantified by integrated density values for each condition where the mutant protein expressed. The integrated density values were compared for highest count to set optimal induction condition parameters for the *S. cerevisiae* SRS2 CTD mutant protein expression. Once optimal conditions are determined, protein expression can be scaled up to isolate the Srs2 CTD Ser893Glu mutant protein for further study and comparison to the wild-type Srs CTD.

01-03. Mutation of Serine to Glutamate Residues at Multiple CDK-1 Phosphorylation Consensus Sites within the S. cerevisiae Srs2 Helices C-terminal Domain to Study the role of Phosphorylation in Mediating its Activity

Alyssa Chesnutwood, (Jana Villemain) - Indiana University of Pennsylvania - Biochemistry

Srs2 helicase regulates Rad51 recombinase activity in the double-strand break repair pathway although its cellular role depends on both its protein binding partner and additional modifications. The Srs2 C-terminal domain (CTD) has five serine residues within or adjacent to the Rad51 protein binding site, which are targeted by CDK-1 following DNA damage and correlate with altered Srs2 activity; direct protein interaction with the Rad51 recombinase is required for Srs2 to exert its anti-recombinase activity. Computational amino acid analysis leads us to propose that the CTD is intrinsically disordered, enabling conformational changes associated with binding partner or modification. We have begun testing multiple site-directed mutations of Serine to negatively charged Glutamate to study the effects of Ser phosphorylation in the CTD with mutant combinations as prioritized by PredictProtein computational analysis and reports based on in vivo studies. We report that the Srs2-helicase CTD (amino acids 783-1174) was mutated using the PCR-based QuickChange Multi Mutagenesis Kit (Agilent) to yield the Ser893Glu mutant as confirmed by DNA sequencing. The corresponding mutant plasmid is being used currently to generate additional CTD Ser to Glu mutant combinations at remaining Ser phosphorylation sites in the CTD: Ser 879, 938, 950, and 965.

01-04. SARS-CoV-2 Spike Mutations and Their Impacts on Protein Stability: A Computational Approach

Olivia Pericak, (Ronald Brown) - Mercyhurst University - Chemistry

The disease COVID-19 is caused by a beta coronavirus, SARS-CoV-2. Similar to other coronaviruses, SARS-CoV-2 is made up of four structural proteins. With a high mutation rate, the spike glycoprotein has recently been of particular interest. In order to facilitate binding and fusion with the host cell ACE2 receptor, the spike glycoprotein has two main subdomains, the S1 (receptor binding) and S2 domain (viral fusion). S1 provides stability and, more importantly, contains the receptor binding domain. Therefore, mutations within the S1 subdomain have been examined in respect to potentially increasing viral pathogenicity. Findings have repeatedly shown no increase in viral toxicity. However, it has been suggested certain mutations may increase the stability of the S1/S2 junction and S1 affinity for the ACE2 receptor. This hypothesis was tested using computational *ab initio* methods. Dissociation energy was determined through optimization calculations which produced free energy data. The research presented here focuses on the D614G (Aspartate substituted by glycine) mutation. D614G demonstrated a decreased S1/S2 protein dissociation energy. Methods used in this research can successfully be used in the future to study other mutations and predict their impact on protein stability and binding affinity.

01-05. Spectroscopic and Molecular Docking Simulation Studies towards Developing Cyt-P450-like Artificial Enzymes for Cannabinoid Differentiation

Ashley Lombardo, (Mary Grace Galinato) - Penn State Behrend - Chemistry

Cannabinoids are compounds found in cannabis, which can either be used for medical purposes (e.g. cannabidiol, CBD), or for recreational intentions (e.g. tetrahydrocannabinol, THC). As these components are present together in cannabis, it is useful to differentiate them in their natural environment. The goals of this project are to develop an artificial hemoprotein catalyst that differentiates THC over CBD; and study the binding interaction of these cannabinoids on the artificial catalyst and other hemoproteins with comparable active site. The first goal is achieved by incorporating heme β into human serum albumin (HSA) to generate an artificial enzyme (HSA-heme) that has an Fe-O(Tyrosine) interaction. This is followed by binding a sulfur-donor ligand to potentially generate a Fe-S(donor) bonding interaction to mimic the active site of Cyt P450 oxidases, which are linked to cannabinoid metabolic routes. The artificial enzyme is referred to as [S(ligand)-HSA-heme]. The second goal is carried out by spectroscopically (absorption and fluorescence) characterizing the cannabinoid bound to the artificial hemoprotein. Further, molecular binding simulations of the S-donor ligands on HSA-heme is used to visualize the binding interaction of the ligand with the heme iron center. Preliminary UV-vis data shows that the S-donor ligands ethanethiol, toluenethiol, and cysteine induce spectral shifts on the protein band and Soret peaks of HSA-heme. Initial molecular docking studies of ethanethiol on HSA-heme demonstrate fairly large Gibbs free binding energy in the range of 18.9 to 22.8 kcal/mol. Ethanethiol interacts with nearby amino acids LEU115, ILE142, and TYR138, while cysteine forms a hydrogen bond with GLN459. Fluorescence studies will be pursued to obtain the binding constant and ratio between the ligand and enzyme, as well as other thermodynamic variables that will help provide insight on the complex formed between the S-donor ligands and HSA-heme.

01-06. Synthesis of Isatin-Thiazolidine-2-Thione Hybrids for Acetylcholinesterase Inhibition

Sydney Davis, (Todd Eckroat) - Penn State Behrend - Chemistry

Alzheimer's disease (AD) is the leading neurodegenerative disease, with over twenty million cases worldwide. While there is no cure for AD, certain treatments have been used clinically to help alleviate symptoms. One of the main ways this is done is by inhibiting acetylcholinesterase (AChE), the enzyme that breaks down the neurotransmitter acetylcholine. The current AChE inhibitors (AChEi) are both incapable of halting or reversing disease progression and potentially damaging to other organs, such as liver toxicity from tacrine. New AChEi that could simultaneously target another aspect of AD would be an important advancement, and a promising contender is isatin. In the literature, isatin has proved to be a better AChEi than tacrine, while also showing diverse additional biological activity. The current research will focus on the synthesis of isatin-thiazolidine-2-thione hybrid molecules as AChEi. The thiazolidine-2-thione heterocycle has yet to be investigated in this capacity, but it is anticipated to interact favorably with the aromatic amino acids at the peripheral and catalytic sites of AChE. The results of a three-step synthetic sequence to access these hybrids with a varying length carbon chain linking the two molecules will be presented. In addition, molecular modeling images of selected hybrids docked with AChE will show the predicted binding energies and conformations. These interactions will be verified using an in vitro AChE assay to determine inhibitory activity. Isatin-based inhibitors could be the key in discovering new treatments to slow AD progression.

01-07. Spectroscopic and Kinetics Studies of HSA-heme Imidazole Derivatives and NOx Complexes

Daniella A Rios Martinez, (Mary Grace Galinato) - Penn State Behrend - Chemistry

Human serum albumin (HSA) is the most abundant protein in our blood plasma. When HSA is reconstituted with a co-factor, heme, it forms a complex called HSA-heme. This artificial complex emulates the secondary function of myoglobin (Mb) and hemoglobin (Hb), which involves the reduction of nitrite to nitric oxide (NO). Unlike Mb and Hb where the Fe center binds to the nitrogen from a histidine residue (Fe-N(His)), HSA-heme has a weak Fe-O(tyrosine) interaction. The active site of Mb or Hb can be mimicked in HSA-heme by adding histidine-like derivatives into it, such as imidazole compounds. The aim of this project is to generate artificial heme proteins from HSA mimicking the active site of Mb, and testing for their nitrite reductase (NiR) activity. Imidazole derivatives, specifically imidazole (Im) and 1-methylimidazole (1-MeIm) were titrated into HSA-heme protein, and the complex formation was monitored with UV-Vis spectroscopy. The absorption spectrum of HSA-heme shows the Soret band at 404 nm shifting to 407 nm upon incorporation of Im, forming a [HSA-heme-Im] complex. Similarly, incorporation of 1-MeIm into HSA-heme ([HSA-heme-1-MeIm]) generates a Soret band at 410 nm. The quantitative titration of the imidazole derivatives into HSA-heme allowed us to preliminarily determine the binding constant of the ligand to the protein, showing a fairly strong interaction. Kinetics studies on the reaction of nitrite to ([HSA-heme-1-MeIm] shows a rate constant of ~0.20 M-1 s-1, which is smaller than that of wild-type HSA-heme (1.3 M-1 s-1) and Mb (~3-5 M-1 s-1). The results obtained by our experiments allow us to correlate structure of the active site in heme proteins to their function as NiRs. The implications of this study offer value on determining how to create a synthetic enzyme that has the ability to convert nitrite to NO, which is essential since abnormal concentrations of NO have been related to physiological disorders such as stroke and muscle disease.

BIOLOGY I

02-01. Confocal Microscopy for the Analysis of Biofilm Matrix Structure and Composition in *Haemophilus ducreyi*

Delaney Lacey, (Tricia Humphreys) - Allegheny College - Microbiology

Bacterial biofilms are ubiquitous, multicellular communities formed at air-liquid interfaces or attached to surfaces. The hallmark of biofilm formation is the extracellular matrix, composed of surface-associated biomolecules as well as secreted polysaccharides, DNA, proteins, and lipids which together envelop cells in a 3-dimensional (3D) matrix. *Haemophilus ducreyi* forms microcolonies, a precursor to biofilm formation, in the presence of human foreskin fibroblast (HFF) cells but formation of a mature, 3D extracellular matrix has yet to be confirmed. To assess the structure and composition of putative *H. dcureyi* biofilms, representative genital (GU) and cutaneous ulcer (CU) *H. ducreyi* strains from each class (35000HP-GFP [GU class I], HMC112-GFP [CU class II], NZS3-GFP [CU class I]) were grown at an air-liquid, stained with 1μg/mL DAPI dicalate and 50μg/mL Concanavalin A Lectin Conjugate Alexa Fluor 647, and imaged by confocal microscopy. Z-stacks confirmed the presence of extracellular DNA and α-mannopyranosyl and α-glucopyranosyl residues which enveloped *H. ducreyi* cells in a 3D matrix, indicative of biofilm formation. New baseline standards for *H. ducreyi* biofilm morphology and matrix composition for each class were established. To assess surface-associated biomolecules and their influence on matrix architecture, wild-type, *Δflp1-3*, and *ΔftpA H. ducreyi* biofilms will be examined by scanning electron microscopy. Identifying infections caused by biofilms and characterizing extracellular matrices will progress the informed development of biofilm eradication and prevention strategies.

02-02. Rhizosphere bacteria associated with seedless vascular plants at Erie Bluffs State Park
Kalyn Phan, (Russell Minton, Michael Ganger, Christopher Dempsey) - Gannon University - Microbiology

The rhizosphere is that region of soil directly affected by plant root systems and the associated microbial community. Plant roots are thought to actively recruit microorganisms from the soil, likely promoting the abundance of beneficial species while discouraging pathogenic species. As such, a plant's root microbiome may represent a unique bacterial assemblage when compared to other species. Root microbiomes in flowering plants have been well studied, however less is known about seedless vascular and non-vascular plants. We collected roots and adhered soil particles from ten seedless vascular plant species at Erie Bluffs State Park. We extracted bacterial DNA using the Qiagen DNeasy PowerSoil kit and sent it off for Illumina sequencing of the 16S V4 region. We processed the resulting reads in QIIME2 and calculated three distance matrices for our samples. First, we measured bacterial diversity between plant samples using generalized Unifrac distances. Second, we determined genetic distance between plant species by calculating the maximum composite likelihood with gamma parameter and rate heterogeneity based on databased *rbcL* sequences as implemented in MEGA X. Finally, we calculated the physical distance between individual plants using latitude/longitude coordinates of the collection sites. We used multiple regression on distance matrices method in the R package *ecodist* to test for correlations in the model (bacterial distance ~ likelihood distance + physical distance); significance was determined through permutation test. Our results suggested that bacterial communities were more similar between closely related plants and plants physically near one another, supporting the notion that rhizospheres are shaped by both plant physiology and soil characteristics.

02-03. Using phage display to select for cortisol specific peptides
Celeste Snyder, (Diana Fagan, Pedro Cortes) - Youngstown State University - Microbiology

Cortisol levels provide indications for many bodily functions including stress response. Cortisol specific peptides are needed for the detection of cortisol. The goal of my project is to use phage display technology to select for filamentous bacteriophage (M13) displaying peptides that bind with high affinity to cortisol. Biopanning of phage libraries allows for the selection of cortisol binding phage clones through cycles of incubation, washing, elution, and amplification. The ligand bovine serum albumin-conjugated to cortisol was used to coat Maxisorp plates. Pre-adsorption wells (bovine serum albumin without cortisol) were used to remove non-specific phage prior to panning against cortisol. Cortisol specific phage were eluted with buffer containing polyvinyl alcohol, gelatin, and potassium phosphate-buffered saline. A third panning of the phage showed 9.00×10^6 plaque forming units. Ten clones were selected, seven have been amplified and titered, with results ranging from 7.25×10^9 to 1.90×10^{11} plaque forming units. The clones will be tested for specificity by ELISA and sequenced. Future applications include the development of wearable sensors to detect cortisol.

02-04. Status of the methylome in *Solanum tuberosum* tubers treated with sprout inhibitor 1,4-dimethylnaphthalene
Emily Eiss, (Michael Campbell) - Penn State Behrend - Genetics

Potatoes are among the largest agricultural crops worldwide. The success of the potato industry depends heavily on the storage of the tubers; if potatoes sprout while in storage, the stock is ruined for commercial sale. For this reason, the industry relies on aerosol sprout inhibitors to prevent sprout growth; one such inhibitor is 1,4-dimethylnaphthalene, or DMN. It is found naturally in potatoes and thus is considered a more natural sprout inhibitor, but it is unknown how DMN prevents growth. This study considers epigenetics as a possible mechanism of sprout inhibition, particularly in the form of methylation; DNA methylation is the covalent attachment of a methyl group ($-CH_3$), particularly to cytosines in areas of dense CG content, that inhibits expression of genes downstream of the methylation. Genomic DNA samples from meristem tissue, or the eyes, of potatoes was isolated and underwent bisulfite conversion and sequencing at Beijing Genomics Institute. This process elucidates methylation data by chemical conversion of non-methylated cytosines into uracil, ultimately providing a final sequence whose only cytosines indicate a location that was methylated. This data was analyzed using the bisulfite sequencing analysis software "bismark" and aligned with an annotated potato genome through the website Comparative Genomics (CoGe). Once visualized, methylation rates were compared between sample and treatment potatoes to identify locations of possible epigenetic control of gene expression and specific genes that may be impacted.

02-05. Examining the Evolutionary Connections Between Annotated Raptor Genes in *Drosophila Species*
Aaron Lehman, Heather Willis, (Brian Yowler) - Grove City College - Genetics

The Genomics Education Partnership is a collaboration of faculty across colleges and universities throughout the United States that aims to acquaint undergraduate students with biological research by annotating genes from newly sequenced genomes. Our research team worked on the Pathways Project, investigating the insulin signaling pathways in *Drosophila* species. Ultimately, the project aims to examine regulatory gene regions and observe their evolution within the context of their location in a network. Specifically, our research team focused on annotating the *raptor* genes in multiple *Drosophila* species, comparing them with the raptor gene in *Drosophila melanogaster*. *Raptor* functions in the insulin signaling pathway; it is a component of the mTORC1 complex and regulates mTOR. It is a scaffold for mTOR kinase, recruiting and phosphorylating substrate. *Raptor* also helps guide mTORC1 subcellular localization. Our research team annotated sequence changes in *raptor* across *Drosophila* lineages.

02-06. Early Detection of Ship-Mediated Aquatic Invasive Species (AIS) Through Environmental DNA (eDNA)
Noel Moore, Emily Dobry, Kyle Deloe, (Matthew Gruwell, Ivor Knight) - Penn State Behrend - Genetics

eDNA is gaining acceptance as a means of monitoring AIS, however signal duration ranges widely. We designed mesocosm experiments using the Great Lakes invader *Hemimysis anomala*, recently discovered in Pennsylvania. We used four control tanks and four exposure conditions (5 tanks each): high and low biological oxygen demand and presence or absence of organisms in exposed lake water. Ten mL water samples were filtered from each tank, 1) prior to organism inoculation, 2) immediately after inoculation, and 3) at regular intervals for 15 days post inoculation. Genomic DNA was extracted and the presence of *H. anomala* eDNA was detected through PCR and gel electrophoresis of CO1 mtDNA. During the first 4 days post inoculation the number of eDNA positive tanks declined for all 4 treatments. For the duration of the experiment, eDNA signal was sporadically positive in all tanks and no significant difference in eDNA signal between treatments was observed. Although these methods were effective in detecting *H. anomala* DNA, the persistence of eDNA signal extends beyond two weeks. Future experiments, with longer duration are needed to determine the extent of signal persistence.

02-07. Identification of Fern Orthologous Genes Implicated in Moss Rhizoid and Grass Root Hair Development
John Vieira, Jenna Sins, (Gary Vanderlaan, Mike Ganger) - Gannon University - Plant Evolutionary Biology

The evolution of terrestrial plants is an approximately 500-million-year story. Although all land plants execute an alternation of generations between a haploid gametophyte and a diploid sporophyte stage, the amount of time and space spent in each generation varies across clades. For instance, the bryophytes typified by *Physcomitrella patens*, are gametophyte-dominant and produce gametophyte structures known as rhizoids for anchoring to substrates as well as for nutrient absorption. Moss sporophytes are dependent on the moss gametophyte, and are diminutive in size, entirely lacking roots. In contrast, anthophytes like *Arabidopsis thaliana* are characterized by sporophyte-dominant stages with an exceptional spatiotemporal reduction in gametophyte structures. Such is the reduction that flowering plants rely on sporophyte root systems for anchorage and nutrient absorption, forgoing any production of rhizoids. In the middle of this plant evolutionary saga lies *Ceratopteris richardii*, a fern capable of not only producing gametophyte rhizoids but also sporophyte root systems. Great strides have been made in the elucidation of the genes required in the specification and development of sporophyte root hairs in *Arabidopsis* as well as for the development of *Physcomitrella* gametophyte rhizoids, but little is known of the specific genes utilized in ferns for similar processes. Recent advances in genomics and transcriptomics for *Ceratopteris richardii* permits orthologous gene-function searches. Here we showcase novel fern genes that are expressed in gametophyte and sporophyte stages that share predicted-peptide conservation with known moss and cress genes that are key molecular players in rhizoid and root hair development, respectively.

BIOLOGY II

03-01. The Role of trans-Golgi Network and Endosomal Adaptors in Nitrogen-Regulated Growth of *Saccharomyces cerevisiae*

Ellen Madden, Rachel Stubler, (Quyen Aoh) - Gannon University – Cell & Molecular Biology

Nitrogen is necessary for the synthesis of amino and nucleic acids and is taken in from the environment by nitrogen permeases. In *Saccharomyces cerevisiae*, these permeases are trafficked throughout the cell in a process involving the endosomal clathrin adaptors Gga1, Gga2, AP-1, Ent3, and Ent5. Evidence suggests that the trafficking of some permeases are more highly regulated by these clathrin adaptors than others. To discern the role of clathrin adaptors in the trafficking of nitrogen permeases, we have constructed clathrin adaptor deletion mutants. Single deletion mutants were constructed via homologous recombination to knockout and replace the genes of clathrin adaptors with a selectable marker in haploid yeast. Cells were mated, sporulated, and dissected to create double and triple delete mutants. Growth assays can be used to determine the effects of adaptor protein deletion on cell growth. A GloMAX® Microplate Reader will be used to measure the OD600 of cell cultures in different nitrogen media every 30 minutes for 30 hours. Growth curves are plotted to visualize the differences in growth rate for the mutant cells compared to wild-type cells. Previous results showed that deletion of either *ent3Δ* or *ent5Δ* did not impact cell growth in either nitrogen environment, but a double deletion reduced growth in cells grown under the preferred nitrogen sources ammonia and glutamine but not in the non-preferred nitrogen source proline. This supports our hypothesis that clathrin adaptors differentially regulate the localization of nitrogen permeases when cells are grown in preferred and nonpreferred nitrogen sources. Our current experiments are investigating the effect of deleting Apl2 in combination with *ent3* and *ent5* mutants. We are testing the growth of *apl2ΔΔ*, *apl2ΔΔ ent3ΔΔ*, *apl2ΔΔ ent5ΔΔ*, and *apl2ΔΔ ent3ΔΔ ent5ΔΔ* mutants. If our hypothesis is correct, we expect growth defects in cell lines lacking more than one clathrin adaptor protein.

03-02. Secretory Carrier Membrane Protein 3's (SCAMP3) Role in β-Amyloid Production and Secretion

Alexandria Zarilla, Daniel Oar, Mia Jang, (Quyen Aoh) - Gannon University – Cell & Molecular Biology

Alzheimer's disease is a neurodegenerative disease associated with loss of memory and cognitive function. The aggregation of extracellular plaques containing Beta-amyloid is related to the processing of the amyloid precursor protein (APP). When endocytosed to the early endosome, APP will either be degraded by the lysosome or sent back to the trans-Golgi network. Degradation of APP is regulated by endosomal sorting complexes required for transport (ESCRTs). Disruption of ESCRT function leads to accumulation of β-amyloid. The secretory carrier membrane protein 3 (SCAMP3) interacts and opposes the function of the ESCRT proteins. We hypothesize then that SCAMP3 may regulate APP trafficking by promoting or inhibiting trafficking of APP to the lysosome. As shown with our poster, we will test this hypothesis by examining the effects of RNA interference of SCAMP3 in two assays: (1) an immunofluorescence colocalization assay with full length APP and (2) and ELISA assay to measure Beta-amyloid levels. Both assays will use H4 neuroglioma cells that have been stably transfected with APP-EGFP. In the immunofluorescence assay, the cells will be fluorescently labeled with antibodies to the lysosomal proteins LAMP1/2 or the early endosomal protein EEA1. Colocalization of EGFP-APP with EEA1 and LAMP1/2 will be observed under the microscope and quantitatively analyzed to determine the degree of colocalization. We then will use a well-established ELISA assay to measure intracellular and extracellular levels of Beta-amyloid. We predict that if SCAMP3 promotes APP trafficking to the lysosome, then a knockdown of SCAMP3 will result in decreased colocalization of APP with lysosomal markers in our immunofluorescence assay and increased intracellular accumulation of Beta-amyloid in our ELISA assay. On the contrary, if SCAMP3 inhibits APP trafficking to the lysosome, then there will be increased colocalization on the lysosome and decreased Beta-amyloid accumulation.

03-03. Induction of ER-Stress Affects Myelin Sheath Production in Oligodendrocytes

Madison Jones, (Ashley Russell) - Penn State Behrend – Cell & Molecular Biology

Endoplasmic reticulum (ER) stress is linked to a variety of neurodegenerative diseases. The ER's function is to synthesize, fold, and transport proteins in the cell, however ER-mediated stress can induce protein misfolding and lead to neuroinflammation. An oligodendrocyte is a cell found in the central nervous system that does not produce electrical impulses, but it creates a myelin sheath around the axons. The myelin sheath allows for quick travel of electrical impulses along neuronal axons. Oligodendrocyte cell death results in degradation of the myelin sheath causing the electrical impulses to taper off. In this study, we aim to assess myelin sheath formation in oligodendrocytes before and after ER-mediated stress. Human oligodendroglioma (HOG) cells will be treated with tunicamycin to induce ER-mediated stress and cell morphology and viability will be assessed. Next, we will perform Western blot analysis to examine expression levels of proteins that are found in myelin sheath (myelin basic protein and proteolipid protein), and proteins that may be upregulated during ER-stress such as IRE1,PERK, and ATF6. To mimic the formation of myelin sheaths on neuronal axons, HOG cells will be plated onto a nano-fiber scaffold and allowed to form sheaths around the fibers. Sheath formation will then be examined and quantified with confocal and electron microscopy after treatment with tunicamycin to induce ER-stress. We hypothesize the western blot of myelin sheath proteins will indicate a decrease in protein production due to ER stress. Proteins found in the ER when stressed will have an increased concentration in the western blot analysis. We hypothesize there will be a decrease in size and formation of the myelin sheath when treated with tunicamycin to induce ER stress of oligodendrocytes. If our hypotheses are supported, the data would suggest that ER-stress in oligodendrocytes can be a causative agent of neurodegenerative disease.

03-04. Role of SCAMP3 Regulating CXCR4 Trafficking

Angelika Chiang, Samantha Valaitis, (Quyen Aoh) - Gannon University – Cell & Molecular Biology

The CXC-Chemokine Receptor Type 4 is a G-protein coupled receptor. The functions of CXCR4 is to regulate the growth, division, differentiation, and migration of cells. When CXCR4 is overexpressed, it has been connected to metastasis in over twenty-three types of cancer along with promoting HIV infection. Under normal conditions, CXCR4 binds to its agonist CXCL12 and is endocytosed into the cell and transported to the early endosomes. At the early endosomes, the CXCR4 is ubiquitinated by the ubiquitin ligase ITCH and is sorted into multivesicular bodies by Endosomal Sorting Complexes Required for Transport. The MVBs buds off the early endosomes and are targeted for degradation in the lysosomes. The disruption of protein functions during this pathway can inhibit lysosomal degradation and lead to CXCR4 being overexpressed. In this research, we will investigate the role of SCAMP3, a Secretory Carrier Membrane Protein, which regulates CXCR4 trafficking and is known to interact with the ESCRT protein Hs and ubiquitin ligase ITCH. For our experiments, Hela cells, an immortal cell line derived from cervical cancer, were used. We will first do a knockdown of SCAMP3 to silence the SCAMP3 gene and then use RNA interference to examine CXCR4 trafficking in the absence of SCAMP3 while using a well-characterized immunofluorescence assay. The immunofluorescence used to determine the colocalization of CXCR4 in the lysosomes are the lysosomal markers LAMP1/2 and CXCR4 antibodies and in the early endosomes are the early endosomal markers EEA1 and CXCR4 antibodies. ImageJ colocalization program will be used to determine the colocalization between CXCR4 and organelle markers. A trafficking time course will be used to ensure that CXCR4 has arrived in the early endosomes between 30-60 minutes and in the lysosomes at 180 minutes. We anticipate that SCAMP3 could either inhibit or promote the degradation of CXCR4 transportation to the lysosomes.

03-05. Protocol for Optimization of Placental derived Extracellular Vesicles

Tahlia Smith, (Ashley Russell) - Penn State Behrend – Cell & Molecular Biology

Extracellular vesicles (EVs) are small, lipid bound packages that are secreted by all cell types and have been implicated in many diseases, such as cancer and neurodegenerative disorders. Though limited, an exciting new area of EV research focuses on their role in the reproductive system and pregnancy. In males, EVs have been implicated in the sperm maturation process and recent evidence suggests that paternal stress can be transmitted to offspring via sperm-EVs. In females, EVs play a vital role in maintaining reproductive organ homeostasis and pregnancy. During the development and maintenance of a pregnancy, the placenta is the main form of communication between the mother and the developing fetus. EVs play an important role in cell to cell communication, and possibly the transmission of pathologies from the mother to the fetus. Chronic stress during pregnancy has been linked to adverse developmental outcomes in infants, yet the mechanism by which this occurs is unknown. Placental-derived EVs may play a key role in mediating the negative effects of chronic maternal stress to the fetus. The goal of this project is to optimize a protocol for isolating placental-derived EVs from placental tissue obtained in collaboration with Magee Womens Research Institute. Techniques such as gentle tissue dissociation followed by differential ultracentrifugation and size exclusion chromatography will be used to separate EVs from tissue and other extracellular components. The vesicles will then be characterized by electron microscopy to assess vesicle morphology, western blotting to assess protein expression, and particle counting and sizing to ensure there are adequate amounts of vesicles and that they are within the expected size ranges. Optimization of this technique will allow for further research on the impacts placental-EVs have on maternal and fetal health, especially in the context of understanding the effects of chronic maternal stress on pregnancy outcomes.

03-06. Expression of Flowering Locus C (FLC) in *Arabidopsis thaliana* declines with increasing length of vernalization

Melissa Bronder, (Michael Ganger) - Gannon University – Cell & Molecular Biology

The onset of flowering in the annual *Arabidopsis thaliana* can be initiated using several pathways. One of these pathways is the vernalization pathway. In winter annual *Arabidopsis thaliana* varieties, the product of the gene *Flowering Locus C (FLC)* is able to block flowering. Time spent in cold (4° C) results in a decrease in expression of *FLC* and ultimately an increase in *FT (Flowering Time)* that leads to the onset of flowering. It is thought that in colder climates individuals begin with a higher expression of *FLC* that must then be reduced through vernalization in order for flowering to occur. This system ensures that flowering is timed to occur early in the spring. In summer annual varieties of *A. thaliana* it is thought that *FLC* expression would begin at lower levels and therefore vernalization is not required to reduce it. Here we test primers for *FLC* and reference genes using the winter annual Cha-0 (Champex) and develop RT-qPCR protocols to determine if *FLC* expression varies with length of vernalization (6-19 days). Our results show that the primers work well and that *FLC* expression declines dramatically over this time period. We also worked with the wild type *A. thaliana* (Col-0) and show that expression of *FLC* is lower overall does not decline as dramatically with vernalization.

03-07. Quantification of Esterase Activity in Grape Berry Moth Across Metamorphosis

Grant Oishi, (Adam Simpson, Samuel Nutile) - Penn State Behrend – Cell & Molecular Biology

The United States relies heavily upon the agriculture industry to support the needs of the population, but also to support local businesses and economies. In northwestern Pennsylvania, grapes constitute the majority of the region's agricultural productivity. Although Lake Erie provides a suitable environment for grapevines, it also supports several destructive pest species. A major invertebrate pest native to the Lake Erie region is the Grape Berry Moth (*Endopiza viteana*). The larval stage of this species burrows into grapes, causing significant damage to grape clusters and thus decimating yields. In order to combat this pest and other similar pests, growers have commonly employed the use of synthetic insecticides, which has ultimately led to the emergence and proliferation of insecticide-resistant populations. While it is known that insecticide-resistant populations of *E. viteana* exist in northwestern PA, the physiological mechanisms of resistance remain unknown. Previous research has developed biochemical assays to quantify the activity of detoxifying enzymes - such as esterases - in other invertebrate crop species. Our research aims to validate an in vitro esterase assay for evaluating potential resistance mechanisms in *E. viteana* and use this biochemical assay to determine how the activity of these enzymes changes throughout the life cycle of *E. viteana*. As a point of comparison, we performed the same assay on a non-target species (*C. dilutus*). Life stages of *E. viteana* and *C. dilutus* that will be tested include larval, pupal, and adult stages. Esterase activity is quantified with the assay - the Fast B Blue and Ellman Assays - by measuring metabolite concentration of an added substrate via absorbance, which corresponds to enzyme activity. While experimentation is currently ongoing, our findings are expected to aid viticulturists in improving their pest management practices by targeting the most sensitive life stage of these pest species.

03-08. Exploring the Importance of Bir1 Sumoylation in Yeast

Julie Cepec, (Yee Mon Thu) - Allegheny College – Cell & Molecular Biology

One of the hallmarks of cancer is genomic instability, and we can study this through looking at sumoylation, a dynamic process which constitutes the addition of a small protein modifier to a target protein. Sumoylation aids in localization, protein-protein interaction, and protein stabilization. Although we are aware of these functions, the direct biological impact of sumoylation for individual target proteins remains to be explored. This study focuses on one sumoylated protein, Bir1, which is a part of the Chromosomal Passenger Complex (CPC) and is required for correct spindle attachment in Saccharomyces cerevisiae. To begin to better understand the implications of Bir1 sumoylation, we generated mutants in which Bir1 was always sumoylated (SuON), never sumoylated (SuOFF), and neutral as it would be naturally in the cell (SuCNTRL). Each of these Sumo-mutants were exposed to DNA damaging agents, UV radiation and MMS (methyl methanesulfonate), but mutants did not exhibit any sensitivity to these agents when compared to the wild-type. A possible explanation for this may be related to redundancy in the cell to allow functions to carry through without the sumoylation of Bir1. Since Bir1 is a kinetochore protein involved in chromosome segregation, I chose to knock out a gene coding for an additional kinetochore protein also involved in this process, CTF19. This is a nonessential protein, but without it, cells experience higher amounts of chromosome missegregation. I expect to put cells in a biological context where Bir1 sumoylation is necessary for genome stability when introduced to mitotic stress. I hypothesize that disruption of Bir1 sumoylation will sensitize cells to genotoxic agents when CTF19 is absent. I have generated mutants, and this semester I will expose them to nocodazole (microtubule targeting drug) and UV radiation (DNA damaging agent).

03-09. Measuring Acetylcholinesterase Activity in *Caenorhabditis elegans* with Applications to RNA Interference

Dan Knapp, (Adam Simpson) - *Penn State Behrend – Cell & Molecular Biology*

RNA interference (RNAi) enables the silencing of genes by initiating the targeted destruction of specific mRNA transcripts; for this reason, it has been proposed for use in pest management. Most pesticides used today have the potential to cause harm to non-target species or the environment thus making RNAi a safer means of pest control. RNAi is often practiced first in model systems, such as *Caenorhabditis elegans*, before it is approved for use in target species. Many organic pesticides target acetylcholinesterases (AChE) because they catalyze the breakdown of acetylcholine; therefore, RNAi-mediated knockdown might be a suitable alternative. This experiment used *C. elegans* of various life stages to validate an *in vitro* AChE assay, with the goal of determining 1) if it can be used as a baseline assay for testing RNAi and 2) if AChE activity varies throughout development. AChE activity was quantified via the Ellman assay using protein homogenates from age-synchronized L1, L4, and adult worms. The development of this assay will allow future experiments to test potential RNAi plasmids for use in *C. elegans* and eventually regional pest species.

03-10. The Investigation of Cortisol's Effects of Iron Transport Proteins in Placental Cell

Sophie Anderlind, (Ashley Russell) - Penn State Behrend – Cell & Molecular Biology

The importance of the placenta is commonly unrecognized to the general public, although it functions for the lungs, brain, heart, intestines, and all other underdeveloped mammalian fetal systems incapable of operating in the uterine environment. These vital operations are attributed to the trophoblast layer of placenta, which facilitates the transfer of oxygen and nutrients to the fetal blood stream. Iron is a prominent nutrient responsible for general development, as inadequate levels have shown to induce pregnancy complications, fetal neural impairments, and fetal death in severe cases. The objective of this study is to determine how the exposure of cortisol, a stress hormone, affects the presence of proteins responsible for iron uptake and release in the placenta. The protein transferrin receptor 1 (TFR1) specifically facilitates iron absorption from the outermost side of the trophoblast layer while ferroportin-1 exports iron from the innermost side of the trophoblast layer. A trophoblast cell line will be conventionally cultured, and then exposed to differing amounts of cortisol and analyzed with western blot techniques to establish the quantity of TFR-1 and ferroportin-1 proteins. Microscopy will also be utilized to examine the localization of TFR-1 and ferroportin-1 proteins in response to cortisol on the trophoblast cells. Polymerase Chain Reaction (PCR) techniques will finalize the study by detecting whether cortisol exposure up- or down-regulates TFR-1 and ferroportin-1 at the level of gene expression. By identifying the amount, localization, and gene expression of these proteins upon cortisol exposure, the results may provide data that stress alters iron uptake and release by the placenta. Given the effects of iron in fetal development, the discoveries provide findings beyond how stress affects pregnant women and birthing complications, but also how stress through generations can affect the neurologic capabilities and disorders.

03-11. Assessment of Powdery Mildew and Fungal Resistance of CYP51 and Protein Mutations

Christian Pacifico, (Michael Campbell[1,2]) - Penn State Behrend School[1], Lake Erie Regional Grape Research and Extension Center[2]- Cell & Molecular Biology

Powdery Mildew caused by Erysiphe necator is a destructive fungal disease that damages grapes throughout the United States and the world. Multiple types of fungicides such as trifloxystrobin and strobilurin are used to inhibit fungal growth. Previous studies have shown that the CYP51 gene contains amino acid mutations such as G37V and Y136F that allow for resistance. Within this experiment, fungal samples from Northeast, PA were studied to identify what genetic mutations were present in facilitating fungal resistance. Multiple sequence alignments through NCBI BLAST verified that G37V and Y136F are mutations that are present within the CYP51 gene. PCR primers were designed to amplify the segment of DNA that contained both amino acid mutations. Multiple fungal DNA extractions were completed using extraction kits so that enough DNA per sample could be amplified. Next, a PCR reaction was done using the designed primers to amplify the sequence of interest. Gel electrophoresis was used to verify if the PCR reaction amplified the sequence. Upon verification within the gel, the sequences are shipped to see if the mutations are present. It was found in Northeast, that Powdery Mildew was spreading throughout multiple grape farms. Within our experiment, DNA extractions and PCR have been completed and gel electrophoresis is currently being completed for verification and will then be submitted for DNA sequencing. If this type of resistant Powdery Mildew is found, then other treatments and sprays can be used to inhibit growth in future harvests, and prevent future spreading throughout Northeast.

BIOLOGY III

04-01. Insect Diversity on Two Green Roofs on the Campus of Gannon University, Erie, PA
Skyler Sevacko, Nathan Maietta, (Dr. Steven Ropski) - Gannon University - Ecology

This research presents the effectiveness of an urban green roofs and the quantity of different species of insects based upon newer and seasoned roofs as well as the possible progression of hierarchy food chain species. We conducted a series of traps using fly ribbon, both aerial as well as ground, to gain a thorough consensus of insect populations. These tests were conducted for a three-day period in the fall, August through October, and in the spring, March through May. From these observations we concluded what mammalian as well as avian species followed the insect population obtained. Through our experiment and results we hope to find that urban green roofs prove that they have a positive effect on wide variety of species in the animalia kingdom.

04-02. Effect of Coverboard Array Design on the Probability of Amphibian Detection
Joseph Forish, Brianna Peyton, (Lynne Beaty) - Penn State Behrend - Ecology

Coverboards attract amphibians and other animals to seek refuge underneath them, where they can then be captured or observed without disturbing the natural cover and vegetation. This method offers several potential advantages as a sampling technique. For example, coverboards require less maintenance and sampling effort compared to other trapping mechanisms. It is unknown, however, how the design of coverboard arrays influences which species choose to live under the boards and how often researchers can find different species. In this study, we aimed to determine if the detection probability and occupancy of different amphibian species are affected by the spatial organization of coverboard arrays, including how close the boards are together and the density of boards, at three sites across Behrend's campus. We also observed how abiotic factors, including soil temperature, pH, and moisture, influenced amphibian detection probability and occupancy. We will discuss our results during the presentation. We hope our research results will fulfill the gap between the distribution of coverboards and the detection of amphibian species. Additionally, our findings can provide valuable information on how some amphibian species spatially organize themselves and have implications for how their spatial organization may impact the effect of disease, human habitat alteration, or predator stress.

04-03. Shape matters: Geometric morphometric analysis of invasive mysterysnails

Wyatt Fleischer, (Lynne Beaty) - Penn State Behrend - Ecology

The Great Lakes Region is well known for its biodiversity. With the large amount of international naval travel, this resource is under a threat from aquatic invasive species. Aquatic invasive species have the capability to out-compete native species and have numerous other negative effects. A group of species that threaten the Great Lakes are *Cipangopaludina* mysterysnails (i.e., the Chinese mysterysnail [CMS] - *Cipangopaludina chinesis* - and Japanese mysterysnail [JMS] - *Cipangopaludina japonica*). Though these two invasive species have different life histories and are reportedly found in different areas of western Pennsylvania, they are difficult to distinguish using shell morphology. What is more, the males and females of each species are also impossible to distinguish using traditional, basic, shell measurements. Given this, the objective of our research is to complete a geometric morphometric analysis of CMS and JMS in an attempt to characterize shape variation between species, between sexes, and between the various sites that these species have been reported. By conducting a more complex analysis of shape variation in these morphologically indistinguishable species, we hope to derive a set of measurements that will facilitate field identification of these two species. In doing so, we ultimately hope to generate more accurate distribution maps for these two species and speculate as to some of the drivers of their variation in shape.

04-04. Hermaphrodite density, male age, and male size affect male to hermaphrodite conversion in gametophytes of the fern *Ceratopteris richardii*

Samuel Wilczynski, (Mike Ganger) - Gannon University - Ecology

In gametophytes of the fern *Ceratopteris richardii*, the absence of hermaphrodite-produced antheridiogen leads to hermaphrodite development while its presence leads to male development. With removal from antheridiogen, males convert to hermaphrodites. Here we explore whether hermaphrodite density, male age, and male size affect the length of time it takes males to convert to hermaphrodites. Males were grown in three hermaphrodite densities for three separate lengths of time (14, 20, and 26 days). Males were removed from the presence of hermaphrodites (i.e., antheridiogen) and placed individually into new dishes. Male size was measured at the time of transfer and males were monitored every 12 hours for signs of conversion. Male size served as a covariate in analyses. Larger males converted faster than smaller males. Males growing in the lowest density of hermaphrodites (lowest antheridiogen concentration) converted faster than males growing in either of the two higher hermaphrodite densities. Older males (26 days old) converted faster than 20-day-old or 14-day-old males. Antheridiogen is an important factor influencing the conversion of males to hermaphrodites. However, results here suggest that male experience can alter the timing of conversion. With the removal of antheridiogen, larger, older males are more likely to convert. As these males convert, they begin to produce their own antheridiogen that would, in turn, influence smaller, younger males in the neighborhood to remain male.

04-05. Determining the Parasite Community of an Invasive Snail Species in Erie, Pennsylvania

Cassidy Ulanowicz, (Lynne Beaty, Adam Simpson) - Penn State Behrend - Ecology

Presque Isle State Park is home to a variety of both native and invasive species. These invasive species can wreak havoc on their surrounding ecosystem and have harmful effects on the native species. There are several invasive snail species that have made a home in Presque Isle State Park, one of them being the Chinese mysterysnail (*Cipangopaludina chinensis*). This species has shown to harbor a generous amount parasites. Trematodes, a common group of parasites that can infect humans as well as wildlife, use snails as intermediate hosts to get to their definitive host. It is uncertain exactly which parasites are contained in Chinese mysterysnails; therefore, it is unknown what effects they could have on the wildlife and humans around them in the park. Given these research gaps, the objective of this project was to determine the identity and abundance of parasites in Chinese mysterysnails at Presque Isle State Park. This was done through shedding the parasites from the snails, morphological identification of the parasites, then DNA sequencing using the COI barcode. By studying these missing pieces of information, we can better predict the effects the invasive Chinese mysterysnail and their parasites may have on Presque Isle State Park. That information can then be used to understand how to protect the wildlife of the State Park as well as the millions of visitors to the park each year.

04-06. Investigating the Role of Invasive Species in the Introduction of Heavy Metal Toxicants

Sage Grenz, (Samuel Nutile) - Penn State Behrend - Ecology
Presque Isle State Park located in Erie, PA is both a large tourist attraction and home to a diverse community of organisms that are interdependent upon one another in order to survive. Given that Presque Isle is located along Lake Erie, a large body of freshwater, it's susceptible to the introduction of invasive species, one being *Cipangopaludina chinensis*. Invasive species are known to degrade the overall quality of an ecosystem by outcompeting native species for resources, leading to their endangerment or extinction, in turn reducing the biodiversity of the ecosystem. It's not entirely known, however, the role invasive species play in the spread of pollutants within an ecosystem, such as heavy metals. The objective of this study was to gain insight on how invasive species contribute to the bioaccumulation of heavy metal toxicants within an ecosystem by analyzing heavy metal concentrations in *C. chinensis*, sediment, and water samples from Presque Isle via microwave digestion and ICP-MS. Pollution of Presque Isle with heavy metal toxicants could not only be potentially degradative to the ecosystem, but through doing so also be degrading the health of visitors through unsuspected exposure. Understanding the role of invasive species in the introduction of heavy metal toxicants is imperative in understanding how to combat the spreading of these toxicants and minimize the chance of harm to the surrounding ecosystem and visitors.

04-07. Effects of Chinese Mystery Snail (*Cipangopaludina chinensis*) Age on Exploratory Behavior

Phoebe Will, Maille Larmon, Jessie Johnson, Kelsey Foley, (Lynne Beaty) - Penn State Behrend - Ecology

Invasive species can be found worldwide in many different habitats. Oftentimes these invasive species have adverse effects on native species and the surrounding ecosystem. One such species that has been thriving throughout water bodies in North America is the Chinese Mystery Snail (*Cipangopaludina chinensis).* They have been able to grow to very large and disruptive densities due to ideal conditions in North America as well as lower infection rates of a parasite that usually controls their populations in their native habitat of Asia. Chinese Mystery Snails (CMS) have also made an impact locally in Erie, Pennsylvania. Unfortunately, they have made their way into Presque Isle Bay. CMS greatly disrupt the aquatic food web because of their high densities and contribute to native snail population decline. Due to their high impact on local ecosystems, it's important to study their behavior to know how they might spread, how they might affect native species behavior, and how they can best be controlled. One aspect that may contribute to behavior is the age of the snails. This study aims to determine the effect of CMS age on exploratory behavior. It's important to know how active different ages of snails are and how much they will explore a new environment as this influences how different ages of snails will be distributed within an area. We will observe a total of 60 snails over a two week period. The age of the snails will be determined by size and each snail will be categorized as juvenile, adult, or elderly with 20 snails per group. Their exploratory behavior will be quantified by what percent of the bin area they explore within a set amount of time. All snails will be observed during the same time of day to eliminate confounding factors. We predict that juvenile snails will explore the most area compared to adult or elderly snails. It is currently unknown how the age of CMS affects their exploratory behavior, and we aim to fill this knowledge gap to aid with this study.

04-08. Sex Differences in Activity Levels of Invasive Chinese Mysterysnails (*Cipangoplaudina chinensis*)

Hunter Frazier, Ramsey Struble, (Lynne Beaty) - Penn State Behrend - Ecology

The presence of aquatic invasive species is rapidly increasing in North America and represents an unquantified threat to the environment in which they reside in. In addition to harming aquatic organisms through crowding and competition, invasive species can greatly impact human populations by clogging water intake pipes and spreading diseases via parasites. An invasive species common to North America is the Chinese mysterysnail (*Cipangopaludina chinensis*). The Chinese mysterysnail is a large freshwater snail that arrived in the United States in the late 19th century and is now spreading across the country. Compared to well-known invasive species, the Chinese mysterysnail is only hypothesized to have adverse ecological and community-level impacts in its ecosystem, with the minimal research that has been completed. In this study, we aimed to determine if the activity of the Chinese mysterysnails differs between males and females in a controlled laboratory environment. We observed individual snail activity once a day for four hours over a four-week period, documenting their behavior based on movement from one location to another within their tank. The results are currently being analyzed and will be discussed further at the Sigma Xi Undergraduate Research Conference. The research results will be useful in creating new management strategies for this invasive species. Current management strategies are lacking because there is little understanding surrounding the ecological and community-level impacts of Chinese mysterysnail invasions. Our findings, detailing the activity of male and female mysterysnails, can specifically be used to determine the roles each sex assumes in its environment. This can potentially shed light on their degree of functional similarity with native species pools, classifying their ecological interactions as negative, positive, or neutral.

04-09. Influence of diet on growth and reproduction of Physa snails
Jake Ruttenbur, Hunter Hughes, (Lynne Beaty) - *Penn State Behrend - Ecology*

Physa snails are commonly used experimental animals that can be fed a wide variety of diets. There are many different options for their diet including algae wafers, boiled lettuce, and fish flakes, but no standardized food source when conducting experiments with Physa. Diet can greatly affect an organism's growth and reproduction, thus feeding snails different substances could lead to different results and make studies not comparable. Standardizing the snail diet for growth and reproduction would be best for future research. The objective of this study was to examine the how Physa diet influences their growth and reproduction. We fed the snails boiled lettuce, fish flakes, and algae wafers for four weeks. The snails were kept in groups of 10 replicated 10 times for each treatment. Snail size (wet mass) and reproduction were documented on the final day of the experiment. The results are currently being analyzed and will be discussed at the Sigma Xi Undergraduate Research Conference. Currently there is no knowledge about the relative effects of different diets, and we aim to fill this gap through our research. Our results can provide very valuable information about the best food to give the snails that leads to consistency in future research.

04-10. Shrinking salamanders: How Habitat Fragmentation and Climate Change Affect Spotted Salamander Body Size
Callie Schafer, (Lynne Beaty) - *Penn State Behrend - Ecology*

Habitat fragmentation can have serious impacts on an ecosystem and the species that thrive within it. Urbanization has been a killer for many species, even though it makes it easier for the human population to get around. These changes in habitat, especially when paired with climate change, can negatively impact species in myriad ways. The construction of the Bayfront Connector divided natural wetlands that were home to sensitive species around Penn State Behrend's campus, specifically the spotted salamander (*Ambystoma maculatum*). Currently, we have no knowledge on the consequences of habitat fragmentation and a changing climate on this population of salamanders. The objective of this project is to determine how spotted salamanders body sizes (i.e., weight and snout-vent-length) have changed over time with increasing fragmentation on campus and a changing climate. Using past salamander size records (1996-2006) and contemporary salamander size data (2019-2020), we can generate regressions to determine how spotted salamanders from sites on Behrend campus with different amounts of fragmentation have changed in size over time. With this information, we can speculate on the impacts that urbanization, past, and future, and climate change may have on spotted salamanders.

04-11. Evaluating the response of invasive Flowering Rush (*Butomus umbellatus*) cytotypes to chemical control measures

Jacob Hockensmith, (Cory Shoemaker[1], Gray Turnage[2]) - Slippery Rock University[1], Mississippi State University[2] - Ecology

Establishment and spread of invasive species has affected ecosystems across the globe. These intruders compete with native species for resources, which often leads to reduced biodiversity as well as other environmental issues. Flowering Rush (*Butomus umbellatus*) is one such species that has invaded the northern United States and Canada. Flowing Rush is a perennial, aquatic species that can be found growing along the shoreline of lakes and other waterbodies. In North America, two distinct cytotype populations occur: diploid and triploid. These cytotypes differ in key anatomical and physiological properties. Despite these differences, current best management practices of chemical control are based solely off research conducted on triploid populations, which account for only 29% of flowering rush populations in North America. In this study, we assessed the effect of two commonly used chemical control measures for aquatic plants, Diquat and Endothall, on diploid and triploid cytotypes. After establishment and subsequent herbicide application, plants were followed to eight weeks post treatment. At this time the plants were harvested to assess the efficacy of the treatments on above- and belowground biomass accumulation, in addition to belowground asexual rhizomatous bud production. We observed that when treated with herbicides, bud production in diploid plants increased, while bud production in triploid plants was unaffected. Additionally, in diploid Flowering Rush, higher concentrations of Diquat and Endothall increased bud production compared to control and low concentration treatments. Both Diquat and Endothall reduced the overall above- and belowground biomass. Our results suggest that diploid and triploid populations display different reactions to chemical controls and that further research is needed to elucidate these differences.

04-12. Response to Predator Pheromones in Physid Snails at Differing Times of Day

Madison Smith, Alayna Devine, Justin Morrison, (Lynne Beaty) - Penn State Behrend - Ecology

Predator-prey relationships are constantly evolving which highlights the importance of predator cues and chemical reception in prey. Much is known about a prey's response to a predator's presence, but information on chemical reception is lacking, especially in the context of predator pheromones and the timing of pheromone detection. The objective of this experiment is to examine how Physid snails (*Physa* spp.) react to predator pheromones during the day versus during the night. We will test this objective by observing Physa snails and their movement in response to the predator (crayfish; *Cambarus carinirostris*) pheromones at three different times of day (morning, afternoon, and evening). We will record the distance moved and whether they are above the water line to determine the level of response. Although our results will be presented at the Sigma Xi Undergraduate Research Conference, we predict that the snails will show a more pronounced response to predator pheromones during the evening/night due to snails generally being more active in darker environments. Furthermore, given that *Physa* can discern varying light intensities, they will likely rely on the detection of chemical cues at night due to their reduced ability to detect visual stimuli. In addition, we suspect that the snails will react more when the pheromones are first introduced into their environment due to their ability to detect pheromone's age, and thus risk of predation. There has been no evaluation on the influence of time of day on snail antipredator behavior, so our study will have implications for interpreting the results of previous studies and the design of future studies of snail antipredator behavior.

BIOLOGY IV

05-01. Using Human Touch to Differentiate Behavioral Traits Between Mysterysnail Species
Justin Heller, Tahlia Smith, Alaina Wyckoff, (Lynne Beaty) - Penn State Behrend - Ecology

Both the Chinese (*Cipangopaludina chinensis*) and Japanese (*Cipangopaludina japonica*) Mysterysnail have been imported into the United States for numerous reasons including hands-on education, to be sold in food markets, and for the international trading industry. Common around the Great Lakes region, these snails can be found at the bottom of lakes and rivers and can be identified by their globus shells often used to protect them from predators. Mysterysnails can also be found being used as touchables in educational programs and there is not much research about the impact these disturbances have on the snail. The objective of this study is to determine how the Chinese and Japanese Mysterysnail species differ in their response to human disturbance. Over the course of six weeks, snails from each species will be picked up and carefully placed back into their environment. An average response time will be calculated by waiting and timing how long it takes each snail to emerge from their shell. By the end of the study, behavioral differences will be more identifiable between the Chinese and Japanese Mysterysnails as they become accustomed to the human disturbances as a species. Being able to behaviorally distinguish between species would be a really valuable contribution to controlling these invasive species. The results of the study will be presented at the Sigma Xi Undergraduate Research Conference via Zoom.

05-02. How the Behavior of Chinese Mysterysnails Differ Between Locations
Amanda Romano, Alina Karnaukh, Brooke Burdick, (Lynne Beaty) - Penn State Behrend - Ecology

Chinese mysterysnails (*Cipangopaludina chinensis)* are one of the largest freshwater, invasive snails in the United States. Originating from Asia, the Chinese mysterysnail is now extensively found in many locations in the continental US. Due to the fact that this snail is now very common and has been in the US since the 1890s, it is suspected that the snails have become locally acclimatized to the multiple locations that they invade, making them more difficult to control. It is important to understand the migration patterns and behavior of the mysterysnails to control them effectively. The objective of this study was to determine how mysterysnail activity behavior differs between different locations. The mysterysnails were collected from three different sites (Lake Pleasant, Presque Isle (Lily Pond), and Lake Canadohta) and 15 snails were observed from each site. This was done on three different days, monitoring each snail for 10 minutes (150 total minutes observed per site) to observe their overall activity level. The results of this study have not yet been determined and are still being analyzed. These results will be further discussed at the Sigma Xi Undergraduate Research Conference. Differences in snail behavior between sites could reflect local adaptation or a founder effect, which we will speculate on with the conclusion of our experiment. If the activity between sites does not differ, that could indicate that either selective pressures are not different between sites, or that there is still movement between invasive populations, making them behaviorally indistinguishable. Regardless, the results of this study will help inform management efforts to control invasive Chinese mysterysnails.

05-03. Effects of harvest intensity on stream chemistry and macroinvertebrates communities

Julia Jiang, Mykenna Zettle, Stephanie Wohlers, (Denise Piechnik, Chuck Keeports) - University of Pittsburgh at Bradford, United States Forest Service - Ecology

Forest management practices, such as timber harvest, may further impact aquatic ecosystems with acidified streams in Pennsylvania watersheds. Timber harvesting increases the NO_3^--N, acidifying soils, while decreasing pH and acid neutralizing capacity (ANC) (Siemion et al. 2011). Harvesting near streams reduces macroinvertebrate diversity, especially the order Ephemeroptera. The effects of harvest intensity on water quality and sensitive macroinvertebrate orders were monitored in six 100-200 acre watersheds in the Allegheny National Forest. Two watersheds were partially harvested (25-35%), and four served as uncut references. Water quality parameters, including pH, temperature, total dissolved solids (TDS), and conductivity were monitored from May to October in 2018 and 2019 using an HI-9828 multimeter. ANC was determined by titration in the lab. Kick net samples of macroinvertebrates were sub-sampled in the lab, and then sorted to order (EPT). Macroinvertebrate diversity decreased across all sites from 2018-2019. Trichoptera were uncommon in these headwater streams, and by 2019 Ephemeroptera abundance decreased by 50% or more in most streams. Five watersheds showed an increase in pH (range: 0.07-1.63), however Whitney Run (reference) decreased by 2.65 after 2018. Temperature increased across all six watersheds by an average of 3.3 degrees, but conductivity and TDS hardly changed. Removing less basal area could explain this response, as described by Siemion et al. 2011, while the macroinvertebrate response was consistent with known effects of timber harvest on diversity. These results help us to gain insight into the possible effects of harvest intensity on macroinvertebrates and stream chemistry in headwater streams.

05-04. Testing the Resource Dilution and the Resource Concentration Hypotheses Regarding Infestation Rate of *Agrilus planipennis* (Emerald Ash Borer) in Stands of /Fraxinus profunda/ (Pumpkin Ash) of Differing Densities in Northwestern Pennsylvania

Hayden Petrick, (Christopher Dolanc) - Mercyhurst University - Ecology

The emerald ash borer (*Agrilus planipennis*; EAB) is an invasive jewel beetle species from Asia whose larvae mature and consume the cambium of host ash trees (*Fraxinus* spp.). Because the infestation of EAB is rapidly spreading, determining the validity of two exclusive hypotheses on resources and host density will afford conservation agencies insight into EAB maintenance. The resource dilution hypothesis proposes that a stand with a less dense host spp. leads to a rapid mortality of host individuals, but the resource concentration hypothesis contests this by instead proposing that a stand with a high density of host species leads to a rapid mortality of host individuals. The objective of this study is to produce data that tests these two competing hypotheses. In 2016, two permanent plots with differing densities of the host species, pumpkin ash (/Fraxinus profunda/), were established before any signs of EAB infestation were observable and ongoing annual censuses have occurred every summer since. The canopy dieback of each individual pumpkin ash tree was rated using a standardized protocol, (1 = normal, progressing to 5 which was little to no canopy remaining) and the number of EAB exit holes, diameter at breast height and other standard measurements were also recorded. After four years, the less dense stand of pumpkin ash had an average ash rating of 4.3 while the stand that was denser had an average of 3.98, and the less dense stand had 4.81 more holes per tree than the denser stand despite the stands being less than 100 m apart. Also, the plot with greater host density had a 22.2% mortality rate while the less dense plot had a 52.4% mortality rate. These findings provide preliminary support for the resource dilution hypothesis. Future work is needed to further these findings. However, if true, land managers will likely want to cease thinning of pumpkin ash stands as a way of preventing infestation as our data suggest this may be to their detriment.

05-05. Does emerald ash borer disproportionately favor stands of pumpkin ash with larger diameters?

Brady Kalchthaler, (Christopher Dolanc) - Mercyhurst University - Ecology

The emerald ash borer (EAB), *Agrilus planipennis Fairmaire*, is an invasive wood-boring beetle native to eastern Russia, northern China, Korea, and Japan. The mature EAB feeds on the foliage of the trees, but causes little damage, while their larvae bore from the outside bark into the cambium after hatching. The larvae then feed on the phloem of ash trees (spp. Fraxinus), restricting nutrient and water flow, inevitably leading the tree towards death. The EAB threatens the nearly 1 billion native ashes living in the north-eastern United States and lower parts of Canada. This paper aims to distinguish which size classes of ash are most susceptible to an EAB infestation. We hypothesize that infection rates will be lower among smaller ash due to the suggested evidence that females are limited to laying their eggs only on trees with prominent bark, or larger, more mature individuals. As part of an ongoing census starting in 2016, we sampled two plots in Asbury Woods near Erie, PA dominated mostly by pumpkin ash (Fraxinus profunda). Ash trees in both plots were first identified, given an ash-rating on a scale of 1-5 (5 being the worst), and an ash break-up rating (1-5). Tress were subdivided into three categories (≤10 dbh, ＞10 dbh, and ≥ 20 dbh) for analysis. Our results indicated the EAB has only a slight preference for ash trees in the categories of ＞10 dbh, and ≥ 20 dbh. The trees in the ≤ 10 dbh category maintained a lower average ash-rating from years 2016-2020, while the trees in the other two classes exhibited similar trends in their respected average ash-ratings. An ash tree with a low ash-rating correlates to a healthier individual; individuals affected less by the EAB in comparison to the other ashes in the plots. These findings do not confidently support our hypothesis that smaller ash trees will have lower infestation rates compared to larger, mature individuals. If true, the ash trees in each dbh category are threatened with infestation and extinction.

05-06. Observations on the Effect of Soil Bacteria on Sexual and Rhizoid Development in Gametophytes of the Fern *Ceratopteris richardii*

Grace Rihs, Erin Renwick, (Michael Ganger, Gary Vanderlaan) - Gannon University – Ecology/Organismal Biology

The sexual development of gametophytes of the fern *Ceratopteris richardii* (C-fern) is influenced by the presence of the hormone antheridiogen, secreted by hermaphrodite gametophytes. Gametophytes exposed to antheridiogen develop as males, while lack of exposure leads to hermaphrodite development. C-fern has been previously shown to interact with a soil bacterium (*Pseudomonas nitroreducens*) that results in gametophytes with both longer rhizoids and a higher percentage of hermaphrodites. Here we ask whether other bacteria can affect C-fern development. Gametophytes exposed to various species of bacteria (including soil bacterium and laboratory strains) resulted in longer rhizoid when exposed to gram-negative bacteria. This indicated a potential mutualistic relationship between *Ceraptoperis richardii* and gram-negative bacteria. Additional studies with *P. nitroreducens*, a gram-negative soil bacterium, an unidentified gram-negative bacterium, and *Lysinibacillus xylanilyticus*, a gram-positive bacterium, showed an inverse relationship between *P. nitro* and *Osen 1-10* in which *P. nitroreducens* induced more hermaphrodites while the unidentified bacterium had a stronger effect on rhizoid length. *L. xylanilyticus* failed to alter either rhizoids or sexual development. This leads us to believe that each of these developmental effects uses a different mechanism. We further found that lower concentrations of bacteria decrease overall rhizoid length and that bacteria do not need physical contact to induce an effect on rhizoid length in gametophytes.

05-07. Phenotypic Plasticity in *Lithasia geniculata* Includes Shell Density

Gabriella Goodwill, (Russell Minton[1], Holly Mihaly[1], Riccardo Fiorillo[2]) - Gannon University[1], Georgia Gwinnett College[2] – Organismal Biology

Pleurocerid snails exhibit shell variation that generally varies with the environment and predation; shells are thicker, more conic, and harder to crush upstream than downstream. Little is known, however, about whether the density of shell material varies in a similar fashion and how it correlates with other shell characteristics and the environment. Using eight populations of Duck River *Lithasia geniculata*, we measured shell material density as a function of X-ray radiopacity and shell thickness and correlated it with river mile and crushing strength. Populations differed in their density which was positively correlated with river mile whether adjusted for shell thickness or not. Regression indicated that shell density showed positive correlation with thickness and negative correlation with crushing strength. Our results in *L. geniculata* are the first to show variation in shell material density in pleurocerids, and our data suggest adaptive trade-offs in response to hydrology and predation pressures.

05-08. Comparative Serration Morphology between *Squalicorax* Species

Lauren Olevnik, (Todd Cook) - Penn State Behrend – Organismal Biology

Squalicorax is an extinct group of medium to large scavenging sharks. Their vast paleogeographical range covers Europe, Africa, Asia, Australia, and North America spanning from Albian to Maastrichtian of the Cretaceous period, approximately 100 to 66 Ma. The serration pattern and morphology of four *Squalicorax* species: *Squalicorax sp*. *A*, *Squalicorax mutabilis*, *Squalicorax kaupi*, and *Squalicorax pristodontus* is described. Teeth of *Squalicorax sp*. *A* have a less defined serration morphology along the cutting edge than the latter three possess. The teeth of *Squalicorax sp. A* and *Squalicorax mutabilis* were both recovered from Turonian Kaskapau Formation in Alberta, Canada. *Squalicorax kaupi* specimens were collected from Maastrichtian Navesink in New Jersey, USA and the *Squalicorax pristodontus* teeth were recovered from Maastrichtian phosphate beds of Khouribga, Morocco. Distinct serration and morphological differences are more easily observed for *S. mutabilis, S. kaupi,* and *S. pristodontus*, particularly from the kerf, pitch, and gullet patterns of the teeth. The serrations of the aforementioned species are composed of a triple-layered enameloid microstructure containing an outermost shiny-layered enameloid (SLE) layer made of individual hydroxyfluorapatite crystallites. A thicker, parallel-bundled enameloid (PBE) layer made of parallel crystallite bundles sits between the SLE and an innermost tangled-bundled enameloid (TBE) which consists of randomly oriented crystallite bundles. An underlying dentine structure which exists as either osteodentine or orthodentine is used to histologically group tooth types. The teeth described are currently undergoing an acid etched histological examination to determine if the internal tissue composition of the serrations varies between the four species.

05-09. Examination of Dental Histology in the Extinct Shark *Archaeolamna kopingensis* Over Time

Lauren Barmore, (Todd Cook, Michael Justik) - Penn State Behrend – Organismal Biology

Archaeolamna kopingensis is an extinct Cretaceous lamniform shark. Evidence from a partial skeleton has shown that this species was a medium to large predator that possessed tearing and grasping dentition. Isolated *Archaeolamna kopingensis* teeth have been recovered from Albian (100 Ma) to Maastrichtian (66 Ma) fossil deposits of Sweden, France, Belgium, and Australia and North America. This temporal range suggests that *Archaeolamna kopingensis* had a species lifespan of 34 Ma. Although the general tooth morphology of *Archaeolamna kopingensis*is similar throughout the Cretaceous, a single species with such an extensive lifespan is somewhat questionable. Could differences in the internal tissues of teeth over time suggest that *Archaeolamna kopingensis*is in actuality multiple species? The dentine and triple-layered enameloid of isolated *Archaeolamna kopingensis* teeth from three separate epochs are examined to determine if there were changes in the dental tissue composition of this species over time. The samples being examined were recovered from the Turonian (94 to 90 Ma), Campanian (84 to 72 Ma), and Maastrichtian (72 to 66 Ma). A strontium isotopic analysis is currently being undertaken to establish the absolute age of the recovered teeth. Following this procedure, a histological examination of the enameloid and underlying dentine will be performed to see if there are any changes in the dental tissue organization between the samples from the three epochs. Any significant histological differences may question the extensive temporal range of *Archaeolamna kopingensis*.

05-10. Zooplankton Assemblages in Presque Isle Bay

Audrey Feldmann, Helen Livingston, (Michelle Kuns) - Gannon University - Zoology

Zooplankton are found throughout the water column and are sensitive to environmental changes. Species composition and abundance change due to temperature and nutrients found during different times of the year. We monitored zooplankton assemblages in Presque Isle Bay as part of a larger program to monitor the health of the Presque Isle Bay aquatic ecosystem. Monthly samples were taken in Presque Isle Bay from May to October in 2020. These samples can be analyzed under a light microscope to determine the differences in zooplankton during these months. Samples were collected using a 20-cm vertical net lowered to near the bottom of the bay (5m) and pulled to the surface and were immediately preserved in 70% ETOH.   In the lab, zooplankton are being counted and identified. Species composition and abundance will be compared to water clarity, light penetration, and nutrient data collected at the same time as the zooplankton.

05-11. Ecotoxicological Assessment of *Caenorhabditis elegans* as a Suitable Surrogate for Mammalian Toxicity Testing

Alaa Kareem, (Adam Simpson) - Penn State Behrend – Environmental Toxins

The development of new pesticides requires thorough toxicity testing to ensure low toxicity to non-target species, particularly mammals. The use of mammals in toxicity testing, however, is subject to debate, especially after the U.S. Environmental Protection Agency announced its plan to phase out mammalian toxicity testing by 2035. Therefore, there is a need to identify alternative models that share similar toxicity profiles with mammals. Recent research has suggested the use of *Caenorhabditis elegans*, a soil-dwelling nematode, as a model for evaluating neurological toxicants. *C. elegans* has numerous advantages over other potential models because it is inexpensive to maintain, exhibits a rapid life cycle, and has a well-studied nervous system. In this experiment, I exposed age-synchronized L4-stage worms to three neurotoxic insecticides: chlorpyrifos, carbaryl, and malathion. Each of these toxicants causes toxicity by inhibiting acetylcholinesterase in the synapse, leading to uncontrolled muscular contractions. The wildtype strain of *C. elegans* (N2) were exposed to a wide range of concentrations in vivo for 24 hours, after which the LC50 (median lethal concentration) was estimated. These values were ranked relative to each other and compared to those of standard mammalian models. Studies such as this, evaluating a variety of toxicants, are necessary in the search for suitable models.

05-12. Selection preference in *Hyalella azteca*: Development of a Behavioral assay for ecotoxicology

Pooja Mehta, (Samuel Nutile) - Penn State Behrend - Ecotoxiocology

Sublethal effects associated with pollutants are often overlooked in ecotoxicology yet have significant environmental implications. In comparison to lethality, study of sublethal effects, such as behavioral changes, can provide insight into toxicological effects that occur below lethal concentrations but cause lethality through indirect means. Despite the importance of behavioral effects of toxicants, no reliable assays exist for evaluating behavioral endpoints, particularly in aquatic species. The objective of this study was to determine if *Hyalella azteca* exhibit preferential selection to substrates as an estimate of this species' behavioral response to contaminants. By designing a two-choice test chamber, preferential selection behaviors were tracked, observed, and measured. Individual *H. azteca* were given a choice between field-collected sediment and sand. They were then monitored for 10 minutes using EthoVision Software. Experiments with individuals were repeated three times to determine intraindividual variation. The results show that *H. azteca* significantly exhibit selection preference behavior of sediment substrate, but a bias for one side of the experimental chamber was observed during initial trials, which is being explored in current experimentation. Despite this side bias, *H. Azteca* demonstrate a clear preference for field collected sediment over sand, suggesting this assay serves as a viable means to explore sublethal behavioral effects of toxicants. Establishing a viable behavioral assay lends opportunity to make determinations on *H. azteca* environmental preference and how contamination alters these preferences. Behavioral changes caused by substances ranging from pharmaceuticals to industrial contaminants can be studied, providing a more realistic view of pollution in aquatic environments.

CHEMISTRY

06-01. Studying the Electrochemical Nitrite Reduction Mechanism at Human Serum Albumin-Heme Modified Glassy Carbon Electrodes
Amanda Dynoske, (Jason Bennett) - Penn State Behrend -Chemistry

Myoglobin and heme-human serum albumin (HSA) are proteins that contain iron metal centers and are thought to possess similar pathways in catalyzing nitrite reduction. However, the redox chemistry of the heme center in myoglobin is better understand than it is in HSA-heme. Comparing the catalytic effects of HSA-heme and myoglobin towards nitrite and nitric oxide reduction, the similarities and differences between the two mechanisms can be compared in order to better understand the redox behavior of HSA-heme. This presentation will focus on studying the electrochemical reduction of nitrite at HSA-heme and myoglobin. The proteins will be kept at the electrode surface by incorporating them into a film of the surfactant didodecyldimethylammonium bromide (DDAB) on glassy carbon (GC). Additionally, spectroelectrochemistry will be attempted to correlate the electrochemical changes with well-known spectroscopic observations to fully understand the nitrite reduction mechanism.

06-02. Manganese Porphyrin Enzymes as Potential Catalysts for Oxidative Desulfurization Reactions
Aaron Trail, (Mary Grace Galinato) - Penn State Behrend - Chemistry

Hydrocarbon fuels can contain sulfur impurities which are detrimental to the environment and public health, with the current method of removing these impurities (hydrogen desulfurization) being difficult to undertake under moderate conditions. Alternative means of sulfur removal have been explored, including oxidative desulfurization (ODS) where sulfur is oxidized to sulfones, allowing easy removal due to their polar nature. One oxidant/catalyst pair that has been effective for ODS reactions is H_2O_2 and hemoproteins (proteins that contain a porphyrin). Manganese porphyrins, which are efficient for catalyzing substrate oxidation, generate sulfones via the ODS reaction in the presence of a N-donor ligand. The formation of a Mn-N bonding interaction is key towards ensuring catalytic activity. Our work intends to use manganese protoporphyrin IX (MnPPIX) in human serum albumin (HSA) with N-donor ligands such as amines and imidazoles incorporated in the matrix, forming a complex referred to as [HSA-MnPPIX-N(ligand)]. The catalyst will be encapsulated in a silica sol-gel which extends its lifetime. Preliminary analysis of the UV-vis spectra of solution [MnPPIX-N(ligand)] indicate the possible formation of a catalyst. Initial ODS reactions catalyzed by myoglobin have been performed to test reaction conditions, indicating that and S-containing substrate (e.g. thiophenes) is different from the product. Further spectroscopic characterization on the silica-encased [HSA-MnPPIX-N(ligand)] catalyst will be carried out, and sulfoxidation reactions will be tested with this catalyst.

06-03. Cu-catalyzed synthesis of 1,3-dihydro-2H-imidazol-2-ones from isocyanates and N-(2-bromoallyl)amines
Hannah Morda, (Todd Eckroat) - Penn State Behrend - Chemistry

Based on cascade reactions for the synthesis of thiazole-2(3*H*)-thiones and thiazolidine-2-thiones that have been previously described in the literature, this research is focused on forming 1,3-dihydro-2*H*-imidazol-2-ones, which may have interesting biological activity, by analogous methodology. Initial investigations have shown that 1-butyl-1,3-dihydro-4-methyl-3-phenyl-2*H*-imidazol-2-one can be synthesized by a novel reaction scheme involving *N*-(2-bromoallyl)butylamine reaction with phenylisocyanate catalyzed by CuI in moderate yield. Although there exists the possibility for multiple isomers to form, NMR analysis shows the 1,3-dihydro-2*H*-imidazol-2-one ring as the major product. The optimized reaction time and temperature required to obtain this major product will be reported. Results of screening various copper(I) and copper(II) catalysts and isocyanate substrates will also be reported. The synthetic work presented here could allow for the discovery of unknown reaction pathways involving isocyanates. This work could also provide biochemical and pharmaceutical fields with improved preparation methods for this heterocyclic ring so that its biological activity can be further explored.

06-04. Substituent Position and Bridging Ligand Impact on Ru-Based Bimetallic Complexes
Noah Garrett, Zach Malone, (Avijita Jain) - Indiana University of Pennsylvania - Chemistry

Ruthenium polypyridyl complexes have been shown to photocleave and photo bind with DNA, a unique property of photodynamic therapy agents (PDT). Incorporation of a sterically strained Ru-based chromophore to a cis-PtCl_2 moiety yields complexes capable of covalently binding to DNA upon photoirradiation through Ru(II) chromophore unit along with covalent binding through cisplatin moiety. Herein we will present the design, synthesis, spectroscopic, electrochemical, and photochemical properties of a series of bimetallic complexes, including $[Ru(6-Mebpy)_{2dppPtCl2}]^{2+}$, $[Ru(4,4-Me\_2bpy_{2dppPtCl2}]^{2+}$, and $[Ru(6-Mebpy)_{2dpqPtCl2}]^{2+}$ (where dpp= 2,3-bis(2-pyridyl)pyrazine, dpq = 2,3-bis(2-pyridyl)quinoxaline, 4,4-Me2bpy = 4,4--dimethyl-2,2--bipyradine, and 6Mebpy = 6-methyl-2,2--dipyridyl. The impact of substituent position on terminal ligand and size and structure of bridging ligands on electrochemical and photochemical properties will be discussed.

06-05. Explorations of pharmaceutical syntheses using alkynyliodonium species based on 1H-1-hydroxy-5-methyl-1,2,3-benziodoxathiole 3,3-dioxide towards the preparation of psychoactive benzofurans
Sydney Huntzinger, Muyuan Xie, (Michael Justik) - Penn State Behrend - Chemistry

A myriad of hypervalent iodine reagents is available to the modern synthetic chemist, including Koser's, Togni's, and Zefirov's reagent, as well as the Dess-Martin periodinane. Many of these reagents quickly and effectively carry out functional group transformations, replacing many metal-based oxidation procedures used in the past. However, the reported application of alkenyl- and alkynyliodonium species to prepare pharmaceutically desirable scaffolds has been limited. In the presented research, two benzofuran-based pharmacologically interesting compounds were prepared using congeners of 1H-1-alkynyl-5-methyl-1,2,3-benziodoxathiole 3,3-dioxide in combination with phenoxide nucleophiles. Subsequent routine chain modifications of the products resulted in the preparation of compounds that are known inhibitors of monoamine oxidase.

06-06. Determination of Benzo[a]pyrene (BaP) in asphalt and other coal tar pitch products using Gas Chromatography-Mass Spectrometry (GC-MS)

Sophia Enterline, (Qun Gu) - Edinboro University of Pennsylvania - Chemistry

The aim of this study is to determine Benzo[a]pyrene (BaP) content in various asphalt samples by use of Soxhlet extraction and gas chromatography-mass spectrometry (GC-MS). BaP is listed as a carcinogen by the EPA. Found in many day-to-day products, including, but not limited to, asphalt, coal tar, and even some food products such as cooking oil, BaP has continued to raise concerns among the scientific community over recent years. In this project, various samples of asphalt were collected from four different locations. The samples were ground and a Soxhlet extraction was performed using dichloromethane. These sample solutions were then analyzed via GC-MS using a Rxi®-5Sil MS column. NIST SRM 1991 (a certified standard containing known content of BaP) was also analyzed to validate our method.

06-07. Preparation of alkenyliodonium species based on 1/H/-1-hydroxy-5-methyl-1,2,3-benziodoxathiole 3,3-dioxide and structural study with Gaussian® calculations

Alexander Stone, Windsor Lundy, (Michael Justik) - Penn State Behrend - Chemistry

Alkenyliodonium species are highly labile to nucleophiles and challenging to prepare. Compared to the myriad corresponding alkynyl and aryl iodonium species described in the chemical literature, only several examples can be routinely prepared. In the presented research, we have attempted to prepare a series of alkenyliodonium species based on 1/H/-1-hydroxy-5-methyl-1,2,3-benziodoxathiole 3,3-dioxide (HMBI).   HMBI utilizes an internal counterion, a sulfonate group, towards the iodonium center, which incorporates increased stability into congeners derived from it. The desired alkenyliodonium salts are readily prepared by treating 1/H/-1-alkynyl-5-methyl-1,2,3-benziodoxathiole 3,3-dioxide compounds, previously prepared in our laboratory, with mixtures of carboxylic acids and their carboxylate salts. Given the challenges to research over the past year, our original goal of preparing crystals for study by X-ray diffraction did not come to fruition. We took the opportunity to study the solid-state structures by Gaussian calculations and compared the output structures to known crystal structures of alkenyliodonium compounds in the literature.

ENGINEERING

07-01. Ant Robot using GPS-RTK

Anna Valenti, Matthew Grauff, (Timothy Mohr) - Grove City College – Electrical Engineering/Technology

This work is part of a long-term research project to develop a mobile robot (rover) that uses a video feed to track ants and other insects as they move across a field, recording precise path data as it moves. The work to date has included development of the robot hardware and deployment of a high-resolution GPS-RTK system to track the robot's location to cm-level accuracy. The GPS-RTK system uses a base station with a LoRa radio link to the rover to communicate RTCM position correction data in real-time. This year's work built on this foundation by programming the rover to navigate through a series of user-defined latitude-longitude waypoints while keeping a log of its position every 100 milliseconds. The rover position is communicated via WiFi to a laptop, which displays the position in real-time on a map of the area.

07-02. Exploring Human Trust in Automation

Morgan Hordinski, John Will, (James Brooks) - Grove City College – Electrical Engineering/Technology

With increasing integration of technology and automated systems into people's lives, the problem of how to best incorporate these systems relies heavily on the understanding of the relationship between humans and their trust in these automated systems. In this paper, we will share the early results from a study designed to help controls engineers design automation systems which are trusted. This two-part study focuses first on understanding people's perceptions of automation performance in the context of a virtually simulated overhead crane system to identify the important metrics of trust. The design and preliminary results of the first part of the study will be discussed as well as ways in which previous researchers have studied and measured trust. The focus of the second portion of study will test the hypothesis that humans trust an automated system when the designed dynamic behavior is most like the human's perception of their manual control of the system. The model overhead crane and a corresponding simulation model designed for this study will be discussed along with preliminary automation system implications.

07-03. 3D Printing of Wax for Investment Casting Applications

Ben Fahrney, MollyAnne Lloyd, (Paul Lynch) - Penn State Behrend - Industrial Engineering/Technology

Investment casting (IC) has been a foundational process in the precision metal casting industry since the beginning of its existence. It has allowed foundries to produce highly accurate parts with a desirable surface finish. The significant drawback of IC lies in the cost of the process. Producing the wax mold that will be used to create the negative cavity in a ceramic shell for the metal to be cast is often considered the most costly part of this method of manufacturing. For low volume production, product prototyping, and other applications that involve design changes from part-to-part the tooling process for the fabrication of wax molds becomes incredibly expensive and often makes IC impractical. Direct additive manufacturing (AM) of these wax molds offers a cost-efficient approach to this problem. This style of mold production offers nearly unlimited freedom in design geometry with the added capability to include substantial iterations from part-to-part. The use of AM technologies in combination with commercially available wax filaments and resins has the potential to substantially drop the cost of IC parts across the industry. This project intends to prove the surface finish and dimensional accuracy capabilities of commercial AM machines for commercial use. Proving that these technologies can match the quality of molds produced by traditional wax injection molding processes at a reduced cost is essential to establishing the viability of this process.

07-04. Developing A Maturity Model and Implementation Plan for Industry 4.0

Michael Magnotti, Samantha Melnik, Cameron Butts, (Faisal Aqlan, Carol Putman) - Penn State Behrend - Industrial Engineering/Technology

History has seen three industrial revolutions: mechanization of production, assembly lines for production, and automation of production. However, society is facing a fourth revolution, the digitization of production or Industry 4.0. This new revolution has spawned from companies necessitating a new form of production to meet increased customer demands. Industry 4.0 focuses on increasing productivity and automation. The philosophy of Industry 4.0 is that it takes on a broader meaning as a status achievable by the company or organization. The amount of integration necessary poses a major barrier to entry for small to Midsize companies (SMEs). This research develops a concept relationship map (CRM) for Industry 4.0 that offers a visual depiction of the connection between the main pillars of Industry 4.0. A maturity model (MM) for companies and organizations to assess their readiness towards integrating Industry 4.0, regardless of their business domain or size, is also developed. The utilization of the maturity model allows these professional associations to develop a personalized implementation plan for Industry 4.0, as well as allow SMEs to more readily take the initiative. The implementation of Industry 4.0 will be further envisioned through the simulation of a modern manufacturing floor in RoboDK® software. This visual representation explains the abstract Industry 4.0 more concretely.

07-05. Drone Battery and Structure Optimization

Tanay Raje, Chadwick Kypta, (Adam Hollinger) - Penn State Behrend - Mechanical Engineering/Technology

Package carrying drones can offer various benefits to everyday life such as a more efficient and environmentally friendly delivery system. However, the increase in accessibility of drones to the public also exposed common problems with drone technology: short hover times and easily breakable frames (specifically arms). Most drone designs that are used are powered by lithium polymer batteries and have simple flat rectangular solid arms. Lithium polymer batteries are space-efficient and have a high energy density. However, they are typically heavier and more expensive than their lithium-ion counterparts. Meanwhile, lithium-ion batteries have stronger mechanical properties because of their steel cylindrical shell. Flat and rectangular drone arms do not require additional connecters to mount motors and connect with the body, which can reduce the drone's weight, but they are easily breakable compared to the hollow cylindrical shape arms. In this experiment, we will continue the research started by resolving the complications that prohibited testing and perform the tests. Next, we will replace the rectangular arms with hollow cylindrical arms filled with 18650 batteries to compare the flight times with different payloads. The new structural design is expected to be stronger and will improve the hovering time.

07-06. Thermal Analysis of a Latent Heat Thermal Energy Storage System Enhanced by Annular Fins

Samantha Moretti, Kyle Shank, (Saeed Tiari) - Gannon University - Mechanical Engineering/Technology

Latent heat thermal energy storage (LHTES) has been studied more frequently in recent years due to its potential applications in waste heat recovery and alternative energy systems. LHTES utilizes a phase change material (PCM) that melts and solidifies, which is how the system charges and discharges. The major downfall of LHTES systems is that PCM takes a significant amount of time to charge and discharge. This is because common PCMs have a relatively low thermal conductivity. To increase the efficiency of LHTES systems, heat transfer enhancement techniques are used to make the charging and discharging processes faster. There are a variety of heat transfer enhancement techniques used with LHTES systems. Some of these techniques include heat pipe networks, metallic nanoparticles, porous metallic foams, and metallic fins. The current study uses an experimental apparatus to evaluate the different fin arrangements on the thermal performance of a LHTES unit. The experimental apparatus includes an enclosed cylindrical acrylic tank that contains the PCM. A copper pipe with a diameter of 2.54 cm runs through the center of the tank to allow the heat transfer fluid (HTF) to flow through the apparatus and charge or discharge the PCM. The HTF in this case was water. The tank was filled with Rubitherm RT-55 as the PCM. Two RTDs were inserted at the entrance and exit of the copper pipe to record the temperature of the HTF at these points. 12 k-type thermocouples were then inserted into the PCM to measure the temperature of the PCM over the course of the charging and discharging processes at different locations. A thermal imaging camera was used to take a sequence of thermal images of the LHTES system during the charging and discharging processes. The enhancement offered by the metallic fins has been evaluated experimentally and it was found that the addition of fins significantly decreased the charging and discharging times of the system when compared to the case with no fin.

07-07. Micromechanical Modeling and Optimization of Polymer Composite Bipolar Plates for Fuel Cells

Jonathan Trimpey, (Adam Hollinger[1], Charles Bakis[2]) - Penn State Behrend[1], Penn State University Park[2] - Mechanical Engineering/Technology

Fuel cells that are composed of polymer composite bipolar plates could be a more economical and environmentally sustainable material choice compared to fuel cells with graphite or stainless steel bipolar plates. The investigated composite is an injection molded bipolar plate with a nylon 6,6 matrix and nickel coated carbon fiber filler. A nylon and nickel coated carbon fiber composite is a better alternative to materials currently used due to the composite being lightweight, having better resistance to corrosion than metals, having an increased life span, and being easily recyclable. The composite is an anisotropic material because the fibers primarily align in the direction that composite is injected into the mold. Micromechanical analysis leads to different numerical values for electrical conductivity and elastic modulus depending on direction in the material, fiber alignment, fiber length and diameter, fiber concentration, fiber conductivity, and fiber elastic modulus. Properties of the composite are modeled to see if a nickel coated carbon fiber bipolar plate can be used effectively based on the U.S. Department of Energy (DOE) guidelines. The specific properties modeled are ultimate strain, electrical conductivity, and material cost. The Halpin-Tsai equations are used for modeling the elastic modulus and ultimate strain, and the Fiber Contact Model is used for electrical conductivity. Development of an objective function for optimizing cost, ultimate strain, and conductivity leads to optimal fiber volume percentages of the composite. Conductivity and elastic modulus are found to increase in the injection direction of the composite with higher fiber loadings as well as improved alignment of the fibers. Determining average alignment for the fibers will improve the micromechanical models for different fiber mass fractions.

07-08. Injection-Molding Electrically Conductive Polymers for PEMFCs

Savanna Carr, Greg Schriner, (Adam Hollinger, Brian Young) - Penn State Behrend - Mechanical Engineering/Technology

Hydrogen fuel cells are an up and coming source of clean energy. Fuel cells can be used in many applications from vehicles to buildings, and can even be grid-independent which is an appealing option for critical operations. However, the bipolar plates of fuel cells are primarily made from graphite, which can be costly and difficult to machine due to its brittle properties. An alternative is to use an injection-molded polymer composite that has comparable electric conductivity. Material samples were injection molded with various mixes of Nylon-6,6 and nickel-coated carbon fiber. Different mixes of the materials were produced and the conductivity of the samples was tested to determine if they met the U.S. Department of Energy's technical target of 100 S/cm. The filler dispersion of the samples was analyzed under SEM imaging. By developing such a composite, a more cost-effective substitute for graphite can be used in the mass production of hydrogen fuel cells.

07-09. Universal Design Analysis for Improving the Usability of FFF 3D Printers

Rebecca Grey, (Charlotte de Vries) - Penn State Behrend - Mechanical Engineering/Technology

3D printing has experienced growing popularity with people including engineering professionals, hobbyists, artists, and teachers. In order to accommodate a variety of users, the concept of usability, the effectiveness of a user's interaction with the printer, must be considered. With the customizability of 3D modeling, there is potential for 3D printing to be utilized in the home for various applications. However, physical limitations such as hand strength, ability to stand, and vision pose challenges for some learning this new technology. User focused design efforts such as universal design, i.e. the idea of appealing design for all age groups or abilities, have largely focused on software improvements. Therefore, this research intends to direct attention to operating the physical 3D printer to expand its field of use. The first analysis focused on universal design and identifying physical challenges of the human body as it moves to interact with fused filament fabrication (FFF) 3D printers. A brief thermal analysis was also conducted to identify major burn hazards of FFF technology. Following such background analysis was survey development in order to better summarize consumer needs in major areas of 3D printer troubleshooting. This usability survey was designed to understand difficulties and preferences of 3D printer users to identify where immediate design focus should be placed. After collecting over fifty survey responses, the results present potential benefits beyond this project for other researchers or 3D printer companies to benefit from a better understanding of 3D printer users. As a result, print bed leveling was identified based on Likert scale responses as the major interest area due to both difficulty and frequency of issue occurring. Guidelines, survey results, and print bed leveling design improvements are intended to lead the continuation of research for more user-friendly options that broaden the possibilities of consumer 3D printing.

ENVIRONMENTAL SCIENCE

08-01. Environmental and economic analysis of high pressure sodium to light-emitting diode streetlight conversion in Meadville, PA

Aaron Chisholm, Mary Allen, (Matt Carter) - Allegheny College – Environmental Science

Growing concern about climate change over the last several decades has led to efforts at the local, state, and national levels to improve efficiency in electric power consumption. Street lighting is one area where electric power consumption can be minimized, while substantially reducing costs. Many cities throughout the United States rely on inefficient mercury vapor or high pressure sodium (HPS) light fixtures. Technological improvements in light emitting diode (LED) fixtures have led to improved energy efficiency, decreased cost, and have demonstrably improved safety by improving light quality over the lifespan of the fixture. The City of Meadville currently has 941 high-pressure sodium (HPS) fixtures that provide their street lighting needs. Utilizing the costs of the current electric bill and the City's light inventory for the HPS fixtures, it was calculated that switching all of the 941 HPS to LED fixtures could save Meadville ~ 350,000 kWh and ~ $10,500 annually. By converting to LED, it was determined that the annual carbon emissions could be reduced by 135,700 kg CO_2, assuming fossil fuel electric power of the Pennsylvania grid is composed of 14% coal and 48% natural gas, with efficiencies of 32% and 35%, and thermal energy CO_2 emissions of 90 kg CO_2/GJ and 50 kg CO_2/GJ, respectively. Meadville does not own their street lights, and while the utility company is willing to convert 24 fixtures to LED per request, the City would need to pay depreciation costs (approximately $110,000 total) associated with the 232 HPS fixtures younger than 20 years old. Preliminary results indicate the two best options for Meadville is to either (1) convert the HPS fixtures that have no upfront fees and use the savings to convert the HPS fixtures with fees, or (2) negotiate with the utility a wholesale conversion of all HPS fixtures to LED. By converting to LED, Meadville can save thousands of dollars per year, reduce carbon emissions, and provide safer, brighter streets.

08-02. ICP-MS Analysis of Otoliths of Bluegill (*Lepomis macrochirus*), Pumpkinseed (*Lepomis gibbosus*) and Round Goby (*Neogobius melanostomus*) from Presque Isle Bay

Cameron Robinson, Ryan Garich, (Greg Andraso) - Gannon University – Environmental Science

Otoliths are calcified structures of the inner ear that aid fish in maintaining equilibrium and hearing. Like soft tissues, otoliths accumulate metals that fish are exposed to in their environment, typically through trophic transfer and absorption through the gills or skin. However, compared to soft tissues, otoliths tend to retain these elements better once they are deposited and therefore provide insight into their accumulation throughout the fish's life. Sediment studies on Presque Isle Bay (PIB) have identified numerous chemicals of potential concern (COPCs) that exceed published sediment quality guidelines (SQGs). COPCs include the metals barium (Ba), cadmium (Cd), Nickel (Ni) and lead (Pb) as well as the metalloid arsenic (As). Quantifying those COPCs within fish otoliths may therefore provide insight into their cycling in PIB. To date, we have analyzed otoliths of bluegill (*Lepomis macrochirus*), pumpkinseed (*Lepomis gibbosus*), and round goby (*Neogobius melanostomus*) collected from several sites in PIB. Methodology involves removal of surface contaminants from otoliths with dilute nitric acid, dissolving otoliths with concentrated nitric acid, and elemental analysis by inductively coupled plasma mass spectrometry (ICP-MS) conducted at Penn State Behrend. Methods to date have focused on diluting samples to maximize sensitivity while retaining the ability to detect COPCs at low concentrations as well as reducing external contamination.

08-03. The role of biodegradation and photodegradation in wetland environments with high dissolved organic carbon concentrations

Emily Pepple, Amelia Beaumont, (Chris Dempsey) - Gannon University – Environmental Science

Dissolved organic carbon (DOC) has many roles in our freshwater ecosystems and the global carbon cycle. Bacteria utilize DOC as an energy source and significant concentrations of DOC are transported, stored, or exported from aquatic ecosystems each year. DOC is capable of being biodegraded (i.e. bacteria) or photodegraded by ultraviolet and visible light. Few studies have focused on these two processes (biodegradation and photodegradation) in wetland ecosystems. We collected surface water from two wetlands in northwestern Pennsylvania with high concentrations of DOC. Our goal was to assess the impacts of photodegradation, biodegradation, and a combined photo/bio treatment to changes in DOC concentration and quality. The above treatments were prepared in Whirlpak bags for each wetland and kept in a temperature-controlled chamber for 21 days. Biodegradation treatments were kept in the dark, photodegradation treatments were exposed to ultraviolet (UV) light in a 14 hour on, 10 hour off cycle, and photo/bio treatments were inoculated with bacteria and then exposed to UV light. Our results indicated that photodegradation and biodegradation treatments did not cause large changes in DOC concentration, but we did observe changes in DOC quality. Exposing treatments to both photodegradation and biodegradation combined did not cause more changes than photodegradation only treatments.

08-04. Pre-restoration summary of organic matter content in Little Arnot Creek, Allegheny National Forest

Amelia Beaumont, Emily Pepple, (Chris Dempsey[1], Luke Bobnar[2], Chuck Keeports[3], Ben Hayes[4]) - Gannon University[1], Western Pennsylvania Conservancy[2], United States Forest Service[3], Bucknell University[4] – Environmental Science

Many small streams in Pennsylvania have become incised due to human activity. This channel deepening has led to a myriad of issues including stream bank erosion and increased discharge during storm events. Headwater streams serve as a critical link between terrestrial and downstream ecosystems in transporting organic material. Both dissolved (DOC) and particulate organic carbon (POC) play a role in the global carbon cycle and serve as an energy source for aquatic heterotrophic bacteria. In the Allegheny National Forest, we are implementing adaptive management strategies on Little Arnot Creek to document changes in organic material. These improvements include the placement of whole trees (with canopy and rootwad), as well as logs in the stream and floodplain. Restoration work is scheduled to begin in the summer of 2021. The goals of the project are to slow the movement of water, raise the water table, disperse more water onto the floodplain, and to increase the storage capacity of organic material within the watershed. We have collected replicate water samples monthly since September 2019 to assess baseline conditions of DOC and POC concentration and DOC quality (absorbance and fluorescence). Water samples are collected by hand at six permanent stations on Little Arnot Creek. We also collect water from a two stations within Cherry Run (control stream). Preliminary data suggests the DOC concentration and quality vary seasonally and that POC concentrations are low.

08-05. Uptake and Toxicity of Palladium to the Common Oyster Mushroom (*Pleurotus ostreatus*)

Savanna David, Alaina Wyckoff, Riley Crissman Lydia McCaleb, Sydnee White, Shannon Steves, (Deborah Aruguete) - Penn State Behrend – Environmental Science

Environmental levels of platinum group elements (PGEs) have been rising in large part due to increasing global ownership of vehicles with PGE-based catalytic converters containing palladium (Pd), platinum (Pt) and rhodium (Rh). Palladium is of particular interest for environmental toxicology as it is more reactive than Pt or Rh, as well as being the dominant PGE in catalytic converters for gasoline (petrol) - fueled vehicles. The effects of PGEs, including Pd, upon fungi are poorly understood, in spite of their importance in terrestrial ecosystems. Therefore, we investigated the effects of palladium (Pd) upon the ubiquitous wood-decomposing fungus known as the oyster mushroom (*Pleurotus ostreatus*). *P. ostreatus* was cultured in potato dextrose broth with Pd (as sodium or potassium tetrachloropalladate, (Na_2PdCl_4 or K_2PdCl_4) at concentrations from 0 ppm - 200 ppm Pd. Dry fungal biomass was collected and weighed. Elemental analysis of dry biomass and post-culture broth was obtained using inductively coupled plasma mass spectrometry (ICP-MS). Preliminary data shows fungal growth is fully inhibited at 200 ppm Pd. Pd concentration in tissue increases with concentration of Pd in broth. Precipitation of Pd-containing solids in abiotic broth occurs, indicating that the chemical effects of the broth may impact Pd bioaccessibility. Results may have implications for the impact of Pd and possibly other PGEs on forest fungi.

08-06. Effects of Chinese Mystery Snail (*Cipangopaludina chinensis*) Age on Exploratory Behavior

Phoebe Will, Maille Larmon, Jessie Johnson, Kelsey Foley, (Lynne Beaty) - Penn State Behrend - Ecology

Invasive species can be found worldwide in many different habitats. Oftentimes these invasive species have adverse effects on native species and the surrounding ecosystem. One such species that has been thriving throughout water bodies in North America is the Chinese Mystery Snail (*Cipangopaludina chinensis).* They have been able to grow to very large and disruptive densities due to ideal conditions in North America as well as lower infection rates of a parasite that usually controls their populations in their native habitat of Asia. Chinese Mystery Snails (CMS) have also made an impact locally in Erie, Pennsylvania. Unfortunately, they have made their way into Presque Isle Bay. CMS greatly disrupt the aquatic food web because of their high densities and contribute to native snail population decline. Due to their high impact on local ecosystems, it's important to study their behavior to know how they might spread, how they might affect native species behavior, and how they can best be controlled. One aspect that may contribute to behavior is the age of the snails. This study aims to determine the effect of CMS age on exploratory behavior. It's important to know how active different ages of snails are and how much they will explore a new environment as this influences how different ages of snails will be distributed within an area. We will observe a total of 60 snails over a two week period. The age of the snails will be determined by size and each snail will be categorized as juvenile, adult, or elderly with 20 snails per group. Their exploratory behavior will be quantified by what percent of the bin area they explore within a set amount of time. All snails will be observed during the same time of day to eliminate confounding factors. We predict that juvenile snails will explore the most area compared to adult or elderly snails. It is currently unknown how the age of CMS affects their exploratory behavior, and we aim to fill this knowledge gap to aid with this study.

08-07. Monitoring Water Quality During Lowellville Dam Removal

Alyssa Armstrong, (Felicia Armstrong) - Youngstown State University – Environmental Science

The Mahoning River is located in Northeast Ohio and extends into Pennsylvania before joining with the Shenango River. For most of the twentieth century the lower reach of the Mahoning River supported steel and coke industries as well as received untreated domestic sewage. Heavy metals, PCBs and PAHs were all deposited in the Mahoning River during that time (Mann et al.2013). There are 15 dams along the Mahoning River that were once used to pool water for cooling industrial processes. The legacy contaminated sediments have accumulated behind the dams which could be released during dam removal. Therefore, dredging is needed prior to dam removal to prevent the contaminants from being released and spreading downstream (US ACOE, 2006). Currently there are plans to remove nine of the low head dams to promote ecological restoration and provide better access to recreational activities. The Lowellville dam is located close to the Pennsylvania border and is the first dam removed on the Mahoning River. Prior to removal, 10,000 cubic yards of sediment were dredged covering 1.2 miles upstream of the dam. Water was sampled prior to dam removal and during deconstruction of the dam. Analysis of the water focused on heavy metals, suspended sediment, and phosphorus to determine how dredging and removal effects transport. Results showed that only when there was a precipitation event did sediments increase downstream of the dam. Furthermore, other water parameters did not seem to be significantly affected by dam removal. Overall the dredging and the systematic removal of the dam did not adversely effect water quality downstream.

EPIDEMIOLOGY & PUBLIC HEALTH

09-01. Epidemiological Study of the Effectiveness of the Safe and Dignified Burial Practices for Ebola Virus Disease in Guinea during the 2013-2016 West African Outbreak of the Zaire Strain

David Roach, (Becky Dawson, Steven Farrelly-Jackson) - Allegheny College - Epidemiology

The West African country of Guinea is currently facing the first outbreak of the Zaire strain of Ebola Virus Disease (EVD) since the West African Outbreak of 2013-2016. It is known that the best way to prevent EVD from occurring is having a robust surveillance system in place, yet when this fails, the recommended course of action is to implement a public health intervention aimed at stopping community transmission at super spreader events such as funerals. In 2014 the World Health Organization (WHO) implemented a guide for performing a safe and dignified burial (SDBP) for someone who was suspected to have died from EVD , claiming that over 60% of new cases and deaths in Guinea were associated with exposure during funeral rights. The goal of my research was to analyze the associations between the SDBP in West Africa and the incidence and case mortality rates of EVD Zaire in Guinea. Incidence rate was defined as the frequency of new cases of EVD during a time period, and case mortality rate was defined as the frequency of deaths associated with EVD during a time period. To test the hypothesis that the implementation of the SDBP reduces the incidence and case mortality rates of EVD, an epidemiological study was conducted on publicly available data regarding incidence and case mortality from the countries where the outbreak was centered. The study population was defined as individuals in Guinea who were classified as having a suspected, probable or confirmed case of EVD Zaire and/or died from EVD Zaire before August, 2014 as well as after January, 2015 representing my range of interest on either side of the implementation date of October 1st. Results were analyzed using chi-squared tests and multivariable linear regression. The results showed that in Guinea there was actually an increase in the incidence and case mortality rates following the implementation of the SDBP.

09-02. Tackling two Pandemics: The Relationship Between COVID-19 and Tuberculosis and its Effects on Communities Worldwide

Taylor Roberts, Olivia Wirfel, (Prasad Dalvi, Gary Vanderlaan, Matthew Gacura) - Gannon University – Epidemiology & Public Health

The recent outbreak of COVID-19 (SARS-CoV-2) has extremely negatively impacted lives of people world-wide. The virus caused tremendous medical and social problems to communities around the globe. While the burden on communities is still growing every day, there is one aspect that has remained neglected during this COVID-19 global pandemic and that is the already existing Tuberculosis (TB) pandemic. There has been a consistent TB spread occurring that began much before COVID-19 and is only getting magnified by the latest coronavirus pandemic. This article will demonstrate the ways that the recent COVID-19 pandemic has intensified and prolonged the underlying TB pandemic. Both COVID-19 and TB target the respiratory system, and if the conditions are contracted simultaneously it creates a heightened likelihood of severe health concerns. The close-quarters and stagnant lifestyle that COVID-19 has pressed upon many communities generates a breeding ground for both infections. There has also been an impact on the ability of those with TB to seek treatment, both physically and emotionally. At present, it appears that there is no effective vaccine against TB whereas effective COVID-19 vaccines have been approved. This review touches on the epidemiological background of both TB and COVID-19, their known methods of pathogenesis, co-infection of TB and COVID-19, measures of prevention, diagnosis, and possible treatments of both infections, current and ongoing research on vaccination for both infections, and finally, we discuss the ways in which the COVID-19 pandemic has heightened the TB epidemic and possible ways to combat the social synergism of these two strikingly similar infections.

09-03. Tobacco smoking: a potential risk factor for COVID-19 complications

Mughiara Qadeer, Julia Del Ponte, (Prasad Dalvi, Gary Vanderlaan, Matthew Gacura) - Gannon University – Epidemiology & Public Health

Coronavirus Disease 2019 (COVID-19) is caused by a newly discovered coronavirus 2 (SARS-CoV-2) that has been shown to affect and cause illness in animals and humans. COVID-19 was first discovered in Wuhan, China, but now has spread throughout the world causing a global pandemic. As of now, COVID-19 has greatly impacted the world with over 110 million confirmed cases and 2.5 million deaths. COVID-19 causes a severe acute respiratory syndrome, and currently, there is no effective treatment for COVID-19, however many scientists and researchers are still experimenting to search for effective treatment and an effective vaccine against newly discovered several mutant variants of COVID-19. Currently, the only prevention of transmission is by wearing masks, maintaining a social distance of about 6 feet, and following hygiene measures. Researchers have observed that the smokers are at a greater risk for contracting COVID-19, and also found a strong connection of increased COVID-19 complications and increased mortality rate among smokers infected with COVID-19. Smoking cigarettes, vaping, or consuming any other products containing nicotine are considered risk factors for developing complications following COVID-19 infection. Currently, tobacco smoking and nicotine addiction cause nearly 7 million deaths each year worldwide, and COVID-19 infection has been found to further increase mortality among smokers worldwide. This review primarily focuses on increased susceptibility of COVID-19 infection, complications and mortality among tobacco users and smokers. Also, this review discusses pathogenesis of COVID-19 in smokers and measures of prevention of COVID-19 infection and complications among the smoker population.

09-04. Factors Influencing COVID-19 Spread on a University Campus Setting: Insights from an Epidemiologic and Metagenomic Surveillance Analysis

Austin Hertel, Madison Heeter Mara Bestram, Olivia Wirfel (Steven Mauro) - Gannon University - Microbiology

COVID-19 has negatively impacted nearly every industry in some manner, and higher education is no exception. Nearly every institution of higher learning has issued responses to mitigate the spread of the virus to its campus community. These methods include but are not limited to wellness surveys, temperature checks, antibody or PCR based surveillance testing, contact tracing, and isolation/quarantine protocols. Gannon University, located in Erie, PA., was one of the first institutions to develop their own in-house PCR based COVID-19 testing programs. In the past year, we have tested over 19,000 samples in this surveillance program, which has been instrumental in allowing Gannon to continue to offer in-person classes throughout both the fall, 2020 and spring, 2021 semesters. It has also been a vital part of continuing athletic competition for the majority of sports offered on campus. This study presents results of our rapid COVID-19 PCR surveillance program in a university-wide setting during the 2020-2021 academic year. Our results indicate a low overall rate of infectivity across campus, most of which were asymptomatic and were at rates below the reported regional averages. However, certain athletic teams, geographic areas, and size of social gatherings were risk factors that contributed to the spread of COVID-19. This suggests individual practices, not institutional safety procedures, drive COVID-19 presence within campus populations. To understand how localized microbial populations might contribute to or be impacted by COVID-19 infection, we also conducted a nasal and fecal bacterial metagenomic study and viral qPCR analysis of COVID-19 infected individuals. These results coupled with our characterization of routes of COVID-19 exposure reveal insights that can be used for the development of risk aversion strategies that can be applied to other higher education institutions and industrial workplaces.

09-05. Examining Putative Mantel Correlations Between Granular COVID-19 Burden and Election Polling Data, Jan-Oct 2020

Julia Danko, Taylor Roberts Mughiara Qadeer, Allison Ahl, (Gary Vanderlaan, Prasad Dalvi, Matt Gacura) - Gannon University - Microbiology

It is well established that war, famine, and disease are tumultuous forces that have driven great changes in a nation's history. Here we seek to measure the cost of the COVID-19 pandemic as reflected in the public perception of elected U.S. officials at all levels of government, with a particular emphasis on incumbent leaders. Using the R-programming language, we plan to perform Mantel Tests to examine if any correlations exist between elevated COVID-19 burden as measured via morbidity & mortality datasets to that of meta-polling data regarding all gubernatorial, house, senate, and presidential races. Our data structure comprises a total of 266 consecutive days of COVID-19 morbidity and mortality in the year 2020 extracted from public-use databases made available from the Centers of Disease Control (CDC). Likewise, our polling data is an aggregate dataset derived from a total of 435 governor-level, 784 House-level, 1,873 Senator-level, and 11,282 presidential-level polling results for the same ten-month timeframe across the country. For all contested races, we seek to test a null hypothesis in which an elevated COVID-19 burden is inversely related to incumbent poll approvals in the sampled window.

HUMANITIES

10-01. Analyzing the Artifacts from the 2019 Mercyhurst University Field School at Jackson Farmstead, Spring Creek, PA

Skylar Secord, (LisaMarie Malischke) - Mercyhurst University - Anthropology

The purpose of my research is to analyze and describe the artifactual material from the 2019 Mercyhurst University field school at Jackson Farmstead, Spring Creek, Warren County, Pennsylvania. Official archaeological investigations of the Jackson Farmstead in 2018 involved the Mercyhurst University Department of Anthropology/Archaeology in conjunction with the Robert H. Jackson Center of Jamestown, New York. This research aims to understand farmstead archaeology as a subdiscipline of historical archaeology, to investigate 19th-and 20th-century historical artifacts and methods for analysis, explore local farm craft industries, and explain and review previous work performed at Jackson Farmstead. A wide range of 19th-century and 20th-century artifacts were recorded and categorized by researchers utilizing various methods. The Jackson Farmstead, named for original owners and ancestors of U.S. Supreme Court Justice Robert H. Jackson, is located in rural northwestern Pennsylvania. The goal of this research is to provide a detailed artifact analysis of the current collection to supplement the ongoing archaeological investigation. The collection of artifacts will be consolidated and curated into archival-quality containers with accompanying paper tags. This consolidation includes the creation of a digital catalog recording artifacts and associated data. Following Pennsylvania Historic and Museum Commission guidelines and several identification handbooks, all artifacts were separated by type and subtype and analyzed in detail for unique characteristics. This raw data will be examined through the creation of tables, charts, and maps to compare artifact type and location within the site, and overall collection interpretations will be made as the final product.

10-02. Feminist Reading of Multi-Ethnic Literature

Jessica Belousov, (Matthew Darling) - Gannon University – English/Literature

In this paper, I use a feminist lens to examine and critique The Color Purple by Alice Walker, The Woman Warrior by Maxine Hong Kingston, and Bless Me, Ultima, by Rudolfo Anaya. Such examples of multi-ethnic literature demonstrate the complexities of the lives of women and how they are portrayed within a society "and a literary tradition" that is predominantly white and patriarchal. The Color Purple and The Woman Warrior both feature female characters who find strength within their heritage but also learn to be strong by their own definitions regardless of background. Written by women, these texts offer empowering views of women characters. Bless Me, Ultima is different in that it is written by a male author and demonstrates some shortcomings of the male perspective on female characters; these shortcomings are found primarily through the characters of Ultima, a curandera who assists the male protagonist's journey to overcome evil, and the protagonist's mother.

10-03. Found in Translation: Our War of the Worlds

Peter Korman, (William Covey) - Slippery Rock University of Pennsylvania – Film & Media Studies

H. G. Wells' *The War of the Worlds* is one of the most important pieces of science-fiction in the English language. What's gets ignored by some in the century since it released was how overtly political it was, and the messaging Wells was trying to convey to his British readers on colonialism and imperialism. Following the most recent major adaptation of the novel, a 2019 television miniseries on the BBC that loosely adapted the novel to make contemporary social commentary on, a discussion began around the perceived "place" for contemporary politics in this kind of story. This is puzzling for two reasons: firstly, Wells directly references a multitude of Britain's atrocities and compares the Martians to the British in the novel's first chapter. Secondly, there are a number of beloved adaptations that are just as political as the novel, none of which generate much uproar. The infamous 1938 radio broadcast is an effective, chilling reflection of a nation helplessly watching the world slowly descend into a horrifically destructive conflict, and features biting commentary on the rise of fascism in the western world. The 1953 film portrays the Martian invaders, essentially, as a godless Communist threat that many Americans feared. The Jeff Wayne concept album paints an existentialist picture of a post-Vietnam America through a perspective closer to the novel. The 2005 film gives shape to the collective trauma many experienced directly following 9/11, focusing more on the feeling following the attack than the attackers themselves. The adaptations that resonate the most with us are the ones that, in their own ways, directly take on whatever the world is collectively feeling in the moment they came to be. /The War of the Worlds/ is a story that's been kept relevant by the ways it is used to explore our own world, and the only way it will remain relevant is if we continue to examine our society through this familiar narrative.

10-04. The Forgotten Labor: How Brexit will Impact Immigrant Communities in the United Kingdom

Marissa Litzenberg, (Dr. Amy Carney, Dr. Lena Surzhko Harned) - Penn State Behrend - History

This research will be a thorough examination of Brexit, its context, and its potential impact. Specifically, the impact on immigrant communities and the role immigration law has had on British culture and politics, and vice versa. This work will firmly place the European Union and the Brexit situation in an accessible and salient position, that takes into account the most recent developments of the Brexit story. Focusing on primary sources, this work will examine a timeline of immigration law and sentiments, squarely landing on Brexit and forecasting its implications both globally and domestically.

10-05. How Robin Frohardt Examines the Strangeness of Everyday Life

Jane Grabowski, (Beth Watkins) - Allegheny College - Theater

Robin Frohardt is an artist and puppeteer whose professional career traces back to about 2005. She is well known for her pieces The Pigeoning and Plastic Bag Store, and her work is generally regarded as humorous, imaginative, and of excellent craftsmanship, with an emphasis on environmentalism. I aimed to discover the worldview Frohardt's work encourages by analyzing common threads throughout the pieces on her public portfolio. These commonalities include worldbuilding and the use of recycled materials. I found that she blurs the line between performance and reality through audience interaction and extrapolates the bizarre from the mundane through her unconventional mediums, therefore bringing the wonder of art into everyday life and opening a non-judgemental conversation about pollution.

10-06. Handspring Puppet Company: How "Autistic" Audiences and Authentic Movement Are Shaping the Puppet Theater Industry

Kimberlyn Rybak, (Beth Watkins) - Allegheny College - Theater

Handspring Puppet Company is a South African performing group founded in 1981. Initially focused on creating puppetry for children and touring local schools, by 1985 the company was revolutionizing puppet theater in South Africa. They began producing works for adults that contained visible puppeteers, rough-hewn South African style puppets, and blatant political commentary that combated the colonialist undertones and racial tensions plaguing South Africa at the time. They then began a series of collaborations with other artists and companies working in the realm of adult theater and soon found their specialty in creating lifelike and expressive animal puppets: everything from a crocodile handbag with snout and tail to the life-size, rideable horses that starred in the world-famous stage adaptation of Michael Morpurgo's War Horse. With their newfound interest in non-humanoid puppets, Handspring's directors had to reexamine their approach to their work in order to breathe life into creatures that were not only inanimate, but sometimes unable to communicate in human speech. In doing so they discovered methods of thinking originated by Temple Grandin and her research into the correlation between the autistic and animal minds. Based on her reasoning, Handspring began treating their audience as pseudo-autistic: while still maintaining their links to cultural roots and art styles, they strove to create a style of puppetry that relies on an audience's innate and often untapped hyper-awareness to breath and movement onstage and the meaning that is subconsciously attributed to it. This research into Handspring's history and methods is intended to draw attention to a means of cultural and dramatic communication that relies not solely on the spoken word, but on a unique interpretation of the physically performative aspect of puppetry that makes it such a complex professional art form.

10-07. "The Dreamers, The Doers, and Me": Jim Henson's Innovative Optimism

Sydney Emerson, (Beth Watkins) - Allegheny College – Theatre/Communication Arts

There is a paradigm in modern society that perpetually pits two groups of people against one another: the dreamers and the doers. Often, the dreamers are pitied as fools, while the so-called doers are praised for their dedication and success. Remembered as one of the most powerful creatives of the twentieth century, Jim Henson was a paradoxical balance of opposites - both a dreamer and a doer. Throughout his career, he carefully reconciled his desire to spread a positive message and have fun while doing so with his awareness of the dog-eat-dog world of film and television, ultimately carving out an entirely unique niche as an entertainer. Muppet performances, which frequently combined the order of high-quality craftsmanship and excellent production value with the zany disordered madness of the actual script, existed in the state of paradox - a state which is necessary for nonsense to exist. Historically a response to a culture obsessed with order and reason, nonsense is meant to challenge social norms and rules in a more digestible package, such as rhymes, fantastical stories, or comedy. Nonsense utilizes paradox to disguise these important messages in easily accepted forms. The Muppets exemplify this idea, their important messages being Henson's optimistic ideals of world peace, acceptance, and diversity and their acceptable format being puppetry - colorful, loud, chaotic puppetry - which can appear at first glance to be nothing more than children's entertainment. The Muppets' nonsense was acknowledged and consumed on a wider stage than perhaps any other popular nonsensical work, owing to Henson's business acumen, spreading his philosophy of harmony and kindness far and wide. Works such as The Muppet Show and The Muppet Movie combine this strong moral philosophy and countless innovations in the field of puppetry - the work of an optimist and dreamer - with the high entertainment value necessary to stay afloat in the television business - the pragmatic foresight of a doer.

PHYSICS, MATHEMATICS, ECONOMICS, & COMPUTER SCIENCE

11-01. Star in A Jar
Paige Morris, (Sheldon Bailey) - *Edinboro University - Physics*

Sonoluminescence, as the name suggests, is the conversion of sound into light. This phenomenon is relatively popular with applications in numerous scientific fields. Sonoluminescence occurs in a wide variety of settings. Biologically, it is used as the mechanism to stun the prey of mantis and pistol shrimp. Chemically, sonochemistry uses the phenomena to alter chemical reactions along with additional ultrasound mechanisms. The two forms of this phenomenon are single bubble sonoluminescence (SBSL), and multi-bubble sonoluminescence (MBSL). SBSL is examined in this study. The step of producing cavitation, the formation of the vapor phase within a liquid, occurs when water is subjected to a reduction of pressure. Acoustic standing waves are utilized to capture and alter the dynamics of the trapped gas bubble in a solution, inducing the collapse of the bubble, producing emission of light. Several theories of light emission exist, including the cold gas theory wherein the stage of collapse, the electric field threshold accedes the threshold of the electric break down of water. Mobile electrons are then generated due to thermal ionization. The effect of having hot electrons in a cold solution drives the high energy transition between excited states and in turn provides an optical window by ultraviolet light flashes are produced between states. Of particular interest is the manipulation of sodium saturation and, or the addition of Nobel gases in a concentrated solution and the effect on light emission. Previous work has indicated a correlation between lower solution temperature and light emission. In this study, experimental design and setup are explored as well as successful bubble trapping via acoustic levitation. Successful light emission and the effect of dissolved gases in and alkalinity of the solution on bubble dynamics are discussed as well as future spectroscopic work on the emitted light.

11-02. Weakly Precedence-Constrained Traveling Salesman Problem
Camryn Grey, (Richard Ligo) - Gannon University - Mathematics

The Traveling Salesman Problem (TSP) is a well-studied problem in graph theory. The traditional TSP requests the optimal route for visiting every node in a network. We examine a variation of the TSP, called the Weakly Precedence-Constrained Traveling Salesman Problem (WPCTSP), in which one or more nodes possesses a "multiplier." A multiplier of m scales by 1/m the weights of all edges traversed after it. We show that methods of solving the traditional TSP are ineffective for this variation, investigate optimal routes for these networks, and classify them accordingly. Identical networks with different multipliers are of particular interest. We present examples illustrating notable results and several applications.

11-03. Linear Programming, Zero-Forcing, and Maximally Diverse Optima
Jakob Loedding, (Thomas Cameron) - Penn State Behrend - Mathematics

This research develops an integer programming model for studying the diversity of zero-forcing sets of a simple graph. Zero-forcing is a coloring game on a graph. Given a graph *G*, an initial set of vertices is colored blue while the remaining vertices are colored white. An iterative color change rule where a blue vertex *b* will force a white vertex *w* blue if and only if *w* is the only white vertex in the neighborhood of *b* is then applied. The zero-forcing set of a graph *G* is defined as an initial set of blue vertices in which the remaining white vertices are forced blue after some number of iterations of the color change rule. The cardinality of the smallest zero-forcing set of *G* is called the zero-forcing number of *G*. This project will build upon preexisting integer programming models that investigate the zero-forcing sets of a simple graph. In this presentation, we will discuss such models and our modifications including the addition of diversity constraints and parameters. Thus, allowing us to compute two optimally diverse zero-forcing sets of a simple graph. Additionally, this model allows us to study the diversity of zero-forcing sets without computing all optima, which is often impractical due to the large number of optimal solutions for the given integer program. Our modified model will be implemented using CPLEX optimization in Python and various examples analyzing simple graphs will be provided.

11-04. Application of Artificial Neural Network in Weather Forecasting
Vu Truong, (Nguyet (Moon) Nguyen) - Youngstown State University - Mathematics

Machine Learning has been applied in predictive work including predicting and forecasting weather. Artificial Neural Network (ANN) is the key feature that stands behind this architecture. In this presentation, we will have a descriptive observation on what this model consists of and how its components come together. We will also have a look at how this model is applied in forecasting temperatures and compare results with those of other models.

11-05. Gamma Function Expansion
Patricia Brotherson, Trevor Johnson, (Jennifer Ulrich) - Penn State Behrend - Mathematics

Through our studies in statistics we were introduced to the gamma distribution which, as the name implies, uses the gamma function and the incomplete gamma function to model the distribution. We were intrigued when we learned that the gamma function is not only used in statistics but has a plethora of uses and applications. It is applicable in combinatorics, as it is an extension of the factorial function. It can be used to find the factorial of fractions, negative, and complex numbers; these applications were first introduced by Euler. The gamma function is also used in Stirling's Formula to calculate approximations of factorials and finding limits involving factorials. We recognized the close relation of the factorial and the gamma function in STAT 301, when we were introduced to three important properties of the gamma function, one of which being that $\Gamma(n) = (n-1)!$. This function is a naturally recursive function that can only be used when n is a natural number thus limiting its domain. There are also applications within differential equations of the gamma function. The function can be used with Laplace transforms; applications of this include finding exponential decay in time or space. There is still much to explore regarding the gamma function. Through our research we were able to investigate how the gamma function can be used to find infinite products. Some infinite products converge to a single value, while others do not. Our plan is to build on our existing research to find a more general form of our previous series expansion. We have found a series expansion approximation of the gamma function which allows us to approximate the factorials of fractions

of the form 1 divided by x, where x is any integer. We'd like to continue our work to find an approximation which allows for any fraction of the form a divided by b, where a and b are integers.

11-06. To what extent is the Venezuelan Economic Crisis affecting the United States?

Laura Gil, (Kenneth Louie) - Penn State Behrend - Economics

In the 21st century, a country's economic performance is no longer just the result of its own domestic decisions. Instead, a nation's economy can be affected, directly and indirectly, by events in other countries around the globe. Therefore, this project will focus on the research problem of assessing the degree and impact of economic interdependence between countries, using the relationship between the United States and Venezuela as a specific case study. The goal of this project is to analyze the commercial ties and mutual economic interdependence that have existed historically between the U.S. and Venezuela, as well as to explore the degree to which the current Venezuelan economic crisis will affect this interdependence in the future. Research into this issue is significant because it allows us to understand how international events can have profound economic consequences and potentially create disruptions to long standing commercial linkages that may have been mutually beneficial in the past. The outcomes from this research project include a detailed analysis of the U.S.-Venezuela economic relationship as well as an assessment of the likely nature of this relationship in the future, especially in light of the ongoing economic crisis in Venezuela.

11-07. LionHELP

Sarah Lengel, Mikayla Mulford, Collin Tice, (Thomas Rossi) - Penn State Behrend – Computer Science/Software Engineering

Mental health is significant to the lives of college students, and when it goes awry, a dangerous situation can result. Thus, the key focus of our research is to provide a resource to Penn State Behrend students to help them recognize signs of mental distress in themselves and their peers, and guide them to properly respond. This resource will be a mobile application called LionHELP. It will be based off the Red Folder, which is a document that is meant to help faculty recognize when a student is showing signs of mental instability and guide them with managing the situation. We assert that if Penn State Behrend students have a mobile application that replicates the concepts of the Red Folder, they will become educated on mental health issues and the appropriate responses to them. LionHELP's main functionalities are expected to teach students to recognize mental health problems in themselves and others, give advice on what actions to take in response, and give them a list of available resources nearby. LionHELP is not a diagnostic tool nor a medical device, and will not require FDA review. The anticipated outcome of our research is to find the best way to deliver information about mental health to a mass audience, as well as help more Behrend students obtain the mental help that they need. Hopefully, our efforts will help future researchers build from our findings and address widespread mental health issues in other populations.

11-08. WheelsFX: an Introductory Tool for Java Based Graphical Programming

Mackenzie H. Sloan, Ryan J. Pape, (Thomas Rossi) - Penn State Behrend – Computer Science/Software Engineering

The goal of this research is to create and implement a package deemed WheelsFX that will enhance the students learning experience and relevance of a mandatory Computer Science course, CMPSC221. This will be done by replacing the outdated package, wheels.unh, that is based on AWT and Swing, with WheelsFX that is based on JavaFX. AWT and Swing are Oracle's outdated Java graphical frameworks. Oracle has transitioned to replace these frameworks with a more powerful and user-friendly framework, JavaFX. The current function of wheels.unh in CMPSC221 is as an introductory tool for graphical programming. Consequently, its replacement should maintain the same ease of use to aid students' learning that are not familiar with Java programming. To accomplish this goal, we need to have sound comprehension concerning the source code of wheels.unh. Since wheels.unh is based on the frameworks AWT and Swing, sufficient research will need to be done to understand the underlying syntax of these to ensure a seamless migration. Additionally, the same diligent research will need to be upheld to understand JavaFX conventions for implementation. Furthermore, detailed planning, testing, and debugging are required so that WheelsFX can be incorporated into CMPSC221s curriculum, including labs and homework, dependably, effectively, and coherently.

11-09. Zero-Forcing and Zero-Forcing Number Algorithm: Genetic Algorithm

Aymen Saidi, (Thomas Cameron) - Penn State Behrend – Computer Science/Software Engineering

Zero-forcing is a coloring game on a graph, where an initial set of colored vertices color the rest of the graph through a set color-change rule. Originally, zero-forcing was introduced in the control of quantum systems, where it was referenced by graph infection. More recently, the zero-forcing number, which is the minimal number of initially colored vertices needed to color the entire graph, was shown to be an upper bound on the maximum nullity of a graph. Since then, integer programming and dynamic programming techniques have been used to compute the zero-forcing number of a graph. Few of these methods seem adaptable to different color-change rules and they are unable to compute related graph parameters such as the propagation time and throttling number of a graph. We will present a stochastic search algorithm, based on a genetic algorithm, that is easily adaptable to different color-change rules and can optimize other graph parameters at will. The genetic algorithm allows for the heuristic search to improves its odds of success with every generation (iteration) no matter the size of the graph in question. In fact, it is bound to find the zero-forcing number due to the genetic algorithms high mutation rate, which allows for a lower chance of getting stuck on a suboptimal solution rather than the most optimal solution. Several numerical experiments are provided to demonstrate the effectiveness of our algorithm.

11-10. Using Localization and Clustering to Map Rescue Paths for Victims of a Building Disaster
John Merino, (Junaid Zubairi) - SUNY Fredonia – Computer Science/Software Engineering

This project explores applications of indoor localization techniques in disaster management with an emphasis on multi-story buildings, which may be partially collapsed and require recovery of victims. We assume that most victims will have a mobile device. We can determine the number and locations of victims with mobile signal processing. An algorithm named MLOCATE will assist emergency crews who can be dispatched to the areas of the building where victims are located. During the project we explored the following research questions: 1) Can we measure the strength of the signal from the nearest cell tower and the signals from the phones of the victims individually using the self-identifying beacon frames? 2) How many different types of disasters can benefit from MLOCATE algorithm? For example, can it be beneficial in "active shooter" scenario? 3) How will the path mapping strategy modify its working in case of random blockages in the hallways of the building? A brief description of the MLOCATE algorithm follows. A building is selected as a model. In this work, Maytum Hall on the SUNY Fredonia campus was selected. An array of distances of the cell phones of victims trapped in the building is generated. The distances can be generated initially using simulation using Gaussian distribution. Distance values are sorted and clustered using anchor points that can be marked inside the building in advance as part of the disaster management plan. The clusters are sorted and prioritized as per the sizes. Graph theory is used to construct a weighted graph with the weights derived from the number of victims per cluster and the distance of the nearest anchor point from the radio meter. The rescue team uses this information in planning out the rescue mission, updating the information as per the status of the rescue attempts and visualizing the rescue paths using a graphical interface.

11-11. Using Artificial Intelligence in a Learning Environment
Matthew Schiffhauer, (Meng Su) - Penn State Behrend – Computer Science/Software Engineering

The COVID-19 pandemic resulted in a rapid increase in the necessity of remote learning across the world. This warrants exploration of other computing-based education solutions to enhance the experience of school in both a digital and real classroom. This project proposes to create a teacher's assistant powered by artificial intelligence. The AI assistant will be able to answer student questions by referencing a knowledge base made up of textbooks relevant to the subject, professor's notes, classroom assignments, and information from the internet. The assistant will select the most relevant information and present it to the student in a helpful, easily understandable format. We used IBM Watson's chatbot framework to create a chatbot capable of understanding students' questions and giving logical answers. We leveraged Watson Discovery to build a machine learning model to read and understand course materials. Teachers have the ability to write answers for frequently asked questions and have the assistant deliver those answers directly. If no suitable answer is found for a student's question in the given material or the teacher's answers, the assistant will search a curated list of documents and webpages and dynamically send most relevant information to the student. The assistant will be tested in a classroom environment during the Summer of 2021. We hope to see high levels of engagement with the assistant and we will periodically survey the students about how useful the assistant has been. Through these trials, we will be able to evaluate the effectiveness of this method of classroom assistance and use that information for future, related projects.

PSYCHOLOGY & SOCIAL SCIENCES I

12-01. Queer College Students Experiences with Hook-up Culture

Emily Joseph, (Maureen McHugh) - Indiana University of Pennsylvania - Psychology

As our world changes through the times, the dating scene changes as well. According to Bogle (2007,2008), overt the last 60 years courting has took a turn towards casual "hook-ups" instead of the traditional route. However, there is ambiguity regarding what constitutes a hook-up; the defining characteristics may vary by community. Research to date, has focused almost exclusively on heterosexual individuals. The present study will explore the motives for hooking up within the LGBTQ+ community. Participants representing the full range of gender identities and sexual orientations were recruited using a network and snowball strategy. Respondents will provide their personal description of a hookup which will be compared to their own hookup experiences. Participants will complete a 5-point Likert scale on how frequently they choose someone to hook up with for the following reason. With This provided data by participants will provide an insight on how the queer community plays a role in the hookup culture on college campuses. The present study has examined hooking up in terms of personal hookup definition, motives for engaging in hookups, and participants' gender/sexual identity. The results of this research have revealed a relationship between motives for engaging in a hookup with participants' gender/sexual identity.

12-02. Relationship Between Consumer Behavior and Self-reported Wellbeing

Melissa Bronder, Brandon Boyce, (Luke Rosielle) - Gannon University - Psychology

Looking at the climate crisis and the overwhelming body of research that supports global warming, one response individuals take to combat the environmental effects of consumerism is to lead a voluntary simple life. A voluntary simple life is one in which an individual chooses to reduce their material consumption to seek satisfaction in non-material ways (Iwata, 2006). Using multivariate regression, this study will examine the relationship between a voluntary simple lifestyle and measures of loneliness and self-esteem. Previously validated scales were used to measure Voluntary Simple Lifestyle (Iwata, 2006), Loneliness (Russell, 1980), and Self-Esteem (Rosenberg, 1965). Our research is aimed to add to these findings, predicting a positive relationship between a voluntary simple life and self-esteem and a negative relationship between a voluntary simple life and loneliness. Findings and future directions for research will be discussed.

12-03. Analysis of Perceived Efficacity: The Relationship Between Self-Efficacy and the Development of False Memories
Olivia Kelly, (Luke Rosielle) - Gannon University - Psychology

Many, if not most, people are prone to developing false memories (Scoboria et al., 2017), but are more efficacious individuals less susceptible? This study examines two basic questions: what is the relationship between self-efficacy and performance on a false-memory test, and what role does feedback play in self-efficacy? Subjects took a self-efficacy pretest (Chen et al., 2001) to assess their baseline self-efficacy. Following this, a false memory test comprised of altered household images was given to all subjects. After the false memory test, one-third of subjects were randomly assigned positive feedback (regardless of their performance), one-third of subjects were randomly assigned negative feedback, and the final third were given no feedback. A second self-efficacy test was distributed to all subjects to ascertain whether feedback had any impact on their self-efficacy. Analysis determined if individuals with higher self-efficacy perform better on a false memory test; further testing examined the difference between self-efficacy pretest scores and posttest scores to see if feedback had an impact on self-efficacy.

12-04. Improving Memory with Words and Images
Cheyenne Jess, Ryan Slater, (Luke Rosielle) - Gannon University - Psychology

People have the ability to remember images far better than words (Grady, 1998). This is known as the Picture Superiority Effect (Paivio, 1971). The goal of our study is to investigate whether the picture superiority effect can be used to help improve students' memories. Words and pictures for the study come from Snodgrass and Vanderwart's (1980) normed picture set. Our participants were presented with word or picture stimuli and tested using a 2x2 (study pictures then test pictures, study pictures then test words, study words then test pictures, and study words then test words) factorial design to obtain our data. We predict that we will see the best memory recall results from people who studied pictures and tested with pictures over any other study/test method.

12-05. Effects of Social Exclusion on Depression and Anxiety with Screen Time as a Moderator
Ava Michael, Logan Brinsky, Angel Mora, (Charisse Nixon) - Penn State Behrend - Psychology

The present study experimentally investigated social exclusion's effects on anxiety and depression with screen time as a moderator and testing past peer victimization (PV) as a covariate. Participants (N = 97) were randomly assigned to either an inclusion or exclusion group to play the game Cyberball. Participants played this online game and completed questionnaires on screen time, peer victimization, anxiety, and depression. Participants who spent more than 37 hours a week on their screens reported more anxiety and depression than those with lower screen times. PV was also significant as a covariate with anxiety, suggesting that anxiety is impacted the most when PV is significant. Screen time as a moderator was significant with anxiety only. Given the significance of PV in the results, further research should be done on the effects of PV and its effects on anxiety and depression, and how it can affect the perceptions of socially excluded individuals.

12-06. Worry, Stress, and Anxiety Levels in First-Year Transitioning College Students

Madison Nash, Caitlin Carnuche, Tyra Campbell, (Victoria Kazmerski) - Penn State Behrend - Psychology

The focus of this study was to observe the worry, stress, and anxiety levels in transitioning college students. We investigated the effects of being in a new learning environment, experiencing new difficulties in classes, utilizing individual social skills, and living away from home for the first time and their relationship with the students' feelings towards their transition. The study hypothesized that first-year college students would have higher levels of worry and anxiety due to the transition into the new lifestyle of being a college student. While collecting our data, first-year students were recruited from the Behrend Psych Pool and completed a survey created in Qualtrics. The survey created in Qualtrics will consist of questions from the Perceived Stress Scale (PSS); (Cohen, 1983), the Penn State Worry Questionnaire (PSWQ); (Meyer et al., 1990), and the Student Adaptation to College Questionnaire (SACQ); (Baker and Siryk, 1987). Along with the different scales, the survey will also consist of questions concerning the students' campus life, involvement in activities or sports, how many classes they are enrolled in, and what their intended major is, if they have decided already. The creation of this study is important to the researchers and to be furthered examined because the data will produce a better understanding as for why first-year students tend to have challenging times during their transition into the first year of college. This study will also highlight the importance and create a better understanding of what directly impacts the mental health during the many situations that can impact the transition into college. Our study differs from prior studies because it does not focus on one determining factor that makes a transition difficult.

12-07. Gender differences: COVID-19 Anxiety and Worry

Ashley Millard, Haylie Kircher, Jessika Drinkall, (Victoria Kazmerski) - Penn State Behrend - Psychology

The COVID-19 pandemic has significantly impacted the lives of everyday people, specifically college students. The purpose of this study is to look more into the current issue of the pandemic and the gender differences of mental health symptoms of the college students at Penn State Behrend. The study will focus on two main aspects of Penn State Behrend's students' mental health, including worry and COVID-19 anxiety. It is hypothesized that there will be a significant relationship between COVID anxiety and worry that will be stronger for females than males. The survey will be created on Qualtrics to gather data on students' self-reported responses and the study will be accessible via the Behrend SONA research pool. The questions for this study will come from two scales. The Penn State Worry Questionnaire (PSWQ) will be asking questions regarding the participants' general anxiety (Meyer et al., 1990). The second scale will be the Coronavirus Anxiety Scale (CAS). The CAS will be asking questions relating to participants' anxiety due to COVID-19 (Lee, 2020). Demographics will also be compared, including gender, age, ethnicity, and college standing. Answers will be saved in Excel and converted into SPSS to run correlational analyses between the variables of COVID anxiety, worry, and gender. Overall, this study will show the important effect of COVID-19 on anxiety levels and worry in male and female college students.

12-08. Student Motivational Levels Involving COVID-19

Mirko Arbutina, Hunter Gray, Timothy Ferry, Tristan Woodring, (Victoria Kazmerski) - Penn State Behrend - Psychology

The purpose of this study is to determine whether college level undergraduate program students are decreasing in motivational levels due to the impacts of the COVID-19 pandemic. The transition from traditional in-person learning, to a nearly fully remote learning setting has produced new information on how students not only interact with the class material, but also their motivation towards finishing the work given. It is hypothesized that students are experiencing lower motivation in their remote education setting than they were during in person learning settings. The decreasing motivation towards achieving educational goals, has become immensely detrimental towards students' educational lives. A 54-question survey that is being used is a modified version of the Contextual Achievement Motivational Scale (CAMS; Smith, 2015), to gauge the levels of motivation reported by the students (Smith 2015). We also are using the Perceived Stress Scale (PSS; Sheldon Cohen, 1983) to look at how stress in students has changed before, and after classes were changed to asynchronous or hybrid. The Survey is being conducted through Qualtrics using the Penn State Behrend SONA Systems for distribution. Questions are being asked twice in the survey to see differences between motivation, and stress before classes became asynchronous or hybrid courses, and after these classes were changed to asynchronous and hybrid courses. The data collected is being used in a single sample T-test statistic to see if there are any differences between reported scores for in-person compared to online-classes. The results of this test were extremely beneficial in seeing newly developed attitudes students had, and still have towards an online college level schooling. Students' motivation towards learning along with the stress they felt can have extremely harmful effects to their psyche, and by gathering data on this topic we have seen how students truly feel when involved in an online setting.

12-09. Does the Social-Influence Model play a role in a person's Judgement and Decision-Making?

Jocelyn Caldaroni, Caitlin Shaner, (Dr. Luke Rosielle) - Gannon University - Psychology

The social-influence model demonstrates that individuals will evaluate different social information based on the opinions of other decision makers (Sweet & Adhikari, 2020). In judgement and decision-making, individuals will seek information from a social-group to reach a decision. Recent studies (Keltner et al., 2008; Postmes et al., 2005) have shown that in public, individuals are likely to change their decisions based on the opinions of others around them in order to conform to the majority. The current study will examine the relationship between a false percentage presented next to a survey answer and the likelihood of a participant choosing the answer with the highest percentage. Participants will be randomly assigned to either a control group or an experimental group. The participants in the control group will be asked to answer fifteen relatively easy multiple choice questions without any social influences. The experimental group will be asked to answer the same 15 questions, but will be given a form of social-influences within the questionnaire. The experimental group's questions will include fabricated percentages next to each option representing the false percentage of people who chose that particular answer. We are interested in whether the presence of misleading social information will influence people to willingly select incorrect answers.

12-10. Influencer Impact: How Social Media Personalities Are Encouraging the Shift to Sustainable Brands

Taylor Love, (Dr. Babajide Osatuyi) - Penn State Behrend – Management Information Systems

Social media influencers have revolutionized the way brands view their marketing strategies. With their huge reach and informative segments, influencers can promote products and brands without their audience even realizing it. Consumers are exposed to advertising on social media in various unsuspecting forms. Advertisements once were thought of as bothersome commercials interrupting the entertainment that a person was watching, but now they are integrated into the content in a way that the consumer finds entertaining by itself. People even seek out this type of content to make better informed purchasing decisions. The brand, the influencer, and the consumer all benefit from this symbiotic relationship. In this study, we investigate this kind of marketing and uncover how different messages that influencers send during this process drive consumer behaviors. Our hope is to demonstrate how influencers are shaping market tastes and enhancing consumer wellbeing. We designed an experiment to investigate how consumers would react to influencers in our predetermined categories. The Instagram biographies and photo captions were manipulated to fit into one of the affiliations: sustainable, consumerism, hybrid (a combination of the two previous categories), and control. Each message was tailored to the influencer to make the ads seem as realistic as possible. Our goal was to capture the feeling of scrolling on Instagram itself, and have the participant imagine that these pictures had just popped up on their feed. Preliminary data from a pilot study supports our hypotheses and indicates that consumers respond more favorably to sustainable and hybrid messages, but unfavorably to consumerist messages. Consumers responded to influencer messaging in the sustainable manipulation more than the others. Findings from this study have implications for influencer marketing strategies on social media.

12-11. Netflix and Panic!

Kaleel Van Voorhees, (Kathryn Bender, Ishita Sinha Roy) - Allegheny College - Economics

When the COVID-19 pandemic hit the United States in 2020, most residences went into lockdown during the month of March, lasting long into summer. During that time, many people resorted to TV as a means to pass quarantine time. Netflix reported an all-time high of record- breaking subscriptions during the month of April 2020, with an increase of 10 new million subscribers. While media industry reports supply lists of surging content releases among SVoD platforms, announcements show general drawback in TV consumption and supply after the month of April. Two schools of thought surrounding subscribers' streaming habits emerge: the first involves resorting to broadcast TV as a means of domestic comfort, and the second embraces increasing SVoD consumption and binge-watching as the months of the COVID-19 pandemic drone on. It was also found that during the pandemic, Generation Z became the second largest group to consume streaming goods. Testing these two viewpoints, this project uses Allegheny College students (Gen Z) as a case study, focusing on student's viewing habits during the month of January 2020 (pre-pandemic) and the month of January 2021 (roughly mid-pandemic). Factors such as residency lockdown, multi-tasking, happiness, binge-watching habits, and genre preference are measured as a means to understand the consumption behavior of college students during a national crisis. Comedy was found to be the most watched genre for both 2020 and 2021, with an increase in viewership in January 2021, year over year. Results revealed that if you're young, female, happy, or have a heavy course load, you would've greatly increased the likelihood that streaming and comedy genre viewership increased during the pandemic.

12-12. **Ecotherapy: Nature's Effect on Stress**
<u>Miranda Gulnac</u>, <u>Pearl Patterson</u>, <u>Kelsey Fredericks</u>, <u>Jennifer Hoffman</u>, (Victoria Kazmerski) - *Penn State Behrend – Ecotherapy/Psychology*

When people are feeling down or stressed, others will often recommend spending some time outside. But will time outside really help? The limited research which has been conducted regarding the influence of relationship to nature on stress suggests a strong correlation between emotional well-being, as well as potential for therapeutic applications. Through this research, we examined the extent to which correlations exist between exposure to nature and emotional well-being. Emotional well-being is measured through levels of stress, anxiety, and trait mindfulness. This research used a survey to determine the strength and nature of these correlations in college populations. Based on the existing literature, we hypothesized that higher levels of exposure to nature predict lower levels of stress and anxiety, and higher levels of trait mindfulness. Collected data was analyzed through SPSS with regression analysis and correlation statistics. Few studies have been done with ecotherapy, and even fewer have used samples of college students specifically. This study helped fill the gaps of previous research and exemplify the benefits of ecotherapy.

PSYCHOLOGY & SOCIAL SCIENCES II

13-01. Study of Childhood Stressful Life Events and its effects on relationship satisfaction
<u>Erica Juriasingani</u>, <u>Kathryn Larson</u>, <u>Ciara Boyle</u>, (Charisse Nixon) - Penn State Behrend - Psychology

Adverse Childhood experiences are moderate to severely stressful life experiences that occur during the first 18 years of life. Research shows that individuals who have high ACE scores are more likely to develop depression and suicidal tendencies (Harris, 2015). These experiences can include things like emotional, sexual, and physical abuse, neglect, parental psychopathology, parental incarceration, and parental separation (Karatekin, 201). In college students, mental health is more prevalent than they were over a decade ago (Blanco et. Al., 2008). This study serves to focus on the relationship between childhood stressful life events and relationship satisfaction with mental health as a moderator. In order to measure relationship satisfaction, attachment was used as a proxy. Participants took a survey that included the measures: Childhood Trauma Questionnaire; Inventory of Parent and Peer Attachment; and Depression, Anxiety, and Stress Scale. The researchers hypothesized that the worse one's mental health, the less satisfaction they will experience in relationships with peers and parents and that the better the mental health, the more satisfaction. A gender effect was also anticipated based on literature. This is an oral presentation.

13-02. Relationship Between Stressful Life Events and Emotional Functioning in College Students
James Kilgallon, Lindsey Honard, Lucas Currier, Mia Baker, (Charisse Nixon) - Penn State Behrend - Psychology

In more recent years, the need for mental health research is increasing, therefore, the present study aims to examine how stressful life events affect the emotional functioning of college students, primarily freshmen. Past research was noted in the study for expanding upon concepts, such as how negative emotional functioning plays a role in the quality of daily life (Baker et al., 2020) for people who have experienced stressful life events (Haj-Yahia et al., 2019); along with the effects experienced since having been diagnosed with Post Traumatic Stress Disorder (Monson et al., 2004). The purpose of this study was to determine if there is any correlation between experiencing a stressful life event and emotional functioning, while using PTSD diagnosis and counseling/treatment prevalence as moderators. To do this, an online survey was conducted to answer questions that were concurrent with the Life Events Checklist (LEC) and the Positive and Negative Affects Schedule (PANAS). A sample size of N = 121 was attained; 45 of those participants were male, 74 female. Furthermore, correlational analyses were conducted between the individual positive and negative subscales of the PANAS, and with the Life Events Checklist categories "happened to me" and "witnessed it" totals. These analyses showed that as stressful life events increased, emotional functioning decreased. Collected datum also supports this finding as the LEC category totals were positively correlated with the PANAS negative subscale, as stressful life events increased, negative affect increased, /r/ = .210, /p/ = .021. Neither PTSD diagnosis or counseling/treatment prevalence moderated this relationship, but no prior counseling/treatment history was related to higher emotional functioning. These findings may help educate college counseling programs about the overwhelming emotions that their students feel. Gender effects, limitations, and future research are discussed.

13-03. Attachment Styles, Childhood Trauma, and Anxiety Levels
Mackenzie Hancock, Hannah Brocious, (Victoria Kazmerski) - Penn State Behrend - Psychology

Significant links between childhood trauma, insecure attachment styles, and psychological disorders have been found in previous studies (Barbaro & Shackelford, 2019; Cloitre et. al., 2005; Lund et. al., 2020; 503; Rimane et. al., 2020; Tibi et. al., 2020). Our study aims to analyze these relationships with a focus on anxiety. Correlations among all three of these variables will be investigated. Additionally, we will explore if childhood maltreatment and insecure attachment style are predictors of anxiety in college-aged students. It is hypothesized that all variables will be significantly correlated with one another. Also, childhood maltreatment and insecure attachment style will be significant predictors of anxiety levels, but not of one another. Data collection will utilize an online survey via Qualtrics and was analyzed using IBM SPSS Statistics 26. We expect the data to show that these hypotheses were significant; there will be correlations between all variables and childhood maltreatment and insecure attachment will predict anxiety levels. The findings of this study may lead to more detailed research regarding these variables as well as providing support for parental education/other preventative measures regarding childhood maltreatment and attachment styles.

13-04. Autism, Anime, and Facial Emotion Recognition
Bridger Standiford, (Kevin Hsu) - Penn State Abington - Psychology

Individuals on the autism spectrum, and those higher in autistic traits, have been shown to experience greater difficulty with interpreting the facial emotions of others than those considered neurotypical. They have also demonstrated an increased affinity for anime, a style of Japanese animation. We hypothesize that this preference for anime is accompanied by an increased ability to understand facial emotional expressions in anime characters. Thus, the study will examine whether individuals higher in autistic traits can better and more quickly recognize emotional expressions in anime faces relative to real human faces. Additionally, the study will examine whether those higher in autistic traits actually outperform those lower in autistic traits at recognizing emotions in anime faces. Participants will complete an online self-report survey on Qualtrics. The survey will include questions about demographics, prior experience with anime and other cartoons, social habits, and social media consumption. The survey will also include a validated, abbreviated measure of autistic traits, and a scale to measure how in touch participants are with their own emotions. Participants will then complete a facial emotion recognition task, consisting of photos of human faces and images of anime faces showing a variety of facial expressions. Participants will be asked to correctly identify the expressions within a time limit. If our hypothesis is supported, individuals higher in autistic traits will perform better at recognizing the facial expressions of anime characters, while performing worse at recognizing the expressions of human faces compared to neurotypical individuals. These findings can be used not only to better understand why facial emotional expressions made by humans are difficult for those on the autism spectrum or with autistic traits to understand, but also what interventions or strategies would be most beneficial in improving facial emotion recognition.

13-05. Smartphone Use Relationship with User's Mental Health
Paige Brumett, Jace Velez, (Victoria Kazmerski) - Penn State Behrend - Psychology

Smartphones are no stranger to anyone in today's society, especially college students who currently rely heavily on technology to obtain their education. The purpose of this study is to examine the effects that smartphone use has on a student's psychological well-being. It is hypothesized that smartphone use will have a negative correlation with psychological well-being. To collect the data, students will be recruited from the Behrend Psychology Pool and will complete a survey on their cell phone usage and their psychological well-being. Because of the current demand for technology access, people are easily susceptible to adverse effects on their mental health. Researchers think it is important to examine these effects so that people can have better balance in their lives: both on-screen and off-screen.

13-06. Increasing Awareness of Needs and Improving Domestic Outcomes in the LGBTQ+ Community

Francesca Giardina, Elias Manjerovic, Kaylee Larson, Jacob Huellen, Paige Brumett, Kelsey Fredericks, Jasmine Lewis, (Melanie D. Hetzel-Riggin) - Penn State Behrend - Psychology

Intimate partner violence (IPV) is defined as the use of malicious physical force or power, threatened physical force, manipulation, that results in injury or psychological harm (Mercy et al., 2017). This can threaten both communities and individuals and have significant consequences to the quality of life of those affected (Mercy et al., 2017). Domestic violence is heavily studied in heterosexual communities but there is a lack of literature in respect to domestic violence in LGBTQ+ communities (Rollè et al., 2018). There are many factors to keep in mind when understanding the impact of IPV on the LGBTQ+ community. Minority stressors such as internalized homophobia have been shown to be related to physical IPV (Longobardi & Badenes-Ribera, 2017). The Center for Disease Control's National Intimate Partner and Sexual Violence Report of 2013 reports the lifetime incidence of an individual having experienced rape, physical violence and/or stalking by an intimate partner at some point in their lifetime as follows: 44% of lesbian women, 61% of bisexual women, 35% of heterosexual women, 26% of gay men, 37% of bisexual men, and 29% of heterosexual men. The present study is an extremely accessible thirty-minute questionnaire that asks about the perceptions of IPV and DV as well as the potential needs of the individual. We seek to gather data from 250 members of the LGBTQ+ community in the region about their experiences seeking services after domestic violence, perceived barriers for service utilization, and ways to improve service provision for domestic violence victims from the LGBTQ+ community. The goal of this study is to apply the needs to implementations of solutions with strategic methods in order to end stigma and allow members to gain access to support if they find themselves in a violent situation or environment. This study also looks to remove negative stigma and improve representation of the LGBTQ+ community.

13-07. The Impact of Body Size on Risk Perception for Sexual Assault

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Women in the United States are often held to unrealistic weight standards idolizing "thinness" (Ravary, Baldwin, & Bartz, 2019). Because being overweight is not the ideal in western cultures, individuals often stand out and develop poor self-image (van Vurren et al., 2019). Body image and the concept of objectification have played a role in how women perceive themselves (Fredrickson & Roberts, 1997). There has yet to be research done to question the relationship between an individual's body image and that same individual's risk perception of being sexually assaulted (de Waal, Christ, Messman-Moore, & Dekker, 2019). The present study evaluates if a person's perception of their body size influences their perception of being sexually assaulted. Our research question is "How does one's body image influence their perception of being sexually assaulted?" The study consists of female participants, 18 years or older from a Northeastern university. All participants speak English and were recruited via the college's Sona Systems subject pool. To date, we have collected data on over 80 participants. They are asked about rape myth acceptance, perceived body weight, general life experiences, sexual experiences, body image dissatisfaction, body esteem, and risk perception. Correlational analyses will be conducted to analyze the results. Upon completion, participants will receive additional information about the study and information regarding resources for counseling, domestic violence, sexual assault, and suicide prevention. We hypothesize that 1) Those with greater body image dissatisfaction will show less risk perception in being sexually assaulted compared to those that have less body image dissatisfaction; 2) Those with increased perceived body weight will show less risk perception in being sexually assaulted compared to those that have less perceived body weight; and 3) those with a lower body esteem will show less risk perception compared to those with higher body esteem.

13-08. Relationship Between Stress and Substance Use Outcomes with Mindfulness as a Mediating Predictor
Kaila Schnell, (Charisse Nixon) - Penn State Behrend - Psychology

This study aims to view the relationship between college students perceived stress levels, and their substance use such as nicotine and alcohol as well as examine the relationship mindfulness has on stress levels, nicotine and alcohol use. Students will be asked to complete surveys assessing their perceived stress, alcohol consumption, and nicotine consumption to view these factors as well as engage in a short mindfulness-based video. We expect 130 students from Penn State Erie, The Behrend College, to participate in this study. Participants will complete the following assessments: Perceived Stress Scale (PSS), The Fagerstrom Test for nicotine dependence (FTND), and The Alcohol Use Disorders Test (AUDIT). *Hypothesis 1*: Stress will have a positive correlation with alcohol use in college students. *Hypothesis 2*: Stress will have a positive correlation with nicotine use. *Hypothesis 3*: Stress can be correlated with destructive methods of coping. *Hypothesis 4*: Mindfulness will have a negative correlation with college students perceived stress, alcohol, and nicotine consumption. Analysis showed that these reported categories of the PSS were positively correlated with the AUDIT totals. Students perceived stress increased, total alcohol use increased, r = .481, p = .01. Researchers analyzed the PSS scale totals and the FTND scale totals. Results of the correlation concluded that college students perceived stress was not significantly correlated with college student's nicotine consumption, r = .150, p = .01. Correlational analysis was conducted using the AUDIT'S subscales for alcohol dependence and alcohol related problems. Analysis concluded a significant positive correlation between college students perceived stress and their dependence on alcohol, college students stress increased, dependence on alcohol increased, r = .495, p = .01. Analysis of college students perceived stress and the subscale of alcohol related problems within the AUDIT concluded a significant positive correlation r = .497, p = .01. Results of this analysis concluded a negative correlation between college students perceived stress and mindfulness r = -208, p = .01.

13-09. Free Will and Determinism: The Influence of Worldview on Blame Attribution Judgments
Hannah Brocious, Tyler Skelton, (Steven Berg) – Penn State Behrend - Psychology

The current research will examine the influence of worldview, such as free will and determinism, on blame attribution judgments. The purpose of this study is to assess the potential relationship between judgements of blame and worldview as measured on the FAD-Plus (Paulhus & Carey, 2010). Subjects may be relatively more or less likely to assess blame in a judgment scenario if they score high on the scale of free will; alternatively, respondents may be more or less likely to assess blame in a judgment scenario if they score high on the scale of determinism. Researchers hypothesize that patterns of blame assessment in the judgment scenarios will align on the basis of worldview and the results on the FAD-Plus. It is also hypothesized that values consistent with determinism will correspond to relatively more lenient responses on blame assessment trials as compared to those who predominantly value ideas associated with free will. The overall goal of this research is to more fully understand the contributing factors that influence patterns of judgment and blame attribution.

13-10. Factors in Pennsylvania School Districts Return to School Platforms Since the COVID-19 Pandemic

Amanda LeSuer, (Patricia Claster, Ivan Chompalov) - Edinboro University - Sociology

Two-Thousand twenty has been a year of "what ifs" and "what now." This study looks at the re-opening plans of 67 public schools across the state of Pennsylvania. Along with schools re-opening plans, I look at census quick facts to collect data on average household income, computer access, internet access, racial diversity, and poverty levels in each of the school's counties. I also collect COVID-19 cases and deaths for each of those counties from the CDC website. The study's central questions: Are school districts located in areas with higher median household income levels and lower poverty levels more likely to have ½ day or online only plans for the fall? Also, are schools located in areas with lower computer and internet access more likely to have full-time in-person classes for the fall? Results have been mixed, but there seems to be a correlation between higher income levels and online-only school plans. There is also a correlation between computer and internet access and a school opting for full-time in-person classes. This study is considered a prelim study, and we are continuing to collect further data.

13-11. Erie County Prostitution

Erin Norris, (Adam Saeler) - Mercyhurst University – Criminal Justice

Understanding the prevalence of illegal prostitution is paramount to the consideration of a diversion program designed specifically to keep sex workers out of the formal criminal justice system. In an effort to understand the prevalence, Erin Norris and Dr. Adam Saeler are collecting both qualitative and quantitative data from local police departments to determine what the official incident data says, what officers say and where the gap may be between the two.