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TWENTY-SEVENTH ANNUAL UNDERGRADUATE STUDENT RESEARCH AND CREATIVE ACCOMPLISHMENT CONFERENCE ABSTRACT BOOK

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ORAL PRESENTATION ABSTRACTS

BIOLOGY I

1. Antimicrobial properties of compounds isolated from honey

Karman Masown, Jillian Wright (Sarah E. Ruffell), University of Pittsburgh at Bradford - Microbiology

With elevated levels of resistant bacteria, the need for research in alternative antimicrobial compounds has risen. Similarly, evidence of compounds in honey demonstrating antibiotic properties has become prevalent. The main purpose of this experiment was to isolate compounds that can demonstrate antibacterial properties in the tested honey. Different concentrations of each honey were tested on *Escherichia coli*, *Staphylococcus aureus*, and *Multi-resistant Staphylococcus aureas* (MRSA). Specifically, the minimum inhibitory concentration test was conducted on several different honeys to determine the chemical compound and compare its effects on resistant bacteria. Honey from many different species were tested; specifically, Buckwheat (*Polygonum convolvulus*), Basswood (*Tilia americana*), Aster (*Symphyotrichum puniceum*), Black Locust (*Robinia pseudoacacia*), Japanese Knotweed (*Polygonum cuspidatum*), and Blueberry (*Vaccinium angustifolium*). The different honey tested in this experiment originate in the northeastern section of the US. This experiment was performed in triple replicate to ensure validity. The results of this study indicate strong evidence of high antimicrobial activity originating from specific compounds within each honey. These results suggest that certain honey have the potential to provide antimicrobials that can be extremely useful against resistant bacteria.

2. Identification of antibacterial components within five plants used within traditional medicine

Courtney N Shade, Kisun Peters-Diaz (Sarah E. Ruffell), University of Pittsburgh at Bradford - Microbiology

Background: With the increasing emergence of antibiotic resistant bacteria, new ways to control the illnesses caused by these bacteria need to be found. A return to traditional medicine could lead to a new source of drugs that can combat these resistant bacteria. The purpose of this study was to discover which key compounds in medicinal plants used by the Seneca people have antibacterial properties. The compounds and chemical structures that contain antibacterial components that make up Burdock (*Arctium minus*), Mullein (*Verbascum Thapsus*), Red Clover (*Trifolium pretense*), Yarrow (*Achillea millefolium*), and Bilberry (*Vacrinium myrtillas*) were tested against many common bacteria including *Escherichia coli*, *Staphylococcus aereus*, *Pseudomonas aeruginosa*, *Enterococcus faecalis*, *Streptococcus pneumoniae*, and *Enterococcus saccharolyticus*. Methods: The major compounds that make up Burdock, Bilberry, Mullein, Red Clover and Yarrow were identified using high-performance liquid chromatography (HPLC). The pure mixtures of the major compounds were tested against the bacteria in a minimum inhibitory concentration assay to see which compounds contained antibacterial components in each plant extract. Results: This study identified the compound in each plant extract (Burdock, Mullein, Red Clover, Yarrow, and Bilberry) that contained antibacterial properties when tested against the six bacteria, *Escherichia coli*, *Staphylococcus aereus*, *Pseudomonas aeruginosa*, *Enterococcus faecalis*, *Streptococcus pneumoniae*, *Enterococcus saccharolyticus*, and *MRSA*. Conclusion: This study can help to find alternative drugs through traditional medicine that are able to fight antibiotic resistant bacteria.

3. Evaluation of Organic Solvents and Thiazolidine-2-thiones for Bacterial Growth and Biofilm Inhibition

Sidney Wallin (Todd Eckroat), Penn State Behrend - Microbiology

Biofilms exist when bacteria attach to a surface and grow encased in a polysaccharide matrix. Bacteria in biofilms, which are seen in ~80% of chronic infections, are less susceptible to antibiotics and cells of the immune system. Thus, biofilms are a key contributor to the growing problem of antibiotic resistance, and novel drugs are needed to control their formation. This study examines the effects of varying concentrations of organic solvents on biofilm formation in *Pseudomonas aeruginosa* using a crystal violet 96-well plate assay. Results show that DMSO, at concentrations that partially inhibit bacterial growth, has minimal effect on biofilm formation. In addition, a series of novel thiazolidine-2-thione analogs of natural products will be synthesized and evaluated for the ability to inhibit biofilm formation in P. aeruginosa. To accomplish this, minimal inhibitory concentrations (MICs) will be determined for planktonic cells to get a baseline for antimicrobial effectiveness. Following the determination of planktonic MICs, the same crystal violet 96-well plate assay will be performed to determine whether the same compounds are effective against biofilms. MICs of planktonic cells will be compared to activity against biofilms. It is hypothesized that the thiazolidine-2-thione analogs will show the ability to disrupt biofilm formation while having minimal effects on planktonic cells.

4. Complementary Genetic Screens Reveal Inactivating and Constitutively Activating Mutations in Two-Component Systems of *Bacillus anthracis*

Michelle Chu, Ellen Upton (Devin Stauff), Grove City College - Microbiology

Two-component systems (TCS) are sensor-regulator pairs ubiquitous among bacteria. The canonical TCS consists of a membrane-localized histidine kinase that undergoes phosphorylation in response to its cognate signal and transfers phosphate to a cytoplasmic DNA-binding response regulator. This response regulator, in turn, alters the behavior of the cell by regulating the transcription of a set of target genes. In many cases, the upstream pathways leading to activation of a given histidine kinase or the identity of its ligand are unknown. Here, we present results from dual, complimentary genetic screens aimed at identifying upstream regulators of two independent TCS in the pathogen *Bacillus anthracis*. Along the way, we identify a set of inactivating mutations as well as constitutively activating mutations in these TCS. Our results solidify the role for both TCS in regulating the expression of their target promoters, and allow us to refine our screen for the future identification of regulators that interface with either or both TCS.

5. Speciation-related toxicity of palladium complexes to the soil bacterium *Pseudomonas aeruginosa*

Rachel Pell, Daniel Muccio, Carson Williamson (Deborah Aruguete & Kelly Miller), Penn State Behrend, Wesley College - Microbiology

Globally, environmental levels of platinum group elements (PGEs) continue to increase due to their use in industry, electronics, and automobile catalytic converters containing metallic palladium, platinum, and rhodium. In areas with elevated chloride (Cl^-) levels, such as salted roadsides and areas impacted by ocean incursion, PGEs released into the environment can be mobilized by interactions with Cl^- and ammonia (NH_3), a common form of nitrogen, to form soluble complex ions. Once PGEs are complexed, they are more toxic than in their metallic form. One important platinum group element is palladium (Pd). While research has shown that Pd is mobile and present in surface environments, its effects on microorganisms and their roles in Pd cycling are largely unknown. We tested three palladium coordination complexes on *Pseudomonas aeruginosa*, a gram-negative bacterium common in soil, to assess possible connections between palladium speciation and toxicity. We conducted a series of minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) tests to determine the smallest concentration of Pd salt that inhibited growth or eradicated the bacteria, respectively. We tested three different palladium coordination complexes, $[Pd(IV)Cl_6]^{2-}$, $[Pd(NH_3)_4]^{2+}$, and $(PdCl_4)^{2-}$, at concentrations ranging from 500 ppb Pd to 7.8 ppb Pd. After the bacteria were exposed to the palladium-enriched media, growth was measured by optical density. To determine whether bacteria were still viable (alive), samples of cultures were plated. We found that $[Pd(IV)Cl_6]^{2-}$, and $[Pd(NH_3)_4]^{2+}$ both had a MIC of 125 ppb, while $(PdCl_4)^{2-}$ had a MIC of 250 ppb. The $(PdCl_4)^{2-}$ and $[Pd(NH_3)_4]^{2+}$ palladium coordination complexes had a MBC greater than 500 ppb whereas $[Pd(IV)Cl_6]^{2-}$ had a MBC of 125 ppb. We also report preliminary results on the effects of a palladium coordination complex on a gram-positive soil bacterial species, *Bacillus subtilis*.

6. Characterization of UBX Binding in *Drosophila melanogaster*

Jessica Yohe (Bradley Hersh), Allegheny College - Biochemistry

Hox genes are a group of highly conserved transcription factor genes that regulate direct and indirect targets through up- or downregulation of gene expression. These genes regulate anterior-posterior patterning in bilaterally symmetric animals. Although mutations in Hox genes are linked to numerous diseases and malformations, little information is known regarding how they choose their target genes. However, most Hox genes have the highest affinity for a DNA sequence of four nucleotides, ATTA. Because the ATTA sequence theoretically occurs every 256 base pairs throughout a genome, distinguishing specific binding site from spurious sites is difficult. We hypothesize that the flanking nucleotides near the core ATTA binding sites in *Drosophila melanogaster* will be important for the specificity of binding. We analyzed *in vitro* effects of previously generated mutations in an Ultrabithorax (UBX) target binding site within the cis-regulatory element of *Cpr47Ee*. The *Cpr47Ee* CRE possesses two ATTA UBX core binding sites, one of which is required for proper expression. The mutated versions were used to identify additional sequences critical for Hox function. UBXIa protein was induced in BL21(DE3)*pLysS E.coli* bacteria, purified on a Ni-NTA column, and electromobility shift assays (EMSAs) were used to analyze binding affinity in wild-type and mutated sequences of Cpr47Ee edge regulatory DNA. Understanding the mechanisms by which Hox proteins bind to target genes could inform the process of evolution of body patterning.

7. Identification of Genes Affecting the Synthesis of Cuticular Hydrocarbons (CHCs) in *Drosophila melanogaster*

Emily Watto (Bradley Hersh), Allegheny College - Biochemistry

The sexual selection of Drosophila consists of both visual and olfactory signals. Cuticular hydrocarbons (CHCs) act as olfactory signals, or pheromones, in precopulatory selection. Sexual selection can eventually lead to reproductive isolation, causing genetic isolation and speciation; therefore, the genes that affect pheromones involved in mate choice are of great interest. Investigation of the fatty acid *elongase jamesbond* (bond) showed that *bond* is essential for male *Drosophila* sex pheromone synthesis. However, not all of the genes involved in CHC synthesis have been identified. We disrupted normal gene function of fourteen predicted fatty acid synthesis genes using tissue-specific RNA interference. We tested these flies for male fertility through a fertility assay and CHC profile via GC-MS. From our results, we can identify which of the tested genes, if any, have an effect on composition of CHCs or on the mating success of the male *Drosophila*. Of the genes tested in GC analysis, *CG16904* and *CG30008* appear to be missing a major peak that appears in the control chromatogram. Based on these results, we can determine genes that are important for CHC production and that may contribute to sexual selection and speciation.

BIOLOGY II

8. Effects of Forced Limb-Use and Exercise on Motor Recovery of a Rat Model of Parkinson's

Katelynn Morrell (Deanne Buffalari), Westminster College - Neuroscience

This study examines the motor recovery of a Parkinson's rat model after forced limb-use and exercise. Twenty-six male Long-Evans rats received unilateral 6-hydroxydopamine lesions and were randomly assigned to one of four treatment groups. The experiment was a mixed design with cast of the non-impaired forelimb and exercise as independent variables, and motor recovery as the dependent variable. It was predicted that the cast + exercise group would show the most motor recovery, and the rats in the no cast + no exercise group would show the least. The results indicate that the cast + exercise group had the lowest limb-use asymmetry score (greatest motor recovery), and the no cast + no exercise group had the greatest akinesia score (least recovery). Although limitations caused variable results, these findings improve our understanding of how physical therapy and exercise may be beneficial for motor recovery in patients with Parkinson's disease.

9. Developing an Ethical and Cost-Effective Murine Model for Type 1 Diabetes Mellitus-Induced Cataract via Single Dose of Streptozotocin

Samuel Thomas (Christy Donmoyer), Allegheny College - Physiology

Cataracts, which are characterized by cloudiness/opacification of the lens, were the leading cause of blindness in 2010. Type 1 diabetes mellitus (T1DM) is one of the most prevalent risk factors for cataracts. To test preventative treatments for T1DM-induced cataracts, a valid, ethical, and cost-effective animal model is necessary. This proposed model used a single intraperitoneal (IP) streptozotocin (STZ) injection of 85 mg/kg body weight (BW) to induce T1DM and cataracts in male C57BL mice by 3- and/or 4-weeks post-injection. This STZ dosage was selected to limit mortality from acute hypoglycemia or hyperglycemia because other investigators have observed mortality rates of 15-20% as a result of higher STZ dosages. Groups A (n=4) and B (n=4) received STZ injections suspended in 0.1M sodium citrate buffer, while the sham control group (n=4) received an IP injection of buffer alone. All mice were weighed daily and tail vein blood samples were obtained biweekly. At 3- (group A) or 4-weeks (groups B & C) post-injection, lenses were dissected immediately following euthanasia and photographed under a microscope. Lens opaqueness was rated from 1-3 (1 being least opaque, and 3 most opaque) by two observers. Average change in blood glucose level for groups A, B, and C were -1 mg/dL, -37.5 mg/dL, and 32 mg/dL, respectively. Average opaqueness for groups A, B, and C were 1.1, 1.6, and 1.5. Using the Mann-Whitney U Test, there was a significant difference in change in blood glucose between groups B and C. However, because group B's blood glucose level actually decreased from baseline (-37.5 mg/dL), it does not appear that this difference indicates STZ-induced T1DM. Otherwise, no statistical differences between opaqueness, change in BW (g), or change in blood glucose were observed between the STZ groups and the sham group. This model could be improved if either the single dosage of STZ was increased from 85 mg/kg BW or if multiple doses of STZ were administered over time.

10. You Can't Judge a Horse by its Color: Examining the Relationship between Horse Coat Color and Personality

Callie Garlick (Ronald Mumme & Bradley Hersh), Allegheny College - Genetics

Many equestrians believe in stereotypes that link a horse's personality to coat color, but the genetics of horse coat color can be incredibly complex. While horses can display many different colors, nearly all horses have a black, bay, or chestnut base coat color controlled by interactions between the MC1R and ASIP loci. This study aims to examine relationships between base coat color and horse personality traits to explore variation at the MC1R and ASIP loci. Multiple owners filled out a survey for 94 horses of various breeds and backgrounds to gauge personality traits. In addition, we performed novel object and handling tests to include two tests administered by a consistent individual that could be related to the owner-reported information. Horses with a stronger reaction to the novel object test were more often reported by the owner to be nervous (p=0.03), skittish (p=0.02), timid (p=0.03), and fearful (p<0.01). Horses were then genotyped at the MC1R and ASIP loci to determine base coat color. We performed principal component analysis, and found no significant relationship between base coat color and horse personality. The results of this study will be useful for horse buyers and trainers when working with new horses and could be useful for breeding programs and for additional studies into pleiotropies between horse coat color and personality.

11. DNA Barcoding of Important Pest Scale Insects from Southeast Asia

Haley Flick, Devin Hill (Matthew Gruwell), Penn State Behrend - Genetics

There are about 8000 described species of scale insects as of today. DNA Barcoding is a taxonomic method that uses a short genetic marker in an organism's DNA from a standardized region of the mtDNA genome to genetically identify scale insects as a particular species. Genes that are usually used to identify insects are COI and 28S. The CO1 gene is short enough to be sequenced fast and cheap yet long enough to find variation among these species and effectively identify them because it evolves very quickly. 28S is a ribosomal subunit that fluctuates between conserved regions and hyper-variable regions, making it possible to have universal insect primers that work on all our scale insect species. We will also use 16S from bacterial endosymbionts for comparison among scale insects. Our focus is scale insects from Southeast Asia that are pest species on crops and ornamentals. Comparing and contrasting our sequences from previous results may lead to new species identification, improved insect identification for growers in Thailand and a better understand of scale insect evolution.

12. Estimating Growth Rates of Yellow Perch (*Perca flavescens*) from Lake Erie Using a Cost-Effective Method of Processing Otoliths

Nolan Pyle, Ileana Calderon-Martell (Greg Andraso), Gannon University - Organismal Biology

The objective of this study was to estimate growth rates of yellow perch (*Perca flavescens*) using a cost-effective method of analyzing otoliths. Sagittal otoliths were removed from 105 yellow perch 55-356 mm total length (TL) collected from Presque Isle Bay (PIB). Otoliths were embedded in casting epoxy, sectioned and ground using readily-available equipment, and polished on a custom-made jig. Sectioned otoliths were photographed under transmitted light, annuli were counted, and distances from the nucleus to each annulus were measured to the nearest 0.001mm. Total length (TL) at age was estimated for each fish using the relationship between TL and distance from the nucleus to ventral margin of sectioned otoliths. Confident age estimates were generated for 85 individuals and ranged from young-of-year to 10+ years. Back calculation of TL at age revealed average growth of 73 mm and 124 mm after one and two growing seasons, respectively, consistent with estimates obtained from size frequency data from PIB. Growth rate beyond the second season was relatively constant at approximately 25 mm per year. On average, fish reached a harvestable length of 194 mm (7.6 inches) by the end of their fourth growing season. Growth rates among individuals was variable, suggesting that there are environmental (e.g. diet, water temperature) or genetic differences within the population.

13. Influence of Diurnal Temperature Variation on the Amphibian Fungal Pathogen, *Batrachochytrium dendrobatidis*

Carissa Lange (Matthew Venesky & Beth Choate), Allegheny College - Ecology

Increases in global temperatures can significantly impact disease dynamics by influencing pathogen development and survival rates, disease transmission, and host susceptibility. However, recent evidence suggests that it is not the increase in mean temperatures, but rather, the increased variation in temperatures that contribute to disease outbreaks. Although recent evidence supports the correlation between long-term temperature variability and disease dynamics, few studies have explored how variation along smaller time scales (e.g., diurnal variation) might affect disease dynamics. To fill this gap in the literature, I focused on the influence of diurnal temperature variation on *Batrachochytrium dendrobatidis* (*Bd*), a fungal pathogen that is partially responsible for a rapid decline in amphibian populations. I exposed salamanders (*Plethodon cinereus*) to either one of three constant temperature treatments (18 C, 23.5 C, 29 C) or to a diurnal temperature treatment (18 C during the night, 29 C during the day). After being placed in the respective temperature treatments, I exposed two thirds of the salamanders in each treatment group to *Bd*. I hypothesized that the variable treatment group would have the highest prevalence and abundance of *Bd*. Additionally, because other studies have shown that *Bd* thrives at cooler temperatures, I predicted that the treatment group housed at 18 C would have higher infection prevalence and abundance than the treatment groups housed at 23.5 C and 29 C. This study will provide a better understanding of how future climate conditions may affect disease outbreak, and it will emphasize the importance of focusing specifically on diurnal temperature variability.

14. Effects of disease pathology on nutrient cycling in aquatic systems

Michelle Woods (Matthew Venesky & Scott Wissinger), Allegheny College - Ecology

Nutrients including carbon (C), nitrogen (N), and phosphorous (P) are necessary for proper organismal growth and development. Autotrophic and heterotrophic species play a role in nutrient cycling within ecosystems, and the rate and efficiency of nutrient cycling is impacted by various physiological and ecosystem factors including the presence of wildlife infectious diseases. An example is *Batrachochytrium dendrobatidis* (Bd) which causes chytridiomycosis (chytrid) in tadpoles. Chytrid predominantly affects the body tissue that contain keratin, specifically the jaw sheaths and labial teeth in tadpoles. This negatively affects tadpole feeding kinematics and foraging rates and efficiency which can lead to abnormal feeding behaviors and reduced food consumption. The impacts of chytrid on tadpole feeding behavior may impact how nutrients and energy flow through ecosystems as the infection could hinder the ability of tadpoles to consume and break down detritus. This study will investigate how the pathology of Bd in *Lithobates clamitans* (Green Frog) tadpoles impacts rates of nutrient cycling of N and P and overall primary productivity in aquatic ecosystems. Microcosms that include detritus, Green Frog tadpoles, and periphyton will be created and the rate of detrital decomposition, the concentrations of ammonium ($NH4^+$), nitrate ($NO3^-$), and total phosphorous (TP), and the rate of primary production in terms of Chlorophyll A concentrations will be analyzed. It is hypothesized that infection will impair the tadpoles' ability to feed on and break down detritus, thus decreasing the rate of detrital processing, the concentrations of N and P within the water column, and the rate of primary production.

15. A Census of the Bat Population of Gannon University, Erie, PA

Lauren Reilly (Steve Ropski), Gannon University - Zoology

For the past eight summers, a census of the bat population has occurred on the Gannon University campus in Erie, PA. The numbers for the first three years held relatively steady, but the data for the past 5 years indicates a dramatic decline. White Nose Syndrome was first reported in 2006 in a cave in New York. The disease has killed an estimated 6 million bats in the eastern United States since then and has spread throughout Pennsylvania and into northeastern Ohio. This fungal infection has killed 95% of bats in some caves and may result in the listing of three bat species as endangered in Pennsylvania, including the Little Brown Bat (*Myotis lucifugus*), the predominant bat on the Gannon campus. This study will compare yearly data by building, time of year, building side and species composition to determine how White Nose Syndrome has affected the Gannon campus bats. A decrease in numbers may be partially responsible for an increase in West Nile Virus in the area. The results will also be used to place bat houses at appropriate locations to encourage bat presence on campus.

CHEMISTRY, MATHEMATICS & PHYSICS

16. Constructing Imidazole Complexes of Human Serum Albumin Reconstituted with Heme and Testing for Nitrite Reductase Activity

Alexandra Alfonso Castro (Mary Grace Galinato), Penn State Behrend - Biochemistry

Human serum albumin (HSA) is abundantly present in our blood and is a repository to many molecules, such as heme. Previous studies have confirmed that HSA reconstituted with heme (HSA-heme) imitates the binding site of other heme enzymes such as myoglobin (Mb) and hemoglobin (Hb), except that an O(tyrosine) bonds to the Fe center of heme instead of a N(histidine) that is present in Mb and Hb. Although the primary function of Mb and Hb is to store and carry oxygen in the muscles and blood, respectively, they also have a secondary function of producing nitric oxide through the reduction of nitrite by Fe(II) under hypoxic conditions, also referred to nitrite reductase (NiR) activity. The aim of this project is to obtain imidazole complexes of HSA reconstituted with heme (HSA-$heme_{Im}$) to mimic the structure of Mb by causing the formation of a N(imidazole) bond to Fe, and then test for their NiR activity. This can be achieved by titrating the protein with imidazole compounds, specifically imidazole, 1-methylimidazole, and 2-methylimidazole. The NiR reaction of the HSA-heme imidazole derivative, which is monitored with UV-Vis spectroscopy, shows spectral features consistent with that of the reaction of nitric oxide and Fe(II), indicating that HSA-$heme_{Im}$ converts the nitrite into nitric oxide. Results from this project will allow us to understand the mechanism of the NiR reaction in more detail, and develop NiR catalysts by tweaking certain parts of the active site of a heme protein.

17. Detection of Narcotics in Beverages Using Colorimetric Methods

Justin Keck, Jake Urbano (Luciana Aronne), Penn State Behrend - Chemistry

The narrow research on the topic of "date rape drugs" is extremely alarming. The purpose of the research being conducted is to determine if certain compounds commonly known as "date rape drugs" can be both tested for and detected via the use of a colorimetric method. It is believed that using a colorimetric method will increase the ease of use and simplicity for the consumers. The drugs are typically administered through the contamination of an alcoholic beverage unbeknownst to the victim. The best defense against this is prevention. If the drinks can be easily tested for contamination before consumption, then the threat generally decreases. This presentation will discuss the experimental methods developed to possibly determine the presence of date rape drugs in alcoholic.

18. Electrochemical comparison of dicyanoferriprotoporphyrin - modified carbon and Pt microelectrodes for selective H_2S detection

Hannibal Pharathikoune (Jason Bennett), Penn State Behrend - Chemistry

Hydrogen Sulfide (H_2S) is a gas produced in the body that has risen in popularity due to its physiological importance, especially in cardiovascular and neurological systems. As a result, detection of H_2S has gained the attention of the scientific community in order to study its role within the body in real time. Electrochemistry is an attractive means for this due to its high sensitivity, fast response and potential for miniaturization. However, selective detection of H_2S is greatly impaired due to the presence of other biological gases, such as nitric oxide (NO) and carbon monoxide (CO). These hinder the selectivity of H_2S due to similarities in size, structure and charge. In the past, $(CN)_2$-FePP supported on Pt was shown to be initially very selective towards H_2S over CO and NO, however the selectivity quickly diminished with use. The reason for this is not fully understood, but is suspected to be due to sulfide species penetrating the porphyrin layer and interacting with the underlying Pt surface. Solutions to improve the $(CN)_2$-FePP signal have been actively sought to address this problem. Computational modeling has shown that H2S has a much lower affinity for carbon compared to Pt. This presentation will compare the electrochemical response of $(CN)_2$-FePP polymerized on to carbon fiber and platinum microelectrodes, in order to determine whether the $(CN)_2$-FePP/carbon fiber system produces a more reproducible and selective H_2S signal.

19. Combined Quantum Mechanical/Molecular Mechanical Investigation of Quorum Sensing Inhibitors

Nathan Gasparovic (Ronald Brown), Mercyhurst University - Chemistry

This research involves investigating ligands as affective inhibitors for the quorum sensing portions of bacteria and comparing the binding energies of these ligands. This is being done in order to find a safer alternative for antibiotics in disabling the viral capabilities of bacteria through inhibiting their quorum-sensing properties. This has the potential to lead to a way to combat bacteria without breeding resistance within the bacteria in the way a traditional antibiotic would. To test the effectiveness of the ligands, they are being investigated using a combined quantum mechanical/molecular mechanical (QM/MM) level of chemical analysis with the Guassian09 software program. The binding energies of the ligands to the *LASR* protein will be found. Using the calculated binding energies, the inhibiting ability of a variety of ligands can be determined. Currently, several different ligand molecules have been analyzed at the B3LYP/6-31G(d,p) quantum molecule level and the UFF molecular mechanics level. Additional calculations incorporating the most significant amino acid-ligand interactions into the quantum mechanical layer will also be presented. The overarching goal is an analysis to determine the effectiveness of the ligands as quorum sensing inhibitors.

20. Bridge Tournament Scheduling

Hong Xin (Paul Olson), Penn State Behrend - Mathematics

Scheduling a Bridge Tournament involves various challenges. A group of twenty-four players participating in a tournament wish to meet weekly for six consecutive weeks. In many cases, two players might be scheduled to meet more than once during the six-week tournament. The problem this project addresses is to avoid grouping players with repetition, using various complex concepts. To make arrangements for every round, the tournament divided twenty-four players into six groups, with each group containing four players. In order to better explore these concepts and discover the pattern of the players' schedules, we examined the sixteen players' schedule which can be found by trying different combinations. We then scheduled twenty players, which cannot be arranged by trying combinations. A former student researcher, Oliver Miles, was inspired by the pattern of Latin Squares, manipulated this pattern, and created a particular template that can be used as a guide to group twenty players for five rounds of tournament without repetition. However, the twenty-four players' arrangement could not be found. Inspired by the Oliver's research, we applied Latin Squares and Combinatorics concepts, and designed a special arrangement that can schedule sixteen, twenty and twenty-four players. After introducing a color coding chart to keep track of repetition, we have proved our arrangement guarantees at least five rounds for groups of sixteen, twenty and twenty-four players. This method solves the original Bridge Tournament scheduling problem of repetition, helping to make scheduling more efficiently. This method also provides further implications for exploring the bases of DNA and gene duplication.

21. Collatz Conjecture: A Problem Mathematics May Not Be Ready For

Caleb Cairns (Michelle Previte), Penn State Behrend - Mathematics

The Collatz Conjecture is a seemingly simple problem posed by Lothar Collatz in 1937. However, several of world's leading mathematicians believe the conjecture is completely out of reach of today's mathematics. This talk presents a brief overview of the problem, its difficulties, as well as approaches that have yielded some success.

22. Optimal forcing location in arrays of Coupled Oscillators

Ziyuan Han (Joseph Previte), Penn State Behrend - Mathematics

This research project studied the chains of coupled oscillators which are connected at several points with no closed loops. The goal of this project is to allow for any configuration (closed loops are acceptable) and to identify optimal locations in these arrays. Using differential equations, we identified the optimal location for entrainment and introduce more loops to the original system, forming a tree-like system with several small loops. We were able generate a function for any tree-like system and determine how the new loops will affect the characteristic of the entire system.

23. Computer simulation of molecules and solids

Zhengxi Yan (Blair Tuttle), Penn State Behrend - Physics

I developed a computer program that incorporates the harmonic potential terms into the calculation of forces on atoms. I first applied this code to simulate the dynamics of diatomic molecules including N_2 and O_2. Then I examined the stretching and bending properties of water. Finally I used the code to examine solids including two dimensional carbon nano-structures.

24. Theory of Band Gaps in Amorphous Nano-porous SiC

Tyler Summers[1], Andrew O'Hara[2], Sokrates Pantelides[2] (Blair Tuttle[1]), Penn State Behrend[1] & Vanderbilt University[2] - Physics

Nano-porous SiC is an important insulator used as a back-end-of-the-line dielectric in scaled integrated circuits. In the present study, nano-porous SiC atomic models are created from cubic SiC supercells. First, a void of diameter of ~ 1 nm is hydrogen passivated. Then, amorphous models ae constructed with an atom type switching procedure, which was applied until the average atomic composition and bond densities converge to experimental values. Density functional theory calculations are used to explore the electronic and physical properties of various nano-porous SiC models. Specifically, we examine the effect of average atom composition and bonding on the bandgap of nano-porous SiC.

25. Optimizing the Power Output of Luminescent Solar Concentrators that Use White Diffusive Backgrounds

(Contains proprietary information – no abstract included)

Jonathon Schrecengost (Bruce Wittmershaus), Penn State Behrend - Physics

COMPUTER SCIENCE & ENGINEERING I

26. Development of Information System for Engineering Research Labs at Penn State Behrend

Andres Santana, (Jalaa Hoblos, Faisal Aqlan), Penn State Behrend - Computer Science/Software Engineering

With the increase of research activities at Penn State Behrend, a dynamic database is required to store and manage lab data. Currently, lab data is stored in an Access database file that is difficult to update and maintain. In order to provide a system for storing and managing the lab data, a dedicated database is developed. The database provides faculty, staff, and students with more efficient ways of obtaining data and information about the labs. The steps for developing the database system include: 1) requirements gathering, 2) entity relationship diagram, 3) data collection, and 4) database implementation. A dedicated website is developed for the labs and can be accessed by all the lab coordinators. The website enhances the lab management and provides real-time access to the lab information.

27. Making Database Management Systems Manageable: User-friendly Automatic Report Generation

Karen Postupac, (Lory Al Moakar), Grove City College - Computer Science/Software Engineering

This presentation describes our solution to simplify data analysis of the latest generation of Database Management Systems (DBMSs). Big Data - which describes the massive amount of data produced and the technology needed to support it - has changed how businesses store and process the data they collect. Various systems, such as relational DBMSs and NoSQL systems, have struggled to maintain the balance between ACID (Atomicity-Consistency-Isolation-Durability) properties and other advantages, such as scalability and availability. In an effort to maximize these benefits, a new class of systems called NewSQL systems have emerged. Each of these systems, however, still requires the users to manually issue multiple queries to the database in order to generate analytical reports. Every time a report is needed, users have to write a series of queries, each outputting a table. Then, they manually combine the tables to generate a meaningful report. Since these reports are a vital component of decision making, this process is replicated multiple times a day to analyze trends. In our research, we designed and built a system on top of a NewSQL database, MemSQL, to automate the report-generating process described above. Our system allows users to routinely generate reports over a specified period of time. It provides an easy-to-use user interface that manipulates the data inside MemSQL. To produce analytical reports, the users can register the report's frequency (i.e., number of minutes, hours or days between reports) and the queries that constitute the report. The system automatically keeps track of the deadlines of each report. Whenever a report is due, it first checks if the data meets specified conditions. If so, the system submits the queries to the database, retrieves the results, and generates a report. In short, our system facilitates the report generation process with minimal user intervention by generating frequent up-to-date reports, saving the user time and resources.

28. Integration and Administration of Macs in the Westminster College Unix Lab

Eric Adams, (David Shaffer), Westminster College - Computer Science/Software Engineering

This project involved the integration of Macs into the Westminster College Unix Lab. At the start of the project the lab was entirely made of Gentoo Linux machines. For the project to be successful I needed to be able to establish a connection with the LDAP server, provide a networked home directory, allow VNC access, provide simple lab management, and integrate with current lab monitoring software. One notable reason for the completion of this project is to make Xcode available for use in future Westminster courses targeting iOS and macOS application development. The software that was used for this project included AutoPkg for creating deployable applications, Munki for application deployment and updates, and Nagios with the NRPE plugin for web monitoring of resources and services on the new machines. In the oral presentation I will detail the steps taken to complete this project and the many challenges and roadblocks on the way. I will discuss how this work simplifies deployment of future Macs in the lab. This project will also provide areas of opportunity for others to continue in the development of the Mac portion of the lab.

29. Development of a Cross-Platform Logbook Application for Athletic Departmental Use

Mitch Stahara, (David Shaffer), Westminster College - Computer Science/Software Engineering

The coaching staff of the swimming and diving team at Westminster College would like to start utilizing logbooks to hold their athletes more accountable for their personal well-being. They have tried this in the past with physical notebooks, which resulted in untimely submissions that have varying degrees of quality; sacrificing the integrity of what the coaches were trying to attempt. Because of this, they asked if a mobile application could be developed that would properly fulfill their requirements. This application was developed on the cross-platform service PhoneGap, though other options were available. Multiple meetings were held with stakeholders to gather requirements, design a user interface, and preview early versions to make sure that an effective application was being developed; leading to deployment on the Google Play Store and Apple App Store. On the app, the coaching staff uploads a workout with an attached form that the athlete then fills out on the mobile application. The coaching staff can see the answers of the forms that the athletes fill out and analyze them to have a better understanding of their athletes' habits. The coaching staff believes that use of this application could lead to more accountable student-athletes in and out of the pool and better performances in season. We will be presenting the problem presented to us by the coaching staff and how the app differs from similar solutions along with the application architecture, user interface design, and database schema.

30. Blockchain Technology: An Initial Step Towards a Coherent Tech Society

Alex Marcinkiewicz, (Adrienne Foos), Mercyhurst University - Computer Science/Software Engineering

At this point, it is certain most of the United States have at least heard of some buzzwords surrounding the recent bitcoin boom: Blockchain, cryptocurrencies, hyper ledger, and decentralization. Just to name a few. Some people believe the crypto market is just a bubble or a scam. The majority of tech-influenced communities realize the revolutionary potential behind this new technology. These communities feel blockchain is here to stay to make a major impact in a myriad of different industries. In this presentation, I plan to discuss practical use cases of blockchain technology and express my viewpoint on how I believe blockchain technology may be the initial step towards a transhumanistic future. Transhumanism being: the belief or theory that the human race can evolve beyond its current physical and mental limitations, especially by means of science and technology. I also plan to discuss some challenges blockchain developers may face and some variables impacting societies ability to keep up with the rapid evolution of technology. My major takeaway from the past year of studying new tech is that the future of technological development is consistently looking like a bright one. Many developers and engineers think that blockchain and Artificial Intelligence (AI) could have the potential to break egocentric perspectives and create a more united world view. I strongly believe that the future will consist of decentralized applications and a global decentralized cryptocurrency. Cryptocurrency's work because they are a digital asset with guaranteed scarcity. This means governments will be unable to print more or manipulate the value of the currency. This gives power to the collective members of a blockchain to determine the value of the currency.

31. Hash Functions in Intrusion Detection Systems

Nicholas Caiazza, (David Shaffer), Westminster College - Computer Science/Software Engineering

During this research, a new hash function was created using a sponge construction. This hash function was tested against metrics that common hash functions follow. These include determinism, confusion, diffusion, preimage resistance, and second preimage resistance. This hash function was intended to be used in intrusion detection systems.

32. Faculty Hiring Decision Support System

Benjamin Reuscher, Shawn Weaver, (Omar Ashour), Penn State Behrend - Engineering

Hiring a new faculty member can be a very long and tedious process for a university. Hiring a new faculty member involves a huge investment, therefore selecting the best candidate that fits in terms of qualifications and culture is very important. A decision support system (DSS) would help the hiring committee in several different ways: Firstly it could save time if candidates' data can be extracted electronically, the DSS would allow the committee to examine all candidates without leaving any candidate out, and the DSS systematically evaluate each candidate in a relatively more fair way than traditional selection process. The DSS is based on a multi-criteria fuzzy information content calculations. The DSS ranks the candidates based on their score. The smallest the candidate information content score, the highest the fit of the candidate with the universities criteria. This DSS requires the committee members to set up various criteria and put in their desired requirements for each one. Once the criteria has been entered the support system will calculate how closely candidate matches the needs of the university. After the candidates have been evaluated through the system the hiring committee can continue the normal hiring process with the top candidates ranked from the system.

33. Simulation Study to Improve Scheduling at a Cardiology Outpatient Clinic

Nicholas Bowers, (Omar Ashour), Penn State Behrend – Industrial Engineering

The outpatient cardiology department at a local hospital provides cardiac care to a large number of patients in the Erie area. This department contains a catheterization laboratory, electrophysiology laboratory, and trans-esophageal echocardiogram laboratory. Patients that have procedures at these labs have a number of preoperative procedures. Some of these procedures may be bypassed if prior testing and evaluation is performed. Currently the department is suffering from excessive waiting times and long length of stay (LOS). Excessive waiting times and long LOS lead to significant costs for the hospital in the form of overtime for its medical staff. This results in both patient and staff dissatisfaction. This paper presents a simulation study of the cardiology department to test different scheduling alternatives. The simulation model was developed in Simio®. Multiple scheduling alternatives were tested. The results show that spreading the arrivals of the patients over longer period would decrease the LOS experienced by the patients. The average waiting time for patients was not affected by these changes.

34. Improving Industrial and Mechanical Engineering Student Satisfaction, Motivation, and Performance through Development and Implementation of the "I-C-D-M" Undergraduate Teaching Methodology

Gina Demeo, (Shraddha Sangelkar, Paul Lynch), Penn State Behrend – Engineering Education

This research work combines two ongoing research initiatives in the School of Engineering at Penn State Behrend. This research focuses on a holistic approach being taken in an industrial and mechanical engineering program to increase student interest, satisfaction, and motivation in the engineering courses. A new teaching methodology has been developed and implemented within the School of Engineering at Penn State Behrend. The "Interact, Cultivate, and Deliver" method, also known as the "I-C-D" method, implements eleven significant factors found to increase undergraduate student motivation and satisfaction. A pilot study of this method was implemented into an IE classroom and it was found that when the significant factors were implemented into the classroom, the satisfaction and effectiveness were significantly better than in courses where the methodology was not implemented. Ongoing work is being carried out to better understand student motivation in undergraduate engineering courses using a focus group approach aimed at discovering factors for student motivation and a content analysis to determine which factors are significant. This specific research seeks to incorporate both the ICD Methodology and the outcomes of the motivation content analysis in an effort to develop the "I-C-D-M" methodology to optimize student satisfaction, motivation, and performance in their courses. The results reported will show the effectiveness of the I-C-D-M (Interact, Cultivate, Deliver and Motivate) model for undergraduate course delivery while also highlighting the results of the content analysis.

ENGINEERING II

35. Analysis of Curved Shelving Units in Retail Stores: A Digital Human Modeling Approach

Jessica Wyckoff, (Faisal Aqlan), Penn State Behrend - Engineering

This research focuses on studying shopper's experience in retail stores using Digital Human Modeling (DHM). We study how the layout of the retail store can impact the shopper's visual experience by testing different layouts of the racks. Various rack layouts with traditional straight designs as well as ones with varying levels of curvature are designed in a CAD program, then imported into a DHM software to be evaluated. The software replicates the field of vision a person has and how much of a rack he or she is exposed to while walking by and turning their head. The research also determines if there is a greater level of exposure to products in a retail setting that makes use of curved store shelves versus the traditional straight shelves.

36. Feasibility Study of Interacting side-by-side Piezoelectric Harvesters in low-intensity grid-generated Turbulence

Kevin Ferko, (Amir Danesh), Penn State Behrend - Engineering

Resonant fluidic harvesters can typically be tuned to the frequency of the flow, so they yield a larger power output compared to their non-resonant counterparts. In order to explore increasing this output for non-resonance harvesters, a feasibility study has been performed to analyze the behavior of two side-by-side piezoelectric harvesters in low-intensity (less than 0.5%) grid-generated turbulence with respect to beam configurations, mean flow velocity, distance from the grid and separation between the two beams. Experimental results show that the potential for energy harvesting is perhaps not as great in the low mean-velocity flow as it is for the higher speed cases which are accompanied by flutter, but the side-by-side piezoelectric beams display potential for use as turbulence sensors at low speeds.

37. Java Based, Web Deployed GUI for the Human Cardiovascular System

Ben Murphy, (Elisa Wu), Penn State Behrend - Engineering

Human cardiovascular system is a very complicate pipe system, which starts from the heart, branches from aorta, to large arteries, capillaries, small veins, veins, and then back to the heart. The understanding of this system is not only important for students in medical field, but also for student in the bio-mechanical field. There are many conditions that affect the response of human cardiovascular system, such as the strength of the heart muscle, activity level, etc. Although the hemodynamics of the human cardiovascular system have been well studied, most textbooks or references are all text based. A complicated numerical simulation package has been developed using Matlab/Simulink (Mathworks, MA). However, a user without expert level of understanding of Matlab/Simulink or without the access to Matlab/Simulink will not be able to use it effectively. One method of increasing the simplicity and availability of the simulation without sacrificing its complexity would be to create a GUI in a more accessible language such as Java. After successfully enabling communication between Matlab and Java, using NetBeans IDE and SceneBuilder, a working model of the simulation was created. Currently efforts are being made to deploy the simulation to the web as well as enhancing its current capabilities. The presentation would focus on how to breach the communication barrier between Matlab/Simulink and Java. This would include what programs are needed, how to format the Matlab/Simulink file, as well as how to format the environmental variables and how to deploy the Java based GUI. Additionally, the presentation would cover errors that could be encountered during the process as well as how to solve such errors.

38. Ergonomic Assessment of Automotive Service Centers: A Case Study

Faris Alzahrani, Ahmed Mushaikh, (Faisal Aqlan), Penn State Behrend - Engineering

Working in automotive service centers (ASC) is a difficult job and is subjected to injuries and ergonomic risks. The tasks performed in an ASC include lifting heavy objects (like tires and other car parts), working in awkward postures, and applying high forces. These factors can cause Musculoskeletal Disorders (MSDs) to the workers. In this research, we focus on ergonomic assessment of ASCs utilizing Quick Exposure Check (QEC) survey and Digital Human Modeling (DHM). Data was collected from different ASCs in Erie, Pennsylvania. Several factors are considered including human physical characteristics (e.g., highest and weight), loads (e.g., different types of tires), as working posture. The objective is to determine the ergonomic risk factors associated with the tasks performed in ASCs and recommend improvement strategies to avoid the risks.

39. Wavy Toolpath Development in Single Point Incremental Forming

Tyler Grimm (Ihab Ragai, John Roth), Penn State Behrend - Engineering

Single Point Incremental Forming (SPIF) is a novel sheet material forming process which is able to form complex geometries without the use of dedicated dies. This forming method deforms sheet material by laterally traversing a forming tool along the contours of the final geometry while incrementally stepping into the sheet material until the final depth is reached. This forming method promises significant reductions in energy consumption at low to medium volume production. However, several drawbacks of this process currently hinder its use in industry. In order for SPIF to be fully realized in industry, several characteristics of the process must be improved. One such characteristic is surface finish, which is degraded as a result of gouging/scalloping produced by the forming tool and is largely dependent on the tool's path. Additionally, while SPIF can achieve greater formability than traditional methods such as stamping, increasing this disparity further encourages SPIF's use in industry. Current literature shows that the surface finish and formability of SPIF can be improved through the use of a vibrating forming tool. However, several inherent limitations exist with this method, such as a sporadic pattern formed on the face of the workpiece resulting from the random motions of the forming tool. By mimicking the motion of a vibrating forming tool through alterations made to the toolpath, significantly greater control of the tool can be achieved. By controlling the vertical motion of the tool to follow a wavy path, the striking pattern can be formed in a repeating pattern, improving surface finish when compared to traditional helical toolpaths. Furthermore, this improvement can be accomplished without the initial cost of expensive/complex vibrating mechanisms.

40. AC System Design for Control of Thermal Environment using Solar Power Application

Emmanuel Fale, Evan Mangan, Daniel Schell, (David Gee), Gannon University - Engineering

In the application discussed here, we have designed and built an enclosure that receives energy by heat transfer. The 4 x 4 x 3 foot enclosure is constructed of 3/8 inch plywood with a transparent 1/4 inch Plexiglas top. The Plexiglas top is attached to the plywood box frame with hinges. A 1/4 inch tubular rubber strip is placed between the Plexiglas and the frame in order to seal the interface when the Plexiglas top is latched shut. Heating is provided by a 120 V radiant floor heating cable placed underneath the subfloor. As the temperature within the enclosure rises, a thermostat triggers an air-conditioning (AC) system to maintain the enclosure's interior temperature within the desired range. The AC system draws power from a deep-cycle battery which is charged using electricity from solar generation. The dual 100 W monocrystalline silicon panels can be operated in direct sunlight, or by artificial illumination. That is, for purposes of demonstration the system is designed to operate even when direct solar illumination is not possible. The AC system has been constructed using components from a residential 120 V refrigeration system; suitably modified to conform to the present application. The system includes a 12 V compressor, an accumulator, an evaporator, a condenser, and a thermal expansion valve, and the components are mounted on the walls of the enclosure. Care was maintained to keep the coolant paths unchanged, with respect to its original configuration.

41. Interaction of Side-by-Side Fluidic Harvesters in Fractal Grid-Generated Turbulence

Nicholas Chiappazzi, (Amir Danesh), Penn State Behrend - Engineering

While the vast majority of the literature in energy harvesting is dedicated to resonant harvesters, non-resonant harvesters, especially those that use turbulence-induced vibration to generate energy, have not been studied in as much detail. This is especially true for grid-generated turbulence. In this paper, the interaction of two side-by-side fluidic harvesters from a passive fractal grid-generated turbulent flow is considered. The fractal grid has been shown to significantly increase the turbulence generated in the flow which is the source of the vibration of the piezoelectric beams. In this experimental study, the influence of four parameters has been investigated: Beam lengths and configurations, mean flow velocity, distance from the grid and gap between the two beams. Experimental results show that the piezoelectric harvesters in fractal grid turbulence are capable of producing at least the same amount of power as those placed in passive rectangular grids with a larger pressure loss, allowing for a potentially significant increase in the efficiency of the energy conversion process, even though more experiments are required to study the behavior of the beams in homogeneous, fractal grid-generated turbulence.

42. Evaluation of Patient Handling Techniques Using Digital Human Modeling

Christopher Lashway, (Faisal Aqlan), Penn State Behrend - Engineering

The patient handling process is the most frequent reason for work-related back pain in the healthcare industry. Repeated manual patient handling activities can cause musculoskeletal disorders to the nurses who perform the handling. Furthermore, other ergonomic risk factors can exist such as awkward postures, lifting heavy loads, and exerting high forces. Continuous assessment of patient handling ergonomic risks is important to avoid injuries and musculoskeletal disorders. This research focuses on utilizing Digital Human Modeling (DHM) to assess ergonomic risks associated with patient handling and provide efficient and safe patient handling. A case study from a local hospital is considered. Results of the case study are used to improve patient handling and provide recommendations for eliminating the risk factors.

ENGINEERING III

43. Experimental Investigation of Tube Flaring with a Rotating Tool

Elizabeth Mamros, (Chetan Nikhare), Penn State Behrend - Mechanical Engineering

As the automotive industry becomes increasingly competitive, the leading manufacturers are striving to design the lightest, most fuel-efficient vehicles to capture the market. To achieve this mission, the material processing techniques used in the manufacture of the vehicle must be investigated further. One such critical technique is sheet metal forming, which creates parts that account for a large percentage of the total vehicle weight. The majority of these sheet metal parts make up the structure of the vehicle and are constructed from thin-walled tubes. To manufacture these thin-walled tubes into the desired shape, one of the main techniques is tube forming which can expand or reduce the tubes' diameters to the desired dimension. One specific tube forming technique is the flaring process which is typically performed at the tube end. In this paper, the tool rotation at its flaring axis was considered. The analysis of the expansion ratio, strain path, and failure limit was also performed along with the experimentation. Frictional effects were considered. It was observed that varying the rotational speed of the flaring tool influenced the ability of the tube to flare. The expansion ratio was maximized with an increase in the temperature of the tube and an increase in the rotational speed of the tool to a certain limit.

44. Analysis of Electrically Conductive Polymer Composites as Bipolar Plates

Meredith Sander, James Pritts, (Adam Hollinger), Penn State Behrend - Engineering

The effectiveness of a microscale direct methanol fuel cell is largely dependent on the ability of its bipolar plates to conduct electricity. Traditionally, metal alloys are used as current collectors due to their inherent high electrical conductivity properties. However, polymer composites offer a promising alternative to metal alloys as they are lightweight, cheaper, and easier to produce if using an injection molding process. Current research has tried using only one filler to attempt to achieve conductivity levels needed for a fuel cell application. Different conductive fillers were compounded into nylon 6,6 at various weight percent in order to determine the optimum filler-to-polymer ratio for electrical conductivity. The fillers most applicable to this research are a blend of carbon fiber, carbon nanotubes, and carbon black. From this research, it was found that carbon fibers at a high weight percent provided samples with the highest conductivity. This was true only when samples were not compounded prior to injection molding. It was also seen that adding carbon black into the process did not improve conductivity. Hopefully more research into electrically conductive polymers will reduce the cost of fuel cells so that they can be implemented into our everyday life.

45. Experimental and Numerical Analysis on Bilayer Tube Flaring

John Olevnik, (Chetan Nikhare), Penn State Behrend - Mechanical Engineering

Moving deeper into the twenty-first century, lightweight construction has become a central principle in component design in industry wide efforts towards increasing vehicle fuel economy to maintain adherence to tighter government environmental standards. To achieve new levels of weight reduction in components, simplistic materials are being replaced with compound materials and composites such as tailored blanks and multi-layered materials or "hybrid" components when dissimilar materials are used together (metal and plastic polymer, for example). Usage of these new composite materials has been observed to yield lower component weights as well as same or higher performance as older, more conventional materials. To investigate this further, conical flaring of a hybrid, bilayer tube of an interior metal tube surrounded by an exterior polymer tube is considered. For experimentation, a steel inner tube was used with a PVC exterior tube. In testing, the formability of the steel tube was observed to have increased with the implementation of the exterior PVC layer in comparison to single layer tubes comprised of steel alone. Observation and analysis of this behavior pointed towards the contact stress of the two materials increased the formability and delays the failure. Beyond the scope of observing the flare, another property of the bilayer tube was that the addition of the PVC layer reduced the collapse of the steel tube just under the flared region and remained undeformed. The results of experimentation confirm that the hybrid component outperforms its conventional counterpart by exhibiting higher formability, lower stress in the flared region, and better overall structural integrity of the specimens after being flared.

46. Resizing Armored Gloves

Morgan Wehler, (Charlotte deVries), Penn State Behrend - Mechanical Engineering

Historical European Martial Arts (HEMA) is a growing martial art across the globe. This includes the study of many different types of medieval European weapons, the most common being german longsword. The martial art is inherientally dangerous and therefore has a need for more specifically designed protective gear. The most difficult of these being the gloves, as they need to provide exceptional mobility along with more protection than other sport gloves currently on the market. To remedy that there must be correct sizing for armored gloves that allows adequate protection while still being comfortable for the most amount of people. DMZ's Hand of Glory gloves provide the current most amount of coverage while still allowing for mobility, however they are currently only offered in one size. By using a combination of ANSUR data along with basic demographic information, these gloves can be designed to fit better and protect better for a wider range of users. This research can be applied to any sort of armored glove, including potential military uses.

47. Springback Analysis of 5083 Aluminum Alloy

Brent McFarland, (Chetan Nikhare), Penn State Behrend - Mechanical Engineering

The most notable issue in regards to any sheet metal manufacturing is known as “springback”. The springback of a metal is a metal's capability to essentially 'spring back' after deformation by some force. This material property, and reaction to deformation, is cause for a significant requirement in wasted energy needed to adequately compensate for this reaction in order to achieve the required dimensions of the sheet metal. This project is an analysis of 5083 Aluminum Alloy (AA5083) with regards to springback. The strategy for this analysis was to study the affect of heat treatment to an AA5083 sample. These samples were heated in pairs consistently for five minutes, and at constant temperatures ranging from room temperature to 550C. Once appropriately heated, the samples were set to cool, and then placed in a hydraulic press where the force required to bend them past a certain point was recorded. After testing was complete, the springback of the specimens was calculated. Tensile testing, under the same preparation conditions, was also completed in order to support recorded data. Overall, the calculated springback of the specimen's decreased as heat treatment temperature was increased.

48. Burst Testing of Biomaterials for Medical Applications

Kelly Miller, (Adam Hollinger), Penn State Behrend - Mechanical Engineering

The process of creating novel, 3D-printed hernia meshes will optimize the way current traditional meshes are produced and will facilitate the custom-design and functionalization of surgical meshes. 3D-printed hernia meshes have never been produced, therefore preliminary burst strength tests must be executed to ensure a tear will not occur once implanted. In this work, an apparatus was designed and machined in accordance with ASTM Standard D6797 Ball Burst Test and attached to an Instron 5966 testing machine to collect data. Materials burst strength tests were conducted on polycaprolactone, poly (1, 8-octanediol citrate), chitosan film, and aluminum foil as a control to validate the device although it was found that 3D-printed hernia meshes provide lower burst strengths than that of the abdominal wall.

49. Experimental & Numerical Investigation of Bend-Unbend Mechanics in the Tube Flaring Process

Bradley Pier, (Chetan Nikhare), Penn State Behrend - Mechanical Engineering

The growing demand for lighter weight vehicles force the automotive industry to efficiently design the material processing techniques. Sheet metal components share a large percentage of the vehicle weight which is used as body-in-white and as structural parts. In the sheet metal category, mainly thin tubular components are used for structural purposes. To process these tubular components, tube forming is one of the main manufacturing technique which is further subdivided depending upon the tube expansion and reduction. One of the tube forming techniques is a flaring process. Most applications for flaring tube ends utilized a conical tool flaring the tube to some point up until failure occurs. Our investigation focuses on the bend-unbend mechanics of the tube flaring and of the forces required that characterize the tube flaring process. The relationship between the flaring and the outer diameter of the tube was characterized by experimental data and then extrapolated flaring limits for a variety of tube sizes. Further numerical simulations were performed to match the results. Based on the data, an empirical equation is proposed. This equation provides a concept based on material or process stiffness. It is believed that once an equation is established and variables are linked to the parameter a better prediction can be carried out for flaring the tubes. Once an accurate relationship of force and displacement requirements are gathered, a new method utilizing a stepped tool to more gradually flare the tube by bending and bending the tube wall and create larger and/or more stable flarings without failure when compared to a standard conical tool. This process adapts a commonly used technique with the promise of much greater range of uses due to the ability to manipulate the tube flarings more than previously achievable by mechanical methods.

50. Study of the Elastic Recovery and Residual Hoop Stress in Steel-Aluminum Rings

Jacob Alexander, (Chetan Nikhare), Penn State Behrend - Mechanical Engineering

The automobile industry is constantly looking of more innovative and efficient methods of manufacturing aimed at keeping costs low. One common challenge that must often be overcome is that in order to make vehicles more durable, light weight, and cost efficient dissimilar materials must often be joined together. Due to different material properties the metals are often too dissimilar to bond by metallurgical processes such as welding. An alternate method is to combine them by taking advantage of their dissimilar elastic properties. For this proposed research, I would study the effects of applying a compressive load to a set of steel and aluminum hoops. Upon relief of the load, their different spring backs will form a pressure lock at their surfaces, joining the two materials together. Effects of friction will be analyzed to determine the effects on the radius of curvature of the joint. Stress concentrations will also be explored in the joined material. The ejection force to dislodge the two metals apart will be tested and it is expected to notice that a greater radius of curvature will produce a greater needed ejection force.

51. Investigation on Square Tube Forming using a Reuleaux Triangle

Ryan Horstman, (Chetan Nikhare), Penn State Behrend - Mechanical Engineering

Currently the standard for forming tube is the use of a variety of shaped mandrels and hydro-static pressures. Tube forming is the expansion of a circular cross-sectional area into a variety of different shapes; this experiment will focus standard tube forming with a square mandrel. Traditionally to create a tube with a square cross-section area, a square mandrel must pass through the circular tube in small increments until the circular cross-section is completely transformed into a square cross-section. This experiment will flare circular cross-sectional tubes using a non-tradition reuleaux triangular shaped bit. While experimenting with the reuleaux triangular bit the force, frictional, and total energy required to form the tube will be analyzed. The reuleaux triangular bit will be tested at a variety of different axial speeds. The final resulting forces, frictions, and energies will be compared to traditional square tube forming.

ENVIRONMENTAL SCIENCE

52. Sustainable Waste Management: Development of a Leachate Collection and Treatment System for The Solomon Islands

Courtney Platt, Madeline Schwerinski, Matthew Hackathorn, (Hwidong Kim, Varun Kasaraneni,), Gannon University - Environmental Science

The Solomon Islands are a collection islands in the UN Small Island Developing State (SIDS) program. The Solomon Islands are located northeast of Australia. In the capital, Honiara, lies an unmanaged dumpsite where the residents take their garbage. This unsanitary dumpsite contains mounds of waste with scattered, stagnant, anaerobic, water ponds. This is resulting in breeding grounds for disease carrying mosquitos, bacteria, and parasites. According to World Health Association, 89.8% of mosquito related cases stem from Honiara. The goal of this engineering project is to ultimately reduce the amount of mosquito related diseases, and improve overall dumpsite sanitation in Honiara by introducing a leachate collection, treatment system, and possible cover materials to their current dumpsite. This project has created multiple replicas of the dumpsite's waste compositions to analyze hydrogen sulfide. Hydrogen sulfide gas can be harmful to humans and has a strong odor which makes living around the dumpsite disparaging. Currently, different biochars are being tested as a possible cover material for the dumpsite. The types of biochar are: chicken bone, timber, and coconut. These materials are readily available in Honiara, so whichever cover material works best will be cost effective to implement. Two different experiments are set up to test for absorbance of hydrogen sulfide on the biochars. One is using the dumpsite's waste composition, while the other is using gypsum drywall, a hydrogen sulfide producer. Testing is also being conducted to see if different test material might be good substances to use to inhibit insect growth. These materials include: ash, salt, and limestone. Using the dumpsite's waste composition, systems are set up with identical amount of mealworms in them with the testing material to visually compare growth of mealworms. These experiments will help determine how to create drier conditions, which will ultimately make the dumpsite more sanitary. The piping for leachate collection will be based off of the amount of leachate produced, which is being found from the Hydraulic Evaluation of Landfill Performance (HELP) model and using fluid mechanics calculations. The materials that will be investigated for use of the piping and collection system will be materials that are available in Honiara.

53. Environmentally Sustainable Redesign of Seabreeze Amusement Park Waste Production

Briana Freeman, (Rich Bowden, Casey Bradshaw-Wilson), Allegheny College - Environmental Science

Corporate sustainability focuses on increasing a company's environmental responsibility while still focusing on the economic, social and moral aspects of business. The tourist industry, specifically amusement parks are major contributors to the production of landfill waste. Seabreeze Amusement Park is a family owned business located in Rochester, NY. The park currently sends approximately 2,400 tons of waste to landfills during each operating season (May through September), costing them around $18,800. To become more environmental responsible, composting is a plausible alternative for Seabreeze. Three options were proposed to Seabreeze Amusement Park, all with a shift towards composting. They include an onsite vermicomposting facility, an onsite in-vessel composting facility and an option to send compost to an offsite facility. The proposal includes the cost of development and the economic and social returns on investment. As well as, guidelines for switching to compostable paper and plastic products given out by the food stands and ways to get guests involved with the shift to composting. The following proposal was designed to push Seabreeze Amusement Park to become a more environmental responsible business. The official proposal was presented back to the managers and owners to be utilized how they best see fit.

54. Assessing the Degradation of Terrestrially Derived Dissolved Organic Matter in three Temperate Lakes

Sarah Magyan, (Christopher Dempsey), Gannon University - Environmental Science

In lake ecosystems, both biodegradation and photodegradation of dissolved organic matter (DOM) can occur. It is not clear which of the above processes are dominant in temperate lakes and on what time-scales these processes operate. Recent research highlights a strong link between a lake ecosystem and its surrounding terrestrial environment. To test the above hypothesis, we conducted short and long-term studies that focused on the processing of terrestrially derived DOM. Three experiments were conducted to determine whether biodegradation or photodegradation was more influential. In all experiments, terrestrial DOM samples were collected via lysimeters, which were installed in wetlands surrounding Lake Lacawac, Lake Giles, and Lake Waynewood (all in the Pocono region of Pennsylvania). The first experiment was conducted at the surface of Lake Lacawac, while the second and third experiments were conducted in the laboratory using controlled environmental chambers. Experiments ranged in length from 48 hours to 90 days. Changes in DOC concentration and quality (absorbance scans) were analyzed. Initial results show that photodegradation is more important than biodegradation, but that the response was variable by lake. Distinct differences were noted between the short and long-term rates of processing.

55. Historical Change in Impervious Surface Cover of Penn State Behrend

Rachel Pell, (Michael Naber, Pam Silver), Penn State Behrend - Environmental Science

Since its establishment, Penn State Behrend has undergone extensive urbanization. This has led to an increase in total impervious surface area. There are many detrimental effects to the ecosystem associated with this type of land change. This observable change in land cover was made quantifiable by conducting a Geographic Information System (GIS) analysis on aerial photos from the campus in 1937, 1957, 1967, and 2015. The entire area of the campus was mapped and categorized by land cover as road, sidewalk, parking lot, building, forest, field, etc. The results show that initially, there was an increase in forest as old farming fields were allowed to reforest. As the campus began to expand, the amount of impervious surface cover increased greatly. Continued work on this project will include calculations and statistics work to more precisely describe the changes shown by the maps.

56. Shoreline change of Presque Isle State Park from 1937 to 2015

Julia Guerrein, (Michael Naber, Pamela Silver), Penn State Behrend - Environmental Science

Presque Isle State Park has changed over time due to the movement of sand from the western part of the park to the spit, Gull Point. The topographical change of the park was mapped using aerial photos from six different time periods between 1937 and 2015. The detailed maps of the changes was made using Remote Sensing, Rubber Sheet, Mosaic photos, and PASDA Orthorectified images in ArcMap. These show the significant deposition of sediment to Gull Point, which has resulted in a change of plant and animal populations, most notably to rare migratory birds. The GIS analysis of the park gives other researchers a tool to minimize erosion.

57. Sustainable Waste Management: Application of yard clippings based Biochar for water treatment

Steven Houser, Blake Dantio, William Morris, (Varun Kasaraneni, Hwidong Kim), Gannon University – Environmental Engineering

The disposal of yard waste is costly and, in many states, illegal and takes up valuable space in landfills. One way to reduce the amount of yard waste in landfills is to use grass clippings as a feed stock to produce biochar. Pyrolysis is a method of decomposition at high temperatures in the absence of oxygen. For char production, 15 g of grass clippings were dried at 80°C for 24 hours, shredded at 5000 rpm for 15 seconds to create smaller grass clippings. The Parr reactor (model 4760) pressure vessel is used to produce the biochar. The char produced is more powdery in composition than granular. The char will then be activated using nitric acid to increase pore size and surface area. After activation, kinetic studies and batch isotherms will be conducted to determine the reaction order and the char's adsorption capabilities for metals such as arsenic, lead, copper, and nickel at various concentrations. The results of batch tests will be used to determine how the activated biochar will be applied to design and fabricate filter to test its metal removal ability under dynamic conditions. Filter uses will then be explored for residential, industrial, or commercial purposes depending on contaminant removal. Potential issues that may arise include pretreatment of the grass clippings due to residual fertilizer and pesticide concentrations, soil composition affecting grass quality, and technology limitations for complete biochar composition analysis. Ultimately, the results obtained from this project could reduce amounts of yard waste disposed of in landfills as well as create a sustainable product for water treatment.

58. Blood Makes the Flowers Grow: Studying Menstruators Menstrual Hygiene Product Usage and Knowledge of their Environmental Impact on Allegheny College Campus

Danielle Higbee, (Richard Bowden), Allegheny College - Environmental Science

There are three main ingredients in tampons and pads including cotton, polyester, and rayon. Each require processes which release harmful by-products into the environment. Two of the main processes to create paper products which includes tampons and pads are pulping and bleaching (Costello, et. al, 1989). These processes produce harmful by-products like dioxin (DeVito, 2002). After the products are used, they are thrown out or sometimes flushed down the toilet. If flushed, they can clog the facility causing extensive damage. If the tampons, pads, and applicators make it through the sewage system, even worse possibilities can arise like washing up on beaches or being eating by sea animals (Butler, 2016). Even when there are proper disposal methods their excess packaging will end up in the landfill. There are alternative methods to regular disposable tampons and pads. One example is the menstrual cup made of silicone. Instead of absorbing like a tampon, menstrual cups collect the blood during flow, but it can be used for up to ten years as opposed to a few hours (Diva International, Inc., 2017). Another alternative to the disposable menstrual products is a reusable pad. Similar to disposable pads, reusable pads are made of cotton. Despite this similarity between disposable pads and reusable pads, reusable pads can be used for many years. Disposable pads and tampons will be used for only a few hours before being thrown into the trash (Lunapads.com, 2018). These alternatives are not only less chemical intensive on the body but have a lesser impact on the environment. This study is aims to determine the menstrual hygiene product use on campus and the knowledge of those consumers on the environmental impact of those products through a survey. Additionally, two products, reusable pad and menstrual cup, were used by two groups of participants. After a few menstrual cycles, participants got together in focus groups to discuss their overall experience using the product.

59. Toxic effects of "environmentally-friendly" deicing alternatives on *C. dilutus. larvae* using 10-day spiked sediment toxicity tests

Megan Solan, (Samuel Nutile), Penn State Behrend - Environmental Science

Recent studies on the effects of increasing road salt pollution on aquatic organisms has incited development of new deicing formulations, many marketed as "environmentally friendly." As with any new product development, the effects of the chemical constituents on aquatic ecosystems should to be considered prior to allocating resources to purchase the product. Chemical risk assessment warrants investigation of chemicals released into the environment, which may accumulate in soils and sediments. Determination of contaminant toxicity can be evaluated using 10-day toxicity testing protocol. *Chironomus dilutus* was selected as the choice organism for its practical and historical application throughout environmental toxicology, ease of handling, and tolerance to contaminated sediments. Therefore, the objective of the current research was to determine toxicity of traditional deicing formulations versus those deemed environmentally friendly using 10-d toxicity tests involving *C. dilutus. C. dilutus* individuals were obtained from the established laboratory cultures and placed into exposure chambers containing either the reference toxicant (NaCl) at one of five concentrations (3, 5, 7, 9, or 11 g/L) or exposure chambers containing one of two environmentally friendly formulations at one of five concentrations (1, 3, 5, 7, or 9 g/L). Negative control chambers containing water only were also included. Preliminary toxicity testing data suggests that two popular deicing products, Safepaw and Snow Joe Enviro-Blend Ice Melter, are more lethal than traditional road salt formulations. Implications of these data prompt the need for further development of less toxic deicing products and highlights the ambiguity of products marketed as "safe."

60. Design of Wastewater Treatment for Erie Water Works Sommerheim Plant

Evan Wujcik, Jedadiah Bortz, David Bovkun, (Varun Kasaraneni, Hwidong Kim), Gannon University – Environmental Engineering

Erie Water Works Sommerheim plant is the primary water treatment and distribution plant for the city of Erie with a max capacity of 45 MGD. The plant on average produces 1.5 MGD of wastewater which is sent directly to the wastewater treatment plant without on-site treatment. The wastewater treatment plant charges Erie Water Works monthly based on raw water turbidity and output water flow. The objective of this work is to propose and design the most effective and economic on-site treatment method for wastewater generated at Erie Water Works Sommerheim plant. Currently, the plant produces wastewater with turbidity anywhere from 30 to 300 ppm. Erie Water Works may discharge water back into the bay at a TSS level of 5 ppm or less. To achieve this treatment goal, different technologies such as a series of screenings, filter press, or separators are being researched. The primary focus is a hydrocylcone centrifugal separator design. To accomplish the task of reducing raw water turbidity, the following tasks are being completed in chronological order: grain size analysis, TSS screening, determine best solutions design, cost analysis, prototype/drawings, design.

HUMANITIES & SOCIAL SCIENCES

61. Sustainable Consumption Goals, Automaticity, and the Consumption Context

Samuel Woodell, (Richard Vann), Penn State Behrend - Marketing

Consumers often struggle with enacting their environmental concerns when facing marketplace decisions (Carrington, Neville, & Whitwell, 2014). The problem addressed during the research was the notion of consumers being distracted from their environmentally-friendly intentions by cues in their environment (retail stores, websites) that activate competing consumption goals (Bargh & Chartrand, 1999). Based on pilot studies, we created a Qualtrics survey including question blocks about environmentally-friendly goal characteristics, a quality consumption goal or control scrambled-sentence task (meant to prime a competing quality-focused consumption goal), and three decision tasks (sock purchase, apartment search, speaker system selection) adapted from prior priming research (Chartrand, Shiv, Huber, & Tanner, 2008). Rather than identifying a simple main-effect, our final study (n = 299, recruited from Amazon's Mechanical Turk and pre-screened to have an active eco-friendly goal) demonstrated that participants were more susceptible to quality goal priming if they viewed their eco-friendly goal as less self-representative ($p = .03$) or autonomously motivated ($p = .03$). These results offer initial evidence that competing goal priming may distract consumers from their eco-friendly goal, especially if their goal is less internalized. Two other versions of competing consumption goal priming (a thrift-focused word task, online visual game priming task) will be used for replications and extensions of future research.

62. Exceeding Expectations: How the Behrend College Grew Exponentially

Michael Steadman, (Joseph Beilein), Penn State Behrend - History

Since the publishing of Ben Lane's book, Behrend Remembered Penn State Behrend has grown exponentially in nearly every way. Under the leadership of both Dr. John M. Lilley and Dr. Jack Burke, the Behrend College increased in enrollment numbers as well as geographically to the area that Behrend currently occupies. The library was completely upgraded adding to the collection of books that students could access. Even with all their success, there would be some rough patches that both deans needed to work through. But both were dedicated to their jobs and worked through them. For Behend to succeed during the college's early years, it needed strong leaders that were willing to dedicate most of their life to make this college a special place, and that is exactly what they got with both Dr. Lilley and Dr. Burke. An investigation of this growth reveals that Dr. Lilley and Dr. Burke's tenure the college saw an increase in donation and grants which allowed them to build more dorms and buildings for classrooms to help support the growing enrollment numbers. While it would appear obvious that more money will equal growth, Dr. Lilley and Dr. Burke were particularly savvy in their application of the funds that they helped raise. This presentation will attempt to better understand the relationship between development and fundraising and the growth of the college.

63. Funding and Support of the Apollo Project: The Role of Politics and Public Opinion

Dylan Perry, (Glenn Kumhera), Penn State Behrend - History

Presently, the Apollo Project is widely regarded as one of the single most impressive feats conducted by the United States to date. The problem with the current belief that the Apollo Project was universally embraced at its time is that this is not the entire story. For Apollo to even begin, a complicated amalgam of politics and public opinion were necessary to provide funding and support for the Apollo Project. The Apollo Project was one of the costliest projects ever undertaken by the U.S. government coming in at around $21.8 billion-$25 billion dollars in the 1960's ($148 billion-$170 billion in 2017). Political figures played an immense role in the future and success of Apollo. Some politicians, notably Dwight D. Eisenhower, initially wanted no part in an immensely expensive spending campaign on a Moon landing while ones such as John F. Kennedy and Lyndon B. Johnson were the driving forces behind keeping Apollo alive through their effective use of persuasion directed at both the American public and Congress. The public and their opinion on a Moon landing played a large role in the funding of Apollo. Public polls were conducted at different stages of Apollo which showed variances in the American public's opinion on such a project. Without the general support of the American public of Apollo, the political and governmental support and funding of it by Congress would be nonexistent. Politicians used their knowledge of political tactics, such as speeches and Congressional persuasion, to garner the necessary positive opinion and funding on Apollo. This presentation examines the role that public opinion and politics had on one of the most expensive projects ever undertaken: Apollo. Personal statements, finances, newspaper articles, and public opinion polls have been carefully analyzed, interpreted, and applied to understand the complexity and the uncertainty that shrouded the public and political figures alike during the Apollo Project and Moon landing during the 1960's.

64. Breaking the Chains: Re-Interpreting the Aztecs

Colin Shakespeare, (Patrick Cosby), Penn State Behrend - History

This research follows recent scholarship that reinterprets the world of the Aztec in sixteenth Century Mexico to contextualize the violence of human sacrifice within a complex cultural life. The first section of the paper deals with Aztec culture and daily life through an archeological lens. The second part of the paper looks at Aztec religion. Specifically, why they believed human sacrifice was acceptable, how religion shaped their culture, and myths and legends that accompanied the practice. The final section of the paper shows how the Aztec and Spanish people interacted with one another after the Spanish conquest in 1521. Without apologizing or attempting to justify the practice, I ultimately argue that human sacrifice should be seen in the context Aztec culture rather than through the moralizing gaze of the European conquerors.

65. Comparative Advantage and Economic Policy Tools based on a Local Economy's Imports and Exports

Hannah Carlino, (Travis Yates), Penn State Behrend - Economics

Comparative advantage is the single most important aspect when deciding if one will import, export, or be self-sufficient. This research initiative will discuss a methodology for identifying a comparative advantage between two counties or customized groups of counties. Current export data only captures international exports. The majority of exports, however, are domestic, meaning they are produced in one county and then exported to another county in the United States. This paper will seek to capture this elusive domestic export data and discuss the methodology for doing so. It will identify which sectors of the economy are bringing money into the region through exports. After this data is created it can be used to develop economic policy to help spur economic growth in the region. This initiative will discuss a unique methodology for discovering and analyzing comparative advantage between two counties, or groups of counties. The procurement of this information will help in determining whether a county should be exporting rather than importing, or importing rather than exporting. The main counties being discussed will be eight counties in Northwestern Pennsylvania. However, this methodology can be applied to other individual counties, customized groups of counties, metropolitan statistical areas, and/or states.

66. Information Literacy and Dual Enrollment Students

Julia Lombard, (Emmett Lombard), Gannon University – Information Literacy

Gannon University Professor Emmett Lombard and dual enrollment student Julia Lombard orally present their findings about information literacy awareness amongst high school students. They inform the audience about the literature on the topic, and share results of an information literacy activity geared towards high school/prospective higher education students. Learning obstacles will be identified, along with possible solutions.

67. Society's Perception of School Mathematics as Told through Memes

Rachel Hughes, (Courtney Nagle), Penn State Behrend - Education

This project explores society's perception of school mathematics through the collection and analysis of memes which portray the subject. Memes portraying the content of school mathematics, as well as portraying students and teachers of mathematics were collected. The memes were analyzed using the lens of standards documents, focusing on the Common Core's eight standards for mathematical practice. The findings highlight society's general perceptions of school mathematics as well as areas where those perceptions are consistent with or at odds with the desired outcomes of K-12 mathematics. These results can inform efforts to help students develop productive mathematical dispositions.

68. Anti-Fascist and Political Protest in Picasso's Guernica

John Jarecki, (Killic Kanat), Penn State Behrend - Poltical Science/Art History

Perhaps no artist has had a greater impact or has enjoyed a greater degree of influence over the scope of 20th century art than has Pablo Picasso. During his lifetime, Picasso set into motion entire schools and styles of painting; styles that would continue to be adapted, reproduced, and employed by subsequent artists. Most notably, Picasso's pioneering of cubism and his contributions to the surrealist movement have secured his legacy in the history of modern art. Less is known, however, about the political and socio-economic problems that haunted his contemporaries in Spain and throughout Europe. In April of 1937, Fascist planes bombed the small non-military community of Guernica, which resulted in the deaths of hundreds of Spanish civilians. The spirit and horror of the bombing can be, in part, understood by Picasso's 1937 mural Guernica, which abstractly depicts the event. This presentation will explore Picasso's political and social motivations for creating this work and others, analyze how style and composition in his paintings contribute to political meanings, and argue that each of Picasso's major works painted after the creation of Guernica express underlying political sentiments.

69. Political Identity of American Volunteers in the Spanish Civil War

William Belding, (Glenn Kumhera), Penn State Behrend - History

Political ideology among the American volunteers fighting on the Republican side of the Spanish Civil War has been a point of significant interest for scholars of the war. Sound research regarding the volunteers was hampered, however, by the dispersion of relevant documents among sealed archives in US and Soviet intelligence agencies, as well as the personal possession of the Volunteers and their friends and families. In the absences of documented evidence, Cold War prejudice against the left wing views held by most of the volunteers, and their association with the Soviet Union that had armed them in Spain, created a tendency to portray the Volunteers as "stooges" and Soviet agents. With the release and compilation of documents regarding the American's role in the War, however, it is possible to create a more detailed and accurate construct of the prevailing ideologies among the volunteers. Through this research and evaluation, it is possible to understand the nature of political organizing, and political life among American radicals before the distortions of the Cold War.

70. Brief History of the Fuzz Detector

Isabelle Odell, (Aaron Mauro), Penn State Behrend – Digital Media, Arts, and Technology

The Brief History of the Fuzz Detector supplies a piece of paper production past to not just engineers and people in the papermaking industry, but also everyday people interested in learning the diverse and unexpected history of paper manufacturing. The Fuzz Detector was a device created by Albert S. Goodrich and Charles R. Tait, two engineers who worked for the Hammermill Paper Company in Erie, PA. The device was designed to allow a person to look at the surface of a sheet of paper and inspect it for "fuzz" or other defects. This document, The Brief History of the Fuzz Detector, covers correspondence between William Brust, Albert Goodrich, and Charles Tait, interest in the Fuzz Detector from various companies around the world, accounting sheets from George Carr, and other various documents about the Fuzz Detector and its successor, the Paper Inspector. The Paper Inspector was an improved instrument that was more flexible and adaptable than the Fuzz Detector. In the documents, the men discuss various issues that arose, like the patent and production costs, but the outcome to some of the problems are unknown because of missing documents; we have a small window into the processes of the company at the time, particularly as these processes relate to quality assurance. The messages begin in 1936 and continue regularly until 1943 when they end abruptly. After 1943, there is only one letter, from 1946. The letter states that production of the Fuzz Detector ceased during World War II, which explains why the correspondence ended in 1943, the same year the War began.

71. Anti-Fascist and Political Protest in Picasso's Guernica

John Jarecki, (Killic Kanat), Penn State Behrend - Poltical Science/Art History

Perhaps no artist has had a greater impact or has enjoyed a greater degree of influence over the scope of 20th century art than has Pablo Picasso. During his lifetime, Picasso set into motion entire schools and styles of painting; styles that would continue to be adapted, reproduced, and employed by subsequent artists. Most notably, Picasso's pioneering of cubism and his contributions to the surrealist movement have secured his legacy in the history of modern art. Less is known, however, about the political and socio-economic problems that haunted his contemporaries in Spain and throughout Europe. In April of 1937, Fascist planes bombed the small non-military community of Guernica, which resulted in the deaths of hundreds of Spanish civilians. The spirit and horror of the bombing can be, in part, understood by Picasso's 1937 mural Guernica, which abstractly depicts the event. This presentation will explore Picasso's political and social motivations for creating this work and others, analyze how style and composition in his paintings contribute to political meanings, and argue that each of Picasso's major works painted after the creation of Guernica express underlying political sentiments.

POSTER PRESENTATION ABSTRACTS

BIOLOGY I

1. Role of Ent Proteins in Nitrogen-Regulate Growth of *Saccharomyces cerevisiae*

Allyson Owens, Olivia Haile, (Quyen Aoh), Gannon University - Cell & Molecular Biology

Cell membrane trafficking is the movement of important cellular cargo between the plasma membrane and organelles. In eukaryotic cells, trafficking plays a key role in proper nutrient uptake, which is essential to cell growth. We are examining the role of trafficking in regulating the localization of nitrogen permeases in the yeast /Saccharomyces cerevisiae/. More specifically how two clathrin adaptors, Ent3 and Ent5 regulate cell growth and affect trafficking of nitrogen permeases under preferred nitrogen sources ammonium and glutamine, and the non-preferred source proline. Ents are adaptor molecules that facilitate the trafficking of many proteins at the trans-Golgi network (TGN) and endosomes. We performed a growth curve assay in mutant cells with single or double deletion of Ent3 and Ent5 to examine cell fitness. Our preliminary data shows that deletion of Ent3 or Ent5 has no significant effect on growth in any of the nitrogen sources, but simultaneous deletion of both Ents causes a significant growth defect in the preferred nitrogen sources, suggesting that both Ent3 and Ent5 are required for robust growth in preferred nitrogen sources, but not in the non-preferred source. To assess the role of Ent3 and Ent5 on trafficking of nitrogen permeases, we monitored localization of the reporter permease Gap1 tagged with Green Fluorescent Protein (GFP) in ent3ΔΔ and ent5ΔΔ mutants in proline and ammonia, and no significant effect on Gap1 localization. The results from our study will give us a better understanding of the regulatory mechanisms that control nitrogen metabolism and cell survival.

2. Examining the effect of Resveratrol Treatment on a Fruit Fly Model for TPI Deficiency

Austin Shirk, Annette Choi, (Martin Buckley, Stacy Hrizo), Slippery Rock University of Pennsylvania - Cell & Molecular Biology

TPI (triosephosphate isomerase) deficiency is a progressive and devastating neurological disease that leads to neuromuscular degeneration and decreased longevity in the patient. There is currently no treatment for this disease. Interestingly, a missense mutation in the Drosophila TPI gene (TPIsgk) causes analogous symptoms in flies (paralysis due to extreme heat or mechanical stress). Previous studies have demonstrated that mutations in TPI cause increased oxidative stress in the Drosophila. Intriguingly, stress phenotypes in the mutant flies worsened with exposure to oxidizing agents. In contrast, treatment with reducing agents improved the paralysis phenotypes. These findings indicate that the TPIsgk mutant has an oxidized redox state that contributes to pathogenesis of the disease. Thus, anti-oxidants may be a class of compounds to treat familial TPI deficiency. To test this hypothesis, we examined the impact of the anti-oxidant resveratrol (found in red grapes) on the paralytic phenotypes found in TPIsgk flies. To do this, we reared TPIsgk and wild type flies on food with or without the anti-oxidant resveratrol and assayed the paralysis phenotypes with mechanical and heat stress. As expected, treatment with resveratrol significantly improved the mechanical stress phenotype in mutant flies. This finding indicates that resveratrol treatment could be used as a therapy for TPI deficiency. In the wild type flies, resveratrol treatment diminished their heat stress phenotype. We hypothesize that this is because in WT flies, resveratrol triggers the expression of the heat shock response pathway to produce the Hsp70 chaperone protein. Hsp70 then mitigates protein misfolding, thereby improving resistance to heat induced paralysis. To begin testing this hypothesis, we are examining the impact of resveratrol on the expression of the heat shock response pathway in living cells.

3. The Effect of DMN on the Expression of Pathogenesis-Related Protein 4 in *Solanum tuberosum*

Abrar Aljahani, (Michael Campbell), Penn State Behrend - Cell & Molecular Biology

It has been shown in recent studies that DMN, (1,4-dimethylnaphthalene), a bio-chemical substance used as a natural preservative, can successfully exert its effects on halting cell division in *Solanum tuberosum*. By preventing cell division, potatoes can be stored for a longer period of time without sprouting. RNA sequence data of potatoes treated with DMN revealed that the gene coding for pathogenesis-related protein 4 (PR-4) is significantly induced in response to DMN. Given that potatoes were treated with DMN in different seasons over the period of two years, the level of PR4 gene expression increased by three folds in the fall and winter, early and mid-storage, and by six folds in the spring, late storage. PR-4 protein belongs to a large family of plant host proteins triggered in response to pathological situations, such as bacteria or virus invasion. Members of PR protein family have different functions. PR-4 is specifically involved in wound response, and it has both RNAse and DNAas activity. In this project, it is hypothesized that the upregulation of PR-4 gene and the increase of its transcript would potentially result in the increase of the protein level. Further examination of PR-4 protein concentration will be achieved by the extraction of the protein from *Solanum tuberosum* root meristem and the use of polyclonal PR-4 antibody.

4. Role of SCAMP3 in B-Amyloid Production and Secretion

Maura Mobilia, (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 βamyloid is related to the processing of the amyloid precursor protein (APP). The degradation of APP is regulated by the endosomal sorting complexes required for transport (ESCRTs) and disruption of ESCRT function leads to accumulation of βamyloid. Previous studies have shown that secretory carrier membrane protein 3 (SCAMP3) interacts with ESCRTs that function in APP processing. We hypothesize then that SCAMP3 functions in trafficking of APP. In this study we use a well-established ELISA assay to determine if RNA-induced knockdown of SCAMP3 promotes or inhibits β-amyloid production.

5. The Effect of 1,4-dimethylnaphthalene on mir-166 microRNA

Alhanouf Alharbi, (Michael Campbell), Penn State Behrend - Cell & Molecular Biology

The compound 1,4-dimethylnaphthalene (DMN) is a natural growth inhibitor produced in dormant potatoes. It prevents potato tubers from sprouting by halting cell division. Recent studies have shown that DMN prevents the growth of microbiomes present on the surface of stored potato tubers. However, the effect of DMN on small RNAs has not been yet investigated. The molecule miR166 is a highly conserved class of miroRNA in many plants. It is found in meristems, and it modulates transcripts of the III homeodomain-leucine zipper family genes to control plant growth. High expression of miR166 in Arabidopsis thaliana downregulated transcription factors such as Phavulota (PHV) and Phabulosa (PHB), suppressing growth of various parts of the plant. Therefore, we hypothesized that DMN increases miR166 expression to inhibit sprouting. Potatoes were exposed to DMN or nuclease-free water (control) for two days. Meristems were isolated, frozen in liquid nitrogen, and stored at -80 C. RNAs were isolated using mirVana kit (Thermofisher.com). Total RNA was measured and converted into cDNAs using stem-loop primers, specifically made for miR166. Taqman qtPCR was used to quantify the expression of miR166 in control and treated samples. The results obtained from taqman qtPCR showed that the expression of miR166 in the treated sample was equivalent to the control sample, suggesting that DMN did not change miR166 expression in dormant potatoes. Further experiments will determine if DMN alters miR166 expression in potatoes after dormancy terminates.

6. Examining if Expression of a Mutant Form of Triose Phosphate Isomerase Results in HSF Activation Using Live Cell Imaging

Kaitlyn McNamara, Kathryn Skolnick, (Stacy Hrizo, Martin Buckley), Slippery Rock University - Cell & Molecular Biology

The purpose of this study is to determine if a mutation in the triose phosphate isomerase (TPI) gene in Drosophila melanogaster results in the activation of the cell stress gene, Heat Shock Factor (HSF). TPI is an enzyme that is responsible for the production of glyceraldehyde-3-phosphate from dihydroxyacetone phosphate in glycolysis. Mutations in TPI are associated with the human disorder, TPI Deficiency. A deficiency in the function of TPI causes individuals to exhibit age-dependent neurodegeneration, hemolytic anemia, increased oxidative stress and susceptibility to infection. These symptoms result in a shortened lifespan for the affected individual. There are currently no known treatments or cures. It is not known if changes in glycolytic activity due to mutations in TPI activate stress response pathways in the cells of these individuals. If they do, these pathways may become pharmacological targets for treatment of individuals with TPI deficiency. One cell stress pathway is the activation of the transcription factor, HSF. HSF is a transcriptional regulator of genes encoding chaperones and other proteins involved in the stress response. Increased expression of HSF target genes prevents protein misfolding and aggregation. If the HSF response does not occur properly, damaged proteins can accumulate in the cell leading to cell death. Our lab has Drosophila with an endogenous copy of GFP tagged HSF. This allows for in vivo visualization of the localization of HSF in the cell. Through genetic crosses, a mutant TPI fly line will be generated that will contain the HSF-GFP construct. It is hypothesized that if HSF is activated in the mutant TPI flies, binding at the HSP70 loci will be observed by confocal microscopy. GFP-HSF expression will also be evaluated in wildtype flies at room temperature (negative control) and wildtype flies after heat shock at 37C (positive control).

7. Pathogenesis Related Protein 5 Expression Influenced by 1,4-dimethyl naphthalene Treated Potato Meristems

Maria Pirritano, (Michael Campbell), Penn State Behrend - Cell & Molecular Biology

The agricultural compound 1,4-dimethyl naphthalene (DMN) can be used to inhibit sprouting and prolong the storage of *Solanum tuberosum*. Potatoes treated with DMN exhibit characteristics including pathogen response, water retention, and greater shelf life, however, the mechanism by which DMN brings about these changes is not well understood. Two years of RNA-seq data demonstrate extensive changes in gene expression within potato samples treated with DMN at different times throughout the year. Significant changes have been highlighted among a particular group of genes located on chromosome one. Pathogenesis-related-protein, PR5 is an extracellular protein with an extensive signal transduction that responds to pathogens and abiotic stress. Among the PR5 family is a group of cytosine-rich proteins called osmotins. Osmotin is a ubiquitous protein among several plant species and serves as a molecular marker for the systemic acquired resistance response, which is analogous to the innate immune system in plants. Gene expression measurements were taken over a six month period, during which dormancy was naturally breached. RNA-seq data reveals 2-3 fold increases between measurements before, during, and after dormancy was broken. These trends in gene regulation imply that the PR5 expression proceeds concurrently with sprout growth in DMN treated potatoes, and are related to the systemic changes seen from the outside of the potato. Phylogenetic analysis reveals the PR5 genes with the greatest changes in expression (7865 and 7870) demonstrate homology among their transcripts. Current analysis is being done using qPCR primers directed towards genes 7865 and 7870. Expression levels from qPCR should mirror the RNA-seq data, in addition to demonstrate more immediate expression following DMN treatment. It has been hypothesized that gene expression spikes in prominent PR5 genes (7865 and 7870) will signify a broad molecular mode of action DMN plays inside /*S.tuberosum*/.

8. The Growth of *Fusarium oxysporum* Spore Isolates from Potato is Inhibited by 1,4-Dimethylnaphthalene

Rachael Adams, (Michael Campbell), Penn State Behrend - Cell & Molecular Biology

Prolongation of storage via temporary meristematic sprout inhibition has effectively been carried out in tubers after brief exposure to 1,4-dimethylnaphthalene (DMN), a compound naturally abundant in the tissues of dormant potatoes. Not only does DMN suppress meristematic growth, but studies have shown that DMN greatly impacts the microbiome on the surface of potatoes, especially with regards to species diversity. Among the diverse microbiome population is *Fusarium oxysporum*, a particular strain of pathogenic fungus responsible for the plant disease fusarium wilt. *F. oxysporum* was successfully isolated from the surface of a tuber using the fusarium selective media Nash-Snider, to which cultures were transferred and maintained on nutritionally complex potato dextrose agar plates. DNA sequencing using selective primers NL1, NL2, ITS1F, and ITS2R confirmed the fungus to be *F. oxysporum*. A single spore isolation technique was utilized to record the number and growth response of spores treated with DMN vs spores treated with water (control). Single spore isolate plates were contained in vacuum sealed chambers and incubated at a constant 22^{o}C while exposed to 7.5ul DMN via aerosol dispersion for four days. After a day of rest, the spores on each plate were measured and counted. The results concluded spores exposed to DMN showed slower diameter growth than those treated with water. Knowing the effect of DMN on *F. oxysporum* is critical in controlling and preventing harvest loss brought on by fusarium wilt. In an attempt to gain more insight on the specificities of the DMN-fungal conundrum, further studies are still being conducted.

BIOLOGY II

9. Inactivation of Escherichia coli on Spice-infused Media Via Radiant Catalytic Ionization

Christopher Pasky, Elena Tran, Thomas McCoy, Andre Francis, Roman Fedchik, (David Fulford, William Mackay, Craig Steele), Edinboro University of Pennsylvania - Microbiology

Foodborne illnesses have become a major concern in the United States. The Center for Disease Control and Prevention (CDC) estimated that foodborne pathogens cause approximately 79 million illnesses, 325,000 hospitalizations, and 5,000 deaths in the United States, annually. *Escherichia coli* is one of the most concerning foodborne pathogens. Food safety and handling research and methods development spotlights Radiant Catalytic Ionization (RCI) as an effective pathogen control measure and sanitizing technique in the food industry. The RCI process generates oxidative gases to produce reactive oxygen species, such as a hydroxyl radical and a superoxide anion, which attack the polyunsaturated fatty acids of the fatty acid membrane and result in lipid peroxidation of the bacterial membrane and reduced cell viability. Previous research has shown that RCI causes a 90% killing of foodborne pathogens during a thirty-minute exposure. Various concentrations of *E. coli* are inoculated on several spice-infused media, to stimulate common food products. The media chosen for this study includes Tryptic Soy Agar (TSA) and TSA infused with organic cinnamon spice, organic garlic spice, and organic ginger spice. The spices were chosen for their natural antimicrobial properties. This study examines the synergistic effects of the spices and RCI exposure and observes the reduction in bacterial populations.

10. Investigating the Synergistic Effects of Green Tea and Î²-lactam Antibiotics

Alex Benedetto, (Kevin McDade), Penn State Shenango - Microbiology

One of the biggest contributions to the prevention of infectious disease has been the development of antibiotics. However, due to their ability to transform their DNA and rapidly evolve, bacteria can acquire antibiotic resistance at an alarming rate. This has led to more costly health care, higher mortality rates, and the need to develop alternative solutions. As one potential solution, green tea has been studied and proven to be successful at inhibiting both Gram-positive and Gram-negative bacteria. Although it's exact primary mechanism of action is yet to be determined, it is largely believed to be attributed to the presence of the polyphenols epigallocatechin gallate (EGCG) and epicatechin gallate (ECG). Due to their negative charge, EGCG and ECG can bind to positively charged lipids on the bacterial cell wall and disrupt enzymatic pathways essential for reproduction and growth. It has also been suggested that this binding causes a phenotypic reversal of antibiotic resistance in Gram-positive bacteria by interfering with the cell wall protein PBP2a. The purpose of this study is to further investigate the synergistic effects of green tea and B-lactam antibiotics against Gram-positive bacteria. The approach will be to perform a Kirby-Bauer disk diffusion susceptibility test to compare across green tea dosage and susceptibility for 5 types of Gram positive bacteria. Once we have obtained susceptibility and dosage data, a multiple sequence alignment will be performed to identify potential PBP2a copy number variants and indels that contribute to the susceptibility. In the first trial we have identified susceptibility in Bacillus cereus for green tea extract. Further investigation of green tea susceptibility is warranted in other types of Gram positive bacteria. Green tea extract can be a potential supplement to various infectious disease treatment plans.

11. Study Examining the Antibacterial Effectiveness of Agion Silver Zeolite Technology in the Biofilms Found in the Ecosystems within the Wintergreen Gorge and Behrend Campus

Anthony Popoff, Na Cho, Tyler Hostetler, (Beth Potter), Penn State Behrend - Microbiology

Silver, the precious metal, has been used to fight infection for many years due to its antimicrobial properties. This metal was incorporated into the aquatic ecosystem of the Wintergreen Gorge by being used in a coating applied to stainless steel coupons. The ability to test silvers antimicrobial properties were demonstrated through placing silver coated and non-silver coated steel coupons in three different streams for three different incubation periods, one week, two weeks, and four weeks. Parameters such as; pH, salinity, temperature, [Nitrate], [Phosphate], alkalinity, dissolved oxygen, light exposure, width, and depth were measured upon each incubation interval. The biofilms that developed on each plate were scraped off and spread plated onto M-TEC and TSA plates to show the abundance of growth on the two different coupons and at how the incubation time affects it. Streak plates were grown to achieve a pure sample of each grown species to preserve and obtain the DNA to be BLASTed and identified. This allows us to identify what bacteria species were and were not able to grow on the steel coupons with and without the presence of the silver zeolite carriers. The total number of colonies grown on each plate showed a trend that more colonies would grow on the coupons lacking the silver ions, while the coupons with the silver coating generally grew less. The difference in incubation times did not directly correlate to a change in the amount of growth in TSA plates, however the M-TEC plates did show more growth in the longer incubated groups.

12. Use of a service-learning project in introductory microbiology lab to understand how students feel about handwashing and vaccinations

Kaitlyn White, Trina Laffey, Olivia Myers, Bianca Johnson, Sara Shuhart, (Beth Potter), Penn State Behrend - Microbiology

Washing one's hands is the easiest and cheapest way to keep yourself healthy, but many of us do not wash our hands correctly or as much as we should. Another mechanism to keep us healthy are vaccinations. The latter has been a controversial topic since an error-prone study was published suggesting links between vaccinations and autism. To help educate our student population on these two topics, students enrolled in Introduction to Microbiology Laboratory (MICRB202) participated in a service learning project to help students learn how to properly wash their hands and learn more about the vaccinations, specifically highlighting changes to the immunization requirements for Penn State students. To develop a greater understanding of the public health predispositions of the Behrend community and aid in refining this activity in future semesters, Behrend students were asked to fill out and surveys on both handwashing techniques and their beliefs and feelings towards vaccinations. The goal of this project is to electronically organize all the data collected and to run statistical analyses on the collected data.

13. Female Flora: Influence of Presence of *Lactobacillus vaginalis* and *Gardnerella vaginalis* on *Haemophilus ducreyi* Growth

Leah Kelly, (Tricia Humphreys), Allegheny College - Microbiology

Chancroid is a sexually-transmitted ulcerative disease caused by *Haemophilus ducreyi*, a human-specific pathogen that has been found to also facilitate other STDs such as HIV. Studies have found that females have a significantly lower natural infection rate than males. This could be due to differences in the natural flora between the two sexes, specifically because of the natural defense mechanisms found in the female natural flora. *Lactobacillus* has been found to maintain adequate vaginal health in women through inhibiting disease-causing bacteria and maintaining the overall low pH of the vagina. Conversely, *Gardnerella vaginalis*, another bacteria found in the female microflora, has been found to have opposite effects as its proliferation results in female-specific diseases such as Bacterial Vaginosis (BV). BV, like chancroid, facilitates the transmissions of other STDs. Two *Lactobacillus vaginalis* strains (08 and 11) and *Gardnerella vaginalis* were co-cultured with *Haemophilus ducreyi* to assess their effects on the pathogenic bacteria. Understanding bacterial interactions between naturally occurring bacteria in female flora and *H. ducreyi* was my experimental aim through this study. In a two-way co-culture between *L. vaginalis* (08 and 11) and *H. ducreyi*, *L. vaginalis* (08 and 11) completely inhibited the growth of *H. ducreyi*. In a two-way co-culture between *G. vaginalis* and *H. ducreyi*, both bacterial species displayed increased growth. The inhibitory effects that *L. vaginalis* has on *H. ducreyi* could be applicable to developing an easily accessible probiotic geared towards a more preventative measure of maintaining adequate vaginal health in resource-poor areas.

14. Ecology of Zoonotic Infectious Disease: Small Mammal Reservoirs and Coinfection Risk by Tick-Borne Pathogens

Kevin Regan, Jeffery Larkin, Charlie Eichelberger, Joseph Wisgo, (Vida Irani), Indiana University of Pennsylvania - Microbiology

Prevalence rates of *Ixodes scapularis* (blacklegged tick) with tick-borne zoonotic pathogen *Borrelia burgdorferi* (Lyme disease) has been growing in areas across the Northeastern and Midwestern United States with central Pennsylvania (PA) now considered a Lyme disease hotspot. Since blacklegged ticks are known vectors for additional zoonotic pathogens *Babesia microti* (Babesiosis) and *Anaplasma phagocytophilum* (Granulocytic Anaplasmosis), there is potential for more than one pathogen to be delivered via a single tick bite to a variety of hosts, including humans. In the natural ecosystem, small mammal species *Peromyscus leucopus* (white-footed mouse), *Myodes gapperi* (southern red-backed vole), and *Blarina brevicauda* (northern short-tailed shrew) act as a host/reservoir for these 3 zoonotic pathogens, thus resulting in pathogen (co)transfer to the blood feeding ticks. But studies evaluating the contribution of these small mammals to the (co)infection rate of zoonotic pathogens among blacklegged ticks is currently lacking. Thus, to better understand the role of these 3 small mammals as reservoirs in blacklegged tick (co)infection with the above 3 zoonotic pathogens, a molecular ecology study is being conducted across 8 PA counties with a high incidence of Lyme disease. Using PCR, a total of 105 small mammal blood samples collected across 8 central PA counties will be analyzed for DNA of the above 3 zoonotic pathogens. Ecological, geographical, and molecular data gathered for this study will aid to dissect the role of these mammal species as reservoirs for any/all of the 3 pathogens. Understanding the relationship of zoonotic pathogen (co)infection in small mammal reservoirs is important for more accurate mapping of current high-risk areas and identification of potential future high-risk areas of (co)infection, which will allow for improved public awareness regarding the transmission and potential health implications of these tick-borne zoonotic pathogens.

15. *Enterobacter aerogenes*: Antibiotic Resistance Responses

Matthew Dilts, (Narveen Jandu), Gannon University - Microbiology

Antibiotic resistance is a growing problem around the world, with no sign of stopping. Antibiotic resistance is a major concern with *Enterobacter aerogenes* (*E. aerogenes*); a gram negative, rod shaped, bacterium which belongs to the family *Enterobacteriaceae*. *E. aerogenes* is an incredibly versatile and adaptable specimen, which is often multidrug resistant, and in some cases pandrug resistant. The organism is naturally found in the gastrointestinal tracts of animals, including humans. The species includes both pathogenic, and non-pathogenic strains, however the major problem caused by this organism is nosocomial infections, as it is an extremely opportunistic microorganism. Nosocomial infections are infections brought on in the hospital environment, as opposed to the community environment. Most commonly *E. aerogenes* causes urinary tract infections, respiratory tract infections, and bacteremia. In 2017 *E. aerogenes* was identified by WHO as a top priority for global research and drug development. Similarly, infections with carbapenem resistant Enterobacter species have a mortality rate of 40-50% in the United States. The main objective of this study is to determine the viability and growth response of a laboratory strain of *E. aerogenes* to common antibiotics tetracycline, ampicillin and streptomycin, in the laboratory setting. We hypothesize that *E. aerogenes* will exhibit greater antibiotic resistance relative to non-pathogenic *Escherichia coli*. Preliminary results reveal a dose-dependent inhibition of *E. aerogenes* growth when exposed to increasing concentrations of ampicillin (0.01ug/mL to 0.133ug/mL). Further studies will explore the growth of *E. aerogenes* with other antibiotics, and with combinations of antibiotics, in reference to *Escherichia coli*.

16. College Student Vaccination Rates and Influenza-like Illness

Cheyenne Annarumo, (Narveen Jandu), Gannon University - Microbiology

A college campus provides a unique setting for the ease of transmission of various infectious disease agents. Housing styles can vary from off-campus to on-campus, with room-mates or without room-mates, shared bathroom facilities or private facilities. Regardless of housing style, students will share many other common spaces (i.e. study spaces, dining areas and social rooms). The aim of this study was to determine if campus housing style impacts the frequency of influenza-like illness amongst college students. Methods: In this study, an online survey was used to determine the influenza vaccination status, housing-style and frequency of illness amongst college students. Survey responses were collected from Oct. 1, 2017 to Jan. 1, 2018. A total of 290-students consented to completing the online survey. Results: The majority of respondents, 63% (n=183) indicated that they received the influenza vaccine, while the remaining 37% (n=107) did not receive the influenza vaccine. In relation to housing-style, the majority of freshmen (56%) live in on-campus suite-style residence with private bathrooms, the majority of sophomores (67%) live in on-campus apartments with private bathrooms, some juniors (31%) may still be living in these on-campus apartments, while some juniors (38%) have transitioned to off-campus housing; and most seniors (61%) are living off-campus. Regardless of housing, 55% of respondents self-reporting getting sick a few (3-5) times per year. In comparison, to their previous year on campus, however, 49% of respondents indicated that they were less sick in subsequent years compared to previous years. Conclusion: College students are susceptible to influenza-like illness in-part due to close proximity in living arrangements and sharing. As students transition through their years of college, changes in their living arrangement (from on-campus to off-campus) and other lifestyle choices will result in less cases of illness throughout the year.

17. Opiates, Injection Drug Users, MRSA & Endocarditis – What's the Link?

Jared McLaughlin, (Narveen Jandu), Gannon University - Microbiology

Endocarditis, or Infective Endocarditis, is an infection of the heart, specifically of the endocardium. The endocardium consists of the innermost lining of the heart chambers and heart valves. Endocarditis is treatable, but if left untreated, the infection can quickly spread throughout the body. Endocarditis initially affects the heart but can enter the bloodstream and spread to attack the central nervous system, kidneys, lungs, and other major organs. The most prominent infective microorganism that causes Endocarditis is *Staphylococcus aureus*. *S. aureus* is a Gram-positive, coccoid bacterium that is spread from human to human via contact. *S. aureus* is more commonly implicated in MRSA (methicillin-resistant *Staphylococcus aureus*) infections, which can range from annoying superficial skin infections, to more serious deep tissue infections and cardiovascular infections (as in the case of infectious endocarditis), to deadly blood infections (i.e. sepsis). MRSA is extremely difficult to treat due to its resistance to methicillin plus multiple additional antibiotics. *S. aureus* is known as one of the most prominent human disease-causing bacterium and infections are frequently seen in both the health care setting and in the general population, most notably amongst intravenous drug users. Endocarditis is rare in humans with healthy hearts, but in drug users, the number of infected people is much greater. Intravenous drug users are at a much greater risk for endocarditis, more specifically right sided endocarditis. In this presentation, authors discuss the increased risk of endocarditis amongst intravenous drug users and the possible cause of increase over the years.

BIOLOGY III

18. Seasonal Effects on Dopamine Levels in Human Urine

Ashley Crilley, Shamim Chaparian, Isaac Hodapp, (He Liu), Gannon University - Neuroscience

Dopamine is a neurotransmitter, the chemical signal molecule between nerve cells. Dopamine is produced in many different areas of the brain, such as the substantia nigra and the ventral tegmental area. It is essential for numerous functions, including pleasure, mood, motivation, movement, and attention. Diminished production of dopamine plays a critical role in Parkinson's disease. In this study, 63 urine samples (23 in early February and 40 in early September) from Gannon University students and members of the Erie community were collected. We were interested in finding out how the levels of dopamine in the body differ under certain conditions, for example, gender, diet, exercise level, and seasons. We tested for the change in dopamine concentration with an ELISA kit. The sample concentrations were calibrated by creatinine, a metabolic product produced at a relatively constant rate in the body. Our results show that the average dopamine level in the samples collected in the winter is more than twofold the average dopamine level in the samples collected in the summer, with or without creatinine calibration. A subset of the subjects who gave samples in both seasons also showed similar differences. Further data analysis will be conducted to examine correlations between the variation of dopamine levels and other factors.

19. Investigating the Neuronal Connections Between the Mediodorsal Thalamus and the Brainstem of Cynomolgus Monkeys

Nina Neumann, Agata Pietrzak, Samuel LaFuria, (Darlene Melchitzky), Mercyhurst University - Neuroscience

The mediodorsal thalamic nucleus (MD) has been shown to have reciprocal neuronal connections with the prefrontal cortex (PFC), and damage to the MD has been shown to have effects similar to damage to the PFC itself, such as working memory deficits. While these connections between the MD and PFC have been studied in detail, empirical evidence of possible connections between the lateral MD and the brainstem is lacking, and thus was the subject of this research. In a previous study, cynomolgus monkeys (*Macaca fascicularis*) were injected in the lateral MD with the retrograde tracer Cholera Toxin Subunit B. Slides from that study were used to determine the number of labeled neurons in the brainstem with tracings using the Camera Lucida drawing tube. Projections to the lateral MD were seen originating from a wide range of brainstem nuclei, including the deep mesencephalic nucleus, and the oral pontine nucleus, the dorsal raphe nucleus, the locus coeruleus and the peduncluopontine nucleus. As these areas of the brainstem have been indicated in diverse functions such as sleep patterns, vestibular functions, stress modulation, motor control as well as cognitive processes such as attention, these connections from the brainstem to the MD may be a means of modulating vital autonomic, homeostatic, and integrative information between the brainstem and the PFC.

20. Fixed Interval Performance of Rats: A comparison of VPA Autism model Rats and Typical Neuro-developing Rats

Alexis Sotelo, Jessica Parkinson, (Rodney Clark), Allegheny College - Neuroscience

The purpose of the present study was to analyze and compare the response rates (response / minute) between the Valproic Acid (VPA) and non-Valproic Acid (non-VPA) rats on Fixed Interval (FI) schedules of water presentation. Rats responded under three fixed interval schedules of water presentation. The schedules were in intervals of FI =10, 20, and 30" respectively. Each interval was in effect for ten days. Each experimental session lasted for twenty minutes each day and rats were water deprived for 23 hours prior to each experimental session. The non-VPA rats performed at consistently higher response rates than the VPA rats. In the FI 10" the both the VPA and non-VPA response rates were almost identical until day four. After which, the VPA rats displayed repetitive movements that were not compatible with lever-pressing. Under the FI 20 and FI 30" schedules, the non-VPA animals generated a relatively higher response rate which was consistent from the first day of each fixed interval, whereas it took the VPA rats until about day five to display consistent responding.

21. Connections between the Basal Forebrain and the Lateral Mediodorsal Thalamic Nucleus in Macaque Monkey

Megan Conley, (Darlene Melchitzky), Mercyhurst University - Neuroscience

The lateral mediodorsal thalamic nucleus (LMD) is well known for its role in higher-order cognitive functions, and its projections with the prefrontal cortex (PFC) are likely involved in these cognitive processes. The basal forebrain (BF) is also involved in cognition, notably in the functions of attention. This may suggest shared circuitry between the LMD and BF. However, previous studies have found no empirical evidence suggesting the presence of connections between the LMD and BF. The goal of this study is to examine the possible projections from the BF to the LMD. In a previous study, cynomolgus monkeys (*Macaca fascicularis*) were injected in the LMD with the retrograde tracer Cholera Toxin Subunit B. Slides from that study were used to determine the number of labeled neurons in the BF. Initial analysis revealed labeled cells in numerous BF regions after injection into the MD. In particular, the basal nucleus of Meynert and the substantia innominata contained labeled neurons. Interestingly, rostral LMD injections produced more labeling in the BNM than caudal LMD injections (33% versus 14%, respectively). These findings suggest that the projections from the BF to the LMD are topographically organized and that BF afferents to the LMD may serve as a transthalamic circuit connecting the BF and the PFC.

22. Effects of Exogenous Estradiol Administration on BACE-1 Alzheimer's Disease Model Mice

Kathryn Weiss, (Lee Coates), Allegheny College - Neuroscience

Alzheimer's Disease (AD) is a progressive, neurodegenerative disorder marked by severe brain atrophy and the presentation of abnormal accumulations of beta-amyloid and tau proteins. AD symptoms include memory loss, language deficits and impaired awareness, especially in regard to place, time, or personal identity. Findings show that two-thirds of all individuals with AD are older women. Estradiol, the most prominent estrogen, is known to have neuroprotective effects in both females and males. After female menopause, there is a sharp decline in estradiol, and the production of this hormone eventually ceases. Theoretically, postmenopausal women lose the protective effects of estradiol, which may be contributing to the difference in AD prevalence rate between sexes. Estradiol treatment before the onset of menopause may decrease the risk of AD development in females. In this study, BACE1 AD Model Mice aged 2-7 months were ovariectomized and administered 1.12 µg 17β-estradiol in 0.1 g of Nutella daily over a period of 4 months. A control group received a sham surgery and placebo of untreated Nutella. Post surgery, Morris Water Maze and Y Maze behavioral tests were performed weekly to determine changes in cognition. The mice receiving estradiol treatment were expected to perform better on the behavioral tests compared to the control.

23. Effects of Sucrose Consumption on Anxiety-Like Behaviors in a Rat Model

Megan Maloney, (Deanne Buffalari), Westminster College - Neuroscience

Sugar has become a regular component of American diets to the point of excess, this sugar consumption contributes to many health-related issues, such as heart disease and diabetes. Studies have shown that consuming excessive sugar also has dampening effects on the hypothalamic-pituitary-adrenal axis, our central stress response system, likely reducing the ability of stressors to cause a hormonal response. Therefore, sucrose consumption might affect behaviors related to anxiety, which was the focus of this experiment. Sixteen Sprague Dawley rats were used to examine how chronic sucrose consumption affected baseline and stress-evoked anxiety-like behaviors. Each rat was tested on the Elevated Plus Maze (EPM) a total of three times; the first test was performed at baseline before any exposure, the second test followed a 28-day exposure to either sugar or water, and the third test followed exposure as well as an acute stressor. Sucrose consumption was expected to decrease baseline and stress-induced anxiety-like behaviors. The results showed there was a similar pattern in anxiety-levels for both the experimental and control groups across tests suggesting a significant effect of test for the study; averages for both groups decreased from test 1 to test 2 and increased from test 2 to test 3. This means the test used is responsible, in part, for the variation in anxiety levels throughout the study.

BIOLOGY IV

24. Derivatives of Folic Acid Rescue the Eye Phenotype in Ethanol Treated Zebrafish Embryos

Trina Laffey, Allison Kuzora, (James Warren), Penn State Behrend – Development Biology

Fetal Alcohol Syndrome (FAS) is a human condition that causes numerous developmental defects in newborns of mothers who consumed alcohol during pregnancy. Zebrafish have been a good system to use to model FAS, since exposing zebrafish embryos to ethanol during early development reproduces many of the defects seen in this human condition. Our lab has also characterized folic acid metabolism in zebrafish, and this study investigates which derivative of folic acid may save disturbed phenotypes associated with ethanol. To study the effects of the different types of folic acid, embryos were exposed to ethanol one hour post fertilization, and then treated with different concentrations of folic acid, folinic acid, or tetrahydrofolate. We first focused on what has been described as the most repeatable ethanol induced defect in zebrafish; eye diameter. By examining hundreds of embryos under different conditions, it was concluded that folinic acid worked the best at rescuing this ethanol associated phenotype. Future studies will determine if folinic acid rescues additional defects related to FAS, such as trunk deformations, enlarged heart sacs and defects in the nervous system. Our lab has started to look at different techniques such as bisulfite sequencing to see if DNA methylation could be causing some of these defects.

25. Comparing the effects of road salt on aquatic insect diversity in southern Lake Erie tributaries

Michelle Phelps, Hannah Jacob, (Matthew Gruwell), Penn State Behrend - Entomology

The US salt belt generally refers to the Great Lakes region where there is an excess of lake effect snow fall and moderate temperatures, allowing for roads to be effectively treated with salt to increase driving safety. To test the effect of salt on stream arthropods we sampled two tributaries on the south side of Lake Erie. The first was four-mile creek, which is located in a populated area in Erie, PA, crossed by many roads and thus in a heavily salted area. The second was an unnamed tributary in rural New York without any major populated areas and significantly less salt stress. Each stream was sampled in 5 places starting near the source, collecting in various areas including close to its outlet in Lake Erie. Insects were identified using dichotomous keys for North American aquatic insects and DNA barcoding techniques. PCR and sequencing techniques were also utilized to analyze the DNA content within the samples.

26. Nematode Infections of Ruffed Grouse (*Bonasa umbellus*) by Year, Age, and Sex in Pennsylvania

Maria Colt, Evan DeFalco, Megan Zimmer, Justin Brown, (Edward Phillips), Gannon University - Zoology

Ruffed grouse (*Bonasa umbellus*) were collected from 21 counties in Pennsylvania during the last three hunting seasons. Necropsies were performed on the intestines and ceca of the grouse to remove parasitic nematodes. Two species of nematodes were identified (not all specimens were identified to species), *Ascarida bonasae* from the intestines and *Heterakis isolonche* from the cecum. The prevalence (% of birds infected) and intensity (mean infection per infected bird) of both species of nematode were analyzed in all birds combined, by year, and by age and sex of the bird. Overall prevalence infection rates with *Ascarida* dropped each season from 64.7% to 53.7% to 30.9%. Individual mean intensity of infection with *Ascarida* also dropped each season from 4.6 to 3.1 to 0.8 worms per bird. The drop to 0.8 during the 2016-17 season was significantly different from the two previous seasons. The prevalence of *Heterakis* remained relatively constant between seasons, and the individual mean intensity of infection dropped during the 2016-2017 season but not significantly so. During the 2016-17 season juvenile grouse had significantly greater mean infections of *Ascarida* than did adult grouse. There were no significant differences between the sexes.

27. Triassic Sharks from Southeast Asia

Ania Gorski, (Todd Cook), Penn State Behrend – Paleontology Biology

Sharks have a long fossil record that dates back over 400 Ma (million years). Unlike the well-studied Late Cretaceous (100 - 66.5 Ma) and Cenozoic (66.5 - present) deposits, shark diversity from Triassic (252 - 201 Ma) rock strata is poorly known. Many of the shark lineages that occupied this period have gone extinct, leaving no descendants. Previously collected fossil shark material from Southeast Asia was examined and analyzed with the use of scanning electron microscopy. The assemblage largely consists of hybodontiforms dentition. The hybodonts are an extinct group of sharks that are consider the sister taxon to the neoselachians (extant sharks and rays).

28. Effects of temporal variability of salt disturbance on leaf decomposition and leaf shredder activity

Grace Schoeniger, Emily Dobry, Blake Bachner, (Pamela Silver), Penn State Behrend - Ecology

The heightened presence of road deicing salt in streams, as a result of increased use during winter months, is a disturbance that interferes with aquatic ecosystem functioning. Leaf shredding insects, which are particularly sensitive to salinity in freshwater ecosystems, aid in the decomposition of leaf litter and are an important indicator of the health of streams. The goal of this experiment was to see how temporal variability of salt delivery within streams affects leaf shredding organisms and leaf litter decomposition. To explore this, we exposed Tipulidae larvae to in laboratory mesocosms of five treatments in which no salt was added (control) or the mean salt concentration (2.75 g/L) over time was constant (press), increased gradually (ramp), or was pulsed (returning to baseline) or pulsed (rising baseline). We kept larvae at a mean temperature of 6°C and provided a set amount of Tulip Poplar leaf litter for 33 days. Leaf litter mass lost was significantly greater in the two pulsed treatments than any other. Despite greater consumption, Tipulid mass lost in pulsed treatments did not vary significantly from other treatments. We hypothesize this result indicates increased osmoregulatory costs to larvae in the treatments with changing salt concentrations.

29. Effects of Barriers to *Salmo trutta* Movement on Fish Community Composition

Joanna Berry, (Scott Wissinger), Allegheny College - Ecology

Native fish communities are threatened by competition and predation by invasive species as well as climate change. Invasive brown trout, *Salmo trutta*, are introduced piscivores in North America that can alter fish community by reducing fish diversity of vulnerable prey species. Brown trout have difficulties passing beaver (*Castor canadensis*) dams and other barriers such as road culverts, whereas native brook trout, *Salvlinus fontinalis*, use side channels to pass dams and can better negotiate these barriers. If these barriers are able to block upstream movement of brown trout, the upstream areas of the stream would act as protected refuges for brook trout and other fish species. Therefore, I hypothesized that beaver dams and road culverts act as barriers to brown trout movement and will thus result in greater fish diversity upstream compared to downstream. To test this, I conducted fish community surveys by electrofishing 10 paired sites above and below barriers to compared the fish community assemblage and the presence/absence of brook and brown trout. Preliminary data analysis suggests that brown trout presence reduces the number of fish species as well as cyprinid number and richness. Taking advantage of barriers when creating management plans will preserve the integrity of upstream fish communities.

CHEMISTRY, MATHEMATICS & PHYSICS

30. Tale of Two Planets: Potential Binary Evolution of Mars and Venus

Cole Brown, Quinn Bierbaum, (Darren Williams), Penn State Behrend - Astronomy

It is clear from evidence obtained by Martian orbiters and rovers that the surface of Mars once had flowing water approximately 3.8 Gyr ago. At this time, however, the Sun was approximately 30% less luminous – indicating the Martian surface should not have had a temperature appropriate to explain the existence of liquid water. We investigate a potential solution to this Faint Young Sun Paradox of Mars. We show that Mars could have once been in a circumplanetary orbit about Venus where it would have had a surface temperature conducive to support liquid water given a less luminous Sun. We then model how Mars could have tidally evolved away from Venus until it eventually escaped and migrated to its present orbit. We show that, given the right initial conditions, Mars tends toward an orbit in the vicinity of its present orbit (1.52AU) after escaping Venus and that the rest of the solar system is changed insignificantly from its present configuration. Furthermore, we are working to show that this resultant orbit of Mars will reach a stable configuration within several million years and that the timescale of the tidal evolution is long enough to explain the observed geological evidence of water on Mars (on the order of 100 Myr).

31. Thermodynamic Analysis of ATP Dissociation in a DEAD-Box Protein

Lisa Yoder, Conner Bardine, Jake Patterson, (Ivelitza Garcia), Allegheny College - Biochemistry

RNA plays an essential role in many cellular functions. Similar to proteins, RNA function is strictly determined by the overall structure and dynamics of the RNA macromolecule. Thus, many cellular proteins or accessory factors are associated with RNA folding. One example of these RNA binding proteins are DEAD-Box proteins. DEAD-Box proteins utilize ATP hydrolysis to unwind and reanneal RNA duplexes to promote correct folding during RNA processing. DEAD-Box proteins possess two conserved RecA-like domains that bind ATP and RNA. In addition, these proteins also contain N- and/or C- terminal domains (NTD and CTD, respectively). Peripheral domains in DEAD-Box proteins are proposed to regulate ATP hydrolysis as well as confer RNA specificity. Thus, the NTD and/or CTD can alter the ATP binding pocket and subsequently alter ATP association and/or dissociation. For example, Rok1p, a yeast DEAD-Box protein, contains both a NTD and a CTD. The NTD in Rok1p is suggested to affect the structure and stability of the protein. Therefore, the dissociation rate of a fluorescence ATP analog was determined through transient kinetics and stopped-flow spectroscopy under various thermal conditions. Resulting trends conform to double exponential fits suggesting a two-step mechanism. The observed slow rate was consistent with a conformation change in the protein that allows rapid dissociation. The rate in which the conformation change occurs was observed to be temperature dependent. The current hypothesis centers on the ability, of the Rok1p peripheral domains, to affect the slow structural change needed for ATP dissociation.

32. Limited Proteolysis Analysis of a DEAD-box Protein and its Domain Truncated Variants

Megan Arnold, Yueting Xu, Eleni Kaffenes, (Ivelitza Garcia), Allegheny College - Biochemistry

RNA helicases play a crucial role in virtually all aspects of RNA metabolism, and although they share a highly conserved structure, the enzymes exhibit a wide variety of biochemical activity. One family of RNA helicases is DEAD-box proteins, and while their functions are diverse, the one defining activity of these proteins is their ability to hydrolyze ATP in the presence of single-stranded or double-stranded RNA. ATPase activity leads to changes in RNA affinity, enabling ligand dissociation and cyclic rebinding to promote correct RNA folding in the cell. For example, Rok1p is a yeast DEAD-box protein essential in ribosomal RNA folding, and is characterized by a catalytic core where ATP and RNA bind, as well as two peripheral domains. The peripheral domains (N-terminal domain or NTD, and the C-terminal domain, or CTD), are proposed to regulate ATPase activity as well as provide a region for RNA specificity. Thus, peripheral domains could play a role in regulating the overall structure of the protein and its mechanism of RNA refolding. To monitor peripheral effects, the structural changes of Rok1p in the presence and absence of a ligand were analyzed using limited proteolysis under various conditions. These results were subsequently compared to the truncated variant, Rok1p-ΔCTD. This comparative analysis determined the structural role of the NTD, and to some extent, the CTD. Time dependent proteolysis suggests that the protein is more dynamic at higher temperatures. In the presence of RNA or a nucleotide, the level of structure fluctuation increases. The observed level of conformational changes is minimal yet has dramatic effects on the ATPase activity of the protein. Specifically, the results show that the protein does not occupy a fully extended core state, which accounts for the unique catalytic activity of Rok1p.

33. Characterization of DNA Aptamers Binding 17B-estradiol for Contamination Mapping in Northwestern Pennsylvania Streams and Lakes

Susan Campbell, (Ivelitza Garcia, Scott Wissinger), Allegheny College - Biochemistry

Human activity has manipulated natural resources and generated pollution for centuries. While science has long established the deleterious effects of some pollutants, like heavy metals, emerging contaminants have been identified recently. Estrogen is one such potent emerging contaminant. While it is synthesized normally in mammals, birds and fish, it can be anthropogenically introduced via wastewater effluents and animal agricultural runoff. Estrogens disrupt human hormone signaling and contribute to cancer risk at concentrations in excess of 0.0033nM. Nucleic acid molecules called aptamers are new technology that can report small molecule binding. This study will investigate the thermodynamic binding characteristics of two DNA aptamers that bind to and report estrogen. Furthermore, it will test aptamer efficacy in water samples collected from streams and lakes in northwestern Pennsylvania. The 75-nucleotide aptamer has a dissociation constant of 0.063nM and a limit of detection around 0.03nM. The methods described in this study improve upon the previously reported dissociation constant and limit of detection. Further aptamer characterization and water testing will be performed to better understand aptamer function and gain information about estrogen contamination risk in northwestern PA.

34. Characterization of a Carbon Dioxide-Hexafluorobenzene Complex using Matrix Isolation Infrared Spectroscopy

Yudhishtara Payagala, (Jay Amicangelo), Penn State Behrend - Chemistry

Utilizing matrix isolation infrared spectroscopy, a 1:1 complex of carbon dioxide (CO_2) and hexafluorobenzene (C_6F_6) was characterized in low temperature nitrogen matrices. Co-deposition experiments with CO_2 and C_6F_6 were conducted in a nitrogen matrix at 17 K. Several infrared peaks for the CO_2-C_6F_6 complex were observed near the O-C-O antisymmetric stretching vibration of CO_2. Identification of the observed peaks of the CO_2-C_6F_6 complex was established by performing experiments with varying concentrations of the CO_2 and C_6F_6 relative to the nitrogen matrix, comparing the co-deposition spectra to the individual monomer spectra of CO_2 and C_6F_6 in nitrogen matrices, as well as matrix annealing experiments (25 - 30 K). Experiments were repeated using the 13-CO_2 isotope and peaks for the 13-CO_2-C_6F_6 complex were also observed near the O-C-O antisymmetric stretching vibration of the 13-CO_2. Quantum chemical calculations were performed for the CO_2-C_6F_6 complex using the Gaussian03W computational chemistry program at the B3LYP and MP2 levels of theory with the aug-cc-pVDZ basis set to obtain the optimal geometries and to simulate the infrared spectrum for the CO_2-C_6F_6 complex, which are used to assign peaks of the complex. Based on the calculations, three stable complex structures were determined; one which the CO_2 molecule is perpendicular and positioned directly above the center of the C_6F_6 ring and two where the CO_2 is parallel and off-center of the ring (parallel-displaced). Upon comparing the predicted and experimental spectra, infrared peaks due to each complex structure have been observed and assigned in the experimental spectra.

35. Synthesis and Biochemical Evaluation of Piperine Linker Analogs for Acetylcholinesterase Inhibition

Maryn Horn, Thalia Soto, (Todd Eckroat), Penn State Behrend - Chemistry

In 2016, an estimated 236 billion dollars was spent in the United States on treatment and care of patients with Alzheimer's disease (AD). Current drug therapies temporarily relieve cognitive symptoms but do not cure AD. This fact illustrates the need to research and develop new treatments for AD. Piperine, a plant-based natural product, has shown inhibitory effects on acetylcholinesterase (AChE), an enzyme implicated in the onset and progression of AD. However, a detailed structure activity relationship is lacking in the current literature. The core structure of piperine can be divided into three regions: linker, amide, and aromatic. Two series of piperine analogs varying in linker length and saturation will be synthesized and evaluated /in vitro/ for inhibition of AChE. These synthetic modifications of the core piperine scaffold should optimize interaction with the enzymatic target, improve inhibitory properties of this natural product, and provide a promising new lead for AChE inhibition and AD treatment.

36. Electrochemical characterization of HSA-heme-imidazole complexes towards future nitrite reductase activity

Ashlyn Kelly, (Jason Bennett, Mary Grace Galinato), Penn State Behrend - Chemistry

Human serum albumin (HSA) is the most abundant protein in human blood plasma, and serves as a transporter for many molecules, including heme. Complexation between HSA and heme generates a fifth ligand to the heme Fe center via tyrosine161 (Fe-O(tyr)), analogous to histidine94 present in globins such as myoglobin (Mb) and hemoglobin (Hb). HSA-heme has functional similarities to some globins. For example, it can reduce nitrite to nitric oxide therefore serving as a nitrite reductase. However, its functions are limited due to the basicity of the tyrosine ligand. In order to explore the full potential of HSA-heme as an artificial enzyme, the complexation of this system with derivatives of imidazole, a molecule that mimics the structure of histidine, was studied. This presentation will focus on the electrochemical and spectroscopic characterization of various HSA-heme-imidazole complexes. The basicity of the fifth ligand is known to influence the catalytic properties of heme enzymes, therefore it is imperative to characterize the redox properties of these artificial enzymes. Results of this project will be compared with another project investigating the potential of these complexes to reduce nitrite. This potentially results in an active site of HSA-heme mimicking that of globins, thereby producing a unique set of artificial enzymes with functionalities similar to Mb and Hb. These derivatives will impact the NO_2^- reduction potential and relate to the NO_2^- reduction potential of the different hemeproteins.

37. A Transition State Study of the Reaction of the Hydroperoxy Free Radical with p-Substituted Phenols using Density Functional Theory

Blaine Laird, (Tim Laher), Gannon University - Chemistry

Transition state geometries and energies were calculated for a series of hydroperoxy free radical/p-substituted phenol activated complexes employing the ωB97X-D density functional algorithm using the 6-31G** basis set. In this study a wide range of para substituents covering the range of strong electron donating groups through strong electron withdrawing groups were docked at the phenolic position with the hydroperoxy free radical, with transition state geometry optimization being performed to obtain transition state geometries and energies. In the study it was noted that electron withdrawing groups tended to stabilize the resulting transition state towards attack by the hydroperoxy free radical, while the opposite effect was observed for electron donating groups. In particular it was noted that the incipient phenolic free radical seemed to reside at the ortho position relative to the phenolic group as verified by spin density plots obtained of the various transition state complexes. Further computational studies are now underway to examine the effect of ortho and meta substituents to elucidate an overall pattern for free radical attack on substituted phenols.

38. Synthesis and reactivity of (phenyliodonio) pyridines: reagents for pyrdinylation of nucleophiles.

Rebecca Novak, (Michael Justik), Penn State Behrend - Chemistry

New methods for the incorporation of the pyridine moiety into synthetic targets are highly desirable. In our current investigation, we have prepared a series of 2, 3 and 4-(phenyliodonio)pyridine salts. In each synthesis the requisite iodopyridine is treated with hydroxy(tosyloxy)iodobenzene (Koser's reagent) under ligand transfer conditions to form hydroxy(tosyloxy)iodopyridines. Treatment of these compounds with electron-rich arenes in 2:1 2,2,2-trifluoroethanol:dichloromethane affords the (phenyliodonium)pyridine tosylates. Initial studies using phenoxide nucleophiles has shown these reagents to be effective for the synthesis of phenoxypyridines.

39. Minimum Variance Linear Unbiased Estimators for Burr III Distribution

Luke Szramowski, (Woosuk Kim), Slippery Rock University - Mathematics

We consider the estimation of the location parameter and scale parameter for Burr III Distribution, when other parameters are known.

40. Fluorescence Quenching Analysis of the Binding of Alpha-Naphthoflavone to the Drug-Metabolizing Enzyme Cytochrome P450 3A4

Robert Hawranko, (Glenn Marsch), Grove City College - Biophysics

Human cytochrome P450 3A4 (P450 3A4) metabolizes ~ 50% of drugs on the market and prominently figures in pharmaceutical development. Here the interaction of α-naphthoflavone (αNF) with P450 3A4 was evaluated by the quenching of the fluorescence of both αNF substrate and the tryptophan residues of P450 3A4. Binding of αNF to P450 3A4 induces fluorescence quenching of both fluorophores. Quenching is also caused by high-energy UV photons that photobleach the fluorescence from both substrate and protein. Thus the strength of the binding interaction is erroneously inflated. To evaluate the photobleaching of P450 3A4 fluorescence, a blank buffer solution was titrated into P450 3A4 solutions (no αNF present). The enzyme was largely resistant to photobleaching: 24% of P450 3A4 fluorescence was photobleached during the entire titration. Only 22 % of αNF fluorescence (no protein present) was susceptible to photobleaching. Photobleaching corrections for substrate and enzyme were then applied to the quenching that resulted when αNF was titrated into a solution of P450 3A4 enzyme. From a Stern-Volmer analysis of quenched protein fluorescence, a strong binding interaction of αNF to P450 3A4 was revealed. The dissociation constant was K_d = 0.333μM.

41. Quantum Properties of Defects in Nano-porous SI-C Dielectrics.

Joseph Noonan, (Blair Tuttle), Penn State Behrend - Physics

Point defect assisted leakage through nanoporous SiC insulators is important for integrated circuits. Using atomic models of nano-porous SiC, we explore the properties of the point defects using density functional calculations. We calculate H passivation energy, gap levels, and hyperfine parameters. The present results experimental and theoretical efforts to understand leakage in nano-porous SiC insulators.

COMPUTER SCIENCE & ENGINEERING

42. Computer Vision with OpenCV, Integrating Object Recognition and LiDAR for Robotic Navigation and Interaction

Kyle Monteleone, (David Shaffer), Westminster College (PA) - Computer Science/Software Engineering

Autonomous, self-navigating robots are becoming more popular. With a wide range of potential applications including self-driving cars, it's no wonder the subject of computer vision has received so much attention. In "level 3" of the Trinity Firefighting Home Robot Competition, a robot must autonomously locate a (toy) baby, remove it from its crib and bring it to a "safe place" in a mock up home. This project focuses on the image detection and recognition of the "crib" object in order to create a robot capable of competing. I will discuss the techniques used to provide the robot's ability to recognize a target object and align itself with the target object in order to grasp it. This is achieved using OpenCV's software and collection of functions. The robot integrates a LiDAR system with OpenCV's image recognition capabilities in order to recognize a target object, determine the object's distance and alignment relative to the robot, and accurately grasp and manipulate the object. The results of Trinity Firefighting Home Robot Competition, and will be presented alongside the rest of the project.

43. Troubleshooting of Complex Electronic-Circuit Systems for Near Space Exploration

Kaitlyn Babiarz, Rachel Amorose, Tenger Batjargal, Stephen Karpinsky, Jessica Moukoro, Cheikhou Toure, (Wookwon Lee, Nicholas Conklin), Gannon University - Electrical Engineering

In this poster, we present technical details of, and know-hows learned from, troubleshooting of the complex electronic circuit systems for the CHErenkov Radiator Payload (CHERP) under development for NASA's Undergraduate Student Instrumentation Project (USIP) program. The CHERP consists of various electronic and communication subsystems to carry out autonomous measurements ultimately for calculations of the energy of cosmic rays arriving at near space. As one of its key subsystems, the Integrator Board includes a set of electronic amplifiers and integrators that convert small amounts of electric current (e.g., 3 micro-amps) from impinging cosmic-rays into measurably larger electronic voltage signals (e.g., 1~4 V). Designing a complex electronic system requires thorough design reviews and troubleshooting for any malfunctioning components of the system. Students gain valuable lessons from it that may not be learned in typical coursework in the curricular setting. With its initial design and current implementation on a custom-designed printed circuit board (PCB), we first provide a brief description of the integrator board functionality and requirements. Then, describe how troubleshooting has been performed toward satisfying the design requirements and functional specifications through various stages of design review and debugging of the hardware. Details of the debugging include proper interpretation and understanding of technical specifications in the datasheets of the electronic amplifiers. These include, developing expected behavior of and its subsequent output signals from the specific circuits; and technical assessments based on hardware testing and collected experimental data. It is expected, as a result of the troubleshooting and to ensure proper functioning of the entire circuits on the Integrator Board, that auxiliary corrector PCBs will be designed and placed between the key electronic amplifiers and integrators on the Integrator Board as appropriate.

44. SEM Characterization and Manufacturability of Advanced High Strength Steels

Beth Gaughan, (Paul Lynch), Penn State Behrend - Engineering

Steel casting producers making ground engaging equipment and locomotive components along with the U.S. military are pushing for this current work to being carried out to develop lower cost steel alloys with acceptable combinations of strength/hardness and ductility. Continued experimental work and SEM characterization is needed to optimize the chemistry and heat treatment processes for these high strength low alloy steels. A thorough understanding of the materials and the advanced manufacturing processes that will be utilized to produce components made from these materials is crucial for the successful integration of these materials into manufacturing supply chains. Compared to our understanding of the conventional higher carbon content low alloy steels tempered at high tempering temperatures, our understanding of these lower carbon content steels heat treated at low tempering temperatures is still relatively new. In castings, ductility, toughness and fatigue performance, which are typically limited by micoporosity, are more strongly influenced by Hot Isostatic Pressing (HIPing) than tensile and yield strength. Researchers have suggested that in many cases micropore closure from HIP can result in cast steel impact toughness values that approach that of similar wrought materials. An increased understanding of the carbide precipitation reactions will help guide future alloying and melt processing studies to improve material performance and sustainability of these alloys. A more thorough understanding of the increased casting performance possible by the use of HIP for cast materials and the feasibility of the integration of HIP into a large scale casting operation is crucial for the potential integration of this technology into the casting supply chain. The results of the carbide characterization and cast + HIP work carried out in this study will be a seed for future steel advanced high strength steel processing guidelines.

45. Graph Grammars GUI

Anthony Walker, (Shradda Sangelkar), Penn State Behrend - Engineering

In engineering design, the development of appropriate design heuristics is important. However, these heuristics may be difficult to generate for those who lack experience or knowledge. Graph grammars is a rule-based technique that is well suited to discrete categorical data. Because of its aptitude for this type of data, this technique can be applied to a database of functional models for the generation of new graphs based on the specified rules. These graphs can then be used as design heuristics. Thus, it is a very powerful tool with respect to computational design synthesis. However, keep in mind that this technique is not a replacement for an expert but rather an aid that can be utilized by an expert to improve the process. Furthermore, the scope of this project aims to create a graphic user interface (GUI) that will streamline the technique by controlling the flow of data between GraphSynth and FSG, which are open source products that are used to employ this technique. To conclude, the primary objective of this project is to develop a flexible, appendable, and user-friendly GUI that employs the graph grammars technique with the use of appropriate software.

46. Quantum Computing: Effective Uses and Challenging Problems

Robert Bevard, (Tarek Elarabi), Penn State Behrend - Engineering

What is Quantum Computing and what benefits could it have? How is Quantum Computing visualized and what is the architecture of this computer system? Although it was hypothesized and researched in the late 60's, it is only recently that Quantum Computer research has escalated. In a classic computer, bits can only take on the values of 0 or 1, however, a Quantum Computer is made up of quantum bits, more commonly referred to as qubits. These qubits can exist in any superposition of 1's or 0's. This can be visualized as a sphere that could be arranged in any number of specific orientations. Keeping this in mind, where a classic computer has multi-billions of bits a quantum computer theoretically needs about 50 to be on the same level in capability as most modern supercomputers. This topic is interesting because it represents the front line of "new" computer development, and potentially has many uses, from simulating chemical reactions to finding very large prime numbers. For decades, engineers and scientists have been researching topics relating to quantum computing, from the general theory, applications, and to the problems that face quantum computing. Two major hurdles still stand in the way of quantum computers being used as readily as our common computers today: size, and decoherence. Most quantum computers are the size of small car due to the many different technologies that allow them to work. However, it might be the case that quantum computers are more suited to specialized calculations and not to everyday computing. Gathering facts on the many different problems and benefits of quantum computers could offer an answer to this problem. With a compilation of research, a greater understanding of quantum computing would hopefully allow the technology to follow the current trend of Moore's law. Quantum computing symbolizes the next great step in computing and from preliminary results, could prove to be faster than traditional computers.

47. Utilizing the Mechanical Strength of 18650 Li-Ion Batteries in a Drone Frame

Dylan McAnallen, Matthew Brockett, (Adam Hollinger, Christopher Rahn), Penn State Behrend, Penn State University Park - Mechanical Engineering

Lithium-Ion (Li-ion) batteries are often used to power drones due to their impressive energy density. However, they can be quite heavy, which poses a problem when dealing with a piece of equipment where weight is a crucial factor. Most drones use a prismatic style rectangular Li-ion battery that only serves as a power source and nothing else. It is proposed that cylindrical 18650 lithium-ion cells could be reinforced with lightweight aluminum tubes and used as structural members as well. The viability was first verified with finite element analysis, and then three-point bend tests were conducted to provide proof-of-concept by comparing the stiffness of the design with and without the batteries. From the tests it was observed that, at its weakest point, the stiffness of the structural assembly would be four times greater than the stiffness of the aluminum member alone, increasing from 484.3 lb/in to 193l lb/in. The lightweight design for the aluminum member also reduced the amount of aluminum used from 11.3 g/cell to 5.7 g/cell.

48. Matlab® Optimization Process for a Ramjet Engine Using a Calorically Perfect Gas Approach

Marco Nunez, (Amir Danesh, Shraddha Sangelkar), Penn State Behrend - Mechanical Engineering

The aerodynamic design of supersonic airbreathing engines has always been a challenge due to the complexity of the flow properties at such speeds and levels of energy. To better find optimal design points computer programs have been increasingly useful as technology and computing power progresses. This research study looks at the application of the Matlab software as a mean of finding the most efficient ramjet design from an aerodynamic perspective. Such design includes considerations for the inlet, diffuser, combustion chamber and nozzle of the engine. One of the key points to solving this design problem in a simpler manner is the assumption that air is a calorically perfect gas. This study is based on this assumption to obtain results which will later on be utilized as the basis for a second study that considers calorically imperfect gases instead, to find a more accurate description of the system.

49. Predictive Analytics Models for Student Admission and Enrollment

Jared Cirelli, (Faisal Aqlan), Penn State Behrend – Industrial Engineering

Data analytics is the process of examining data for the purpose of drawing conclusions and discovering patterns throughout the data set. Various softwares and system techniques are used to do so. Data analytics is widely used to allow companies and institutions to make supported decisions based off of the trends discovered throughout the data. Predictive modeling is the technique of using historical information on a certain attribute or event to identify patterns which will assist in predicting a future value of the same attribute with a certain probability attached to it. Its application is invaluable in the field of different sciences, particularly in an academic setting to study patterns in admission and enrollment in higher educational institutions. This project will focus on the analysis and modeling of student admission and enrolment data to provide a decision support for the admission staff at Penn State Behrend. It is important to note that this model cannot be a stand-alone and only serves to compliment the University administrators' decision making process to manage admissions and enrollments effectively efficiently. The analytical software, IBM SPSS Modeler, will be utilized to develop the prediction models which will provide the University's admission office the important factors that correlate to the applicant's decision whether to enroll or not.

50. Quantum Computers Architecture

Matthew Silloway, (Tarek Aqlan), Penn State Behrend – Computer Engineering

Quantum computing has the potential to be more powerful than traditional computing. The main difference between these two computing methods is their computer architecture; quantum computers use the quantum bit or qubit. When compared to a traditional bit that can only hold discrete values of 0 and 1, the qubit is able to hold continuous values between 0 and 1. The continuous values give the quantum computer the ability to run quantum algorithms at a very efficient rate. This research project will discuss the architecture, quantum algorithms, and difficulties behind the development of quantum computers.

51. Degradation of Shear Induced Crystallization in PLA

Valerie Zivkovich, (Alicyn Rhoades), Penn State Behrend - Polymer Engineering

Poly (Lactic Acid), PLA, is a popular industrial polymer for its biodegradability and biocompatibility. The rate of degradation in PLA is dependent on the stability of the crystalline structure, molecular weight, temperature, and moisture. In this study, PLA is thermally sheared with a film extruder at different manufacturing temperatures and shear rates. The films are thermally tested using Differential Scanning Calorimetry (DSC) to characterize percent crystallinity at the different temperatures and shear rates. After characterization, the film samples were kept in a degradation testing setup with temperature, UV, and moisture control. During this time, the amount of degradation on the polymer chains were measured using Fourier-Transform Infrared Spectroscopy (FTIR) to observe the increase in C-C stretching and decrease stretch of carboxylic acid. The purpose of the study is to fingerprint the biodegradable structure of PLA as it can be used for large production packaging.

52. Studying the Effect of Various Molecular Weight Poly-ether-ether-ketone on Crystalline Peak Half Times Using Fast Scanning Chip Calorimetry

Olivia Dubin, (Alicyn Rhoades, Anne Gohn), Penn State Behrend - Polymer Engineering

In this study the isothermal crystallization process was evaluated for Poly-ether-ether-ketone (PEEK) of various molecular weights. PEEK is a fast crystallizing polymer and requires the use of the relatively new fast scanning chip calorimetry (FSC) technique to accurately capture the crystalline half times. Samples were tested in the FSC using an isothermal crystallization method over a broad temperature range of 170°C-285°C. The crystallization occurring close to the glass transition and melting point were further studied using an interrupted technique to indirectly study the slower crystallization processes. It was found that increased molecular weight increases the time required for crystallization due to hindered molecular movement.

53. Financial Analysis of Commodities, Trades, and Options in Real-Time (F.A.C.T.O.R)

Jacob Scott, Matthew Partin, Jacob Fickes, Kyle Burns, (Meng Su, Timothy Krause), - Computer Science/Software Engineering

The science of stock price forecasting has existed since before the dawn of the computer age. Today, investors use research and intuition, or techniques such as technical analysis and numerical regression, as well as various forms of predictive algorithms, which prove to be marginally accurate at best. While some success has been achieved with these systems, there is room for improvement. The intent of this project is to develop an algorithm capable of predicting stock market changes more accurately. This will be done by leveraging artificial intelligence, as well as data and statistical analysis, to investigate the relationships between news articles and stock prices. This program will then be able to utilize an algorithm to predict the effect that future events could have on share prices of publicly traded companies. The algorithm will gather news, use natural language processing to gather sentiment and relevance, and then store the articles categorically for analysis. These algorithms will then use regression methods to predict the future price, comparing against the benchmark of what happens, and then adjust the formula. This algorithm will prove invaluable to stock traders and investors, as well as economists looking at future economic projections. Once this method proves successful, the algorithms behind this project can then be used in numerous other applications, such as improving search algorithms and big data analysis.

ENVIRONMENTAL SCIENCE

54. Monthly Water Quality Changes in Presque Isle Bay

Kaylee Luchansky, Christopher Ross, (Christopher Dempsey), Gannon University - Environmental Science

Monitoring water quality in aquatic ecosystems is critical to our understanding of how they change over time. Here in Erie, PA, Presque Isle Bay (PIB) is a unique body of water that provides ecological, economic, and recreational benefits. Faculty and students at Gannon University have implemented a monthly sampling program in an effort to monitor environmental and biological changes in Presque Isle Bay. Our part of this multidisciplinary project is to focus on changes in water quality, nutrients, light, and dissolved organic carbon. Each month we collect water quality data (temperature, conductivity, pH, and dissolved oxygen) using a YSI profiling instrument. We take light readings using a LICOR PAR (photosynthetically active radiation) meter and conduct a Secchi disc reading. Lastly, we collect water samples from 0, 2, 4, and 5 meter depths. These samples are analyzed in the laboratory for ammonia, phosphate, and dissolved organic carbon concentrations/quality. Our goal is to piece together a long term data-set of change in Presque Isle Bay. Information presented here focuses on data from fall 2016 to spring 2018.

55. Impacts of Woodcock Creek Dam on the Fluvial Geomorphology of Woodcock Creek in Crawford County, Pennsylvania

Chris Micucci, (Matt Carter), Allegheny College - Environmental Science

Impounded dams have been shown to profoundly alter the hydrodynamics of a river system. Dams trap large grains and other sediments, preventing their downstream transport, and lower the frequency of downstream flooding - impacting the downstream fluvial geomorphology and ecology, respectively. The Flood Control Act of 1962 authorized the construction of Woodcock Creek Dam for the purpose of flood control and creation of recreational activities. Yet, no major studies have investigated the dam's impact on the fluvial geomorphology of Woodcock Creek. This study compares grain size distribution and channel width upstream and downstream from the dam to better understand how Woodcock Creek is responding to the dam. Five transects were selected along the river profile where two sediment samples of approximately 2 kg were obtained from each bank as well as two within the channel. Stream velocity and channel width measurements were also taken at each transect. Each sample of sediment was dry-sieved and cumulative frequency curves were generated based on weight percent. Preliminary results show a downstream decrease in gravel and an increase in sand-sized grains in both bank and channel samples; upstream bank samples have the highest percentage of gravel out of all sampled banks. Initial measurements also show a decreasing trend in channel width downstream. These results suggest that the reduction in flow velocity inhibits the transport of gravel directly below the dam, leading to an increase in sand and fine-grained content downstream from material eroded from the channel banks. Low stream velocity and decreased gravel content of the stream may also account for a decrease in downstream channel width. Future studies could investigate where (if at all) the creek reestablishes a sediment distribution equivalent to those upstream from the dam.

56. Assessing the Penn State Behrend stream health through analysis of macroinvertebrate assemblages in natural leaf packs

Megan Palko, Emily Brown, (Pamela Silver), Penn State Behrend - Environmental Science

In response to the heavy snowfall that Erie receives every winter, salt is applied to Penn State Behrend's walkways and parking lots for the safety of the Behrend community. Salt-laden runoff enters directly into campus streams via storm drains, thereby spiking stream conductivity. In an earlier study, we analyzed leaf decomposition in Behrend streams and found few leaf-shredding macroinvertebrates. In the present study, we assessed aquatic macroinvertebrates in natural leaf packs to determine if salt input is affecting the insect community. We sampled three random leaf packs at two locations in Trout Run, two locations in Glenhill, and one site in a reference stream on the Behrend campus between 2 February 2017 and 9 December 2017. Contents of the packs were sieved immediately after collection, and all macroinvertebrates were preserved in 70% ethanol. We air-dried leaves for 48 h and measured dry mass. Reference stream mean annual conductivity (481.15 ± 210.38 μS/cm) did not differ significantly from that of Trout Run Up (798.04 ± 308.02 μS/cm) or Down (1044.73 ± 274.60 μS/cm). Conductivities were significantly higher at Glenhill Up (2248.45 ± 885.61 μS/cm) and Down (2558.55 ± 731.81 μS/cm) than all other sites. The most abundant insect families in all streams were Chironomidae (midges) (44.9% of collected insects) and Simuliidae (black flies) (21.2%). Neither insect density nor relative abundances differed among streams. We concluded that conductivity may not be the sole reason for the lack of leaf-shredding macroinvertebrates in Behrend streams.

57. Environmental Analysis of Platinum Group Elements and Solubility in Road Salt Solutions

Rose Kerr, Galen Gerber, (Deborah Aruguete), Penn State Behrend - Environmental Science

Environmental levels of platinum group elements (PGEs), in particular palladium and platinum (Pd, Pt), are increasing as a byproduct from use of automobile catalytic converters (ACC) and are continuously emitted in metallic form from car exhaust [1]. PGEs that have been dispersed into the environment can mobilize by complexing with free anions in aqueous solutions. Road de-icing salt contains anions, mainly chloride and cyanide (Cl-, CN-), which both have a high affinity for and affect the mobility of Pd while in solution [2]. This analysis was aimed at modeling the interaction between ACC and road salt solutions containing ferrocyanide additives at varying concentrations and PGE solubility. Imitation road salt solutions, with and without ACC material, were analyzed using ICP-MS. High road salt levels correlated with soluble Pd forms and showed statistical significance ($(\alpha) < 0.05$) between salt solutions that have lower ionic strength. Pd and Pt released from ACC materials readily transition to a soluble form in the presence of road salt and are likely to be more bioavailable and also toxic to life forms.

58. Early Learning Center Bottle House Construction Project and Natural Play Space Design

Nik Dombkowski, Ann Quinn (Mike Naber), Penn State Behrend - Environmental Science

The Early Learning Center (ELC) is taking on some spring/summer renovations to the children's outdoor play spaces. The biggest concern is storm water management, as the play space does not drain well and leaves a mucky area that continually gets the children muddy while playing. The play space will be modified for better drainage by a 3rd party. Once the play space properly drains we are looking to have a bike loop put in for the children to ride around. We will also be looking to construct a bottle house that is safe and exceeds the children's expectations. The children will be involved in designing the bottle house to ensure it is something they will enjoy. We are also planning to add a vegetable garden as well as a certified pollinator garden. A few other smaller projects will also be taking place in the new play space and some of those include planting shallow rooted trees to help mitigate storm water (must be shallow roots so they don't interfere with the new drainage system), a do-it wall that will be built with help from Engineers Without Borders, and setting up a rain barrel from the ELC building's gutter system so the children have water for their mud kitchen. Every aspect of each project will be designed and completed to be environmentally sustainable, as much as feasibly possible.

59. Cation exchange of grit induced by melted road salt

Gaoming Zhou, (Deborah Aruguete), Penn State Behrend - Environmental Science

Foundry sand consists primarily of uniformly sized, high-quality silica sand mixed with clay and oil. It is used in metal casting. It is also widely used as a landfill liner and with deicing salts to increase traction. These uses can impact surface water and groundwater if elements associated with the foundry sand are released. Vehicles, pedestrians and precipitation wash foundry sand down drains and elements can be leached in landfills. Currently, few data are available on the environmental chemistry of foundry sand. Such elements can be mobilized (released into water) by cation exchange, in which one type of cation (generally sodium or hydrogen) is substituted for one or more other cations bound to a solid. Foundry sand mixed with road salt is exposed to a high level of sodium, making cation exchange inevitable. Cation exchange from foundry sand is the focus of the study. The anticipated outcome is that road salt solutions will induce cation exchange and thus metal(oid) release from foundry sand, including toxic elements. Result of this study can be used to better understand the environmental impact of road salt.

60. Feasibility investigation for hydrokinetic power generation in French Creek (Meadville, PA)

Nathan Pastorek, Cayton Hornberger, David Shipe, (Matt Carter), Allegheny College – Energy Systems

Increased concern about climate change over the last several decades has led to efforts to decarbonize society's energy systems. Most of the nation's large-scale hydropower resources have been established, yet, many small to mid-size hydropower resources remain undeveloped. This study investigated the feasibility of hydrokinetic power generation within the French Creek watershed to better understand how water resources within the Commonwealth could be leveraged for public and private use. Stream velocity data was collected at three different sites along French Creek near Meadville, PA. At each site, three transects recorded depth of the water column and stream velocity near the creek banks and through the middle of the creek. Average velocity data were calculated and compared to discharge and stream height from a nearby United States Geological Survey stream gage (03023100). Results indicate that stream height was > 1 m 42% of the year (mostly in late fall, winter, and spring months) producing an average power of 0.22 kW/m^2. The cost and power generation potential for three different hydrokinetic turbines were compared as well as permitting procedures and environmental restrictions. Electric power generation for all investigated turbines is too low to merit their installation at any of the observed locations due to varying stream velocity (and ice conditions) as well as low electricity costs (7.93 ¢ /kWh for commercial and 11.91 ¢ /kWh for residential). Return on investment is estimated to be greater than 20 years for all considered turbines. Further, the permitting process for low-impact hydrokinetic turbines is cumbersome (3-5 year timescale) and several environmental and historical protections on the creek would add cost and time. We suggest that future investigations should focus on larger streams that have an annual stream height of > 1.5 m, a minimum stream velocity of 1 m/s, and streams with less seasonal variability and environmental restrictions.

HUMANITIES & SOCIAL SCIENCES

61. Can Evidence Based Occupational Therapy Practices Enhance the Development of Children Born to Young Mothers

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Children of young mothers (age < 21) have significant developmental delays compared to children of older mothers due to adolescent mothers having lower education, having lower socioeconomic status, and the child's increased likelihood of low birth rate (Mollborn & Dennis, 2012). Additionally, these children often progress below average compared to their peers through adolescence. Occupational therapy has proven to be beneficial in closing the gap between developmental delays and behavioral issues. For children born premature or with low birth weight, Occupational Therapy interventions often begin in the Neonatal Intensive Care Unit. Occupational Therapy in the Neonatal Intensive Care Unit is heavily focused on parent education, positioning, infant feeding development, and formal assessments such as the Sensory Processing Assessment and the Motor Development Assessment to provide the infant with an environment that will foster appropriate development (Nightlinger, 2011). Young children with social-emotional developmental delays can improve through relationship interventions such as positive caregiver interaction; and touch based intervention, such as deep pressure application (Case-Smith, 2013). In addition, it was found that children with sensory processing and integration difficulties who attended an occupational therapy horseback riding lesson for 1 hour over the course of 12 weeks showed increased social interaction and improved sensory processing upon completion (Pfeiffer, Clark, & Arbesman, 2018). Occupational Therapy has positive effects in children with developmental delays using frames of reference including; Cognitive Behavioral Therapy, Sensory Integration, Early Intervention and School Based Practice (AOTA, 2018). This research will provide a review of Occupational Therapy's highly recommended evidence-based practices and Frames of Reference used when treating the pediatric population to improve preterm birth, low birth rate, and developmental delays.

62. Reading and Writing through Emergent Genres

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Reading and writing through emergent genres in literature was investigated to determine how reading texts in emergent genres such as hybrid texts, free verse texts, graphic novels, and post-modern picture books engages readers in the practice of close reading. While close reading is usually conducted with traditional texts, the purpose of this research was to specifically examine if reading and writing in emergent genres influenced students' ability to close read both independently and with support.

63. Shifting Conservative Environmental Attitudes Using Moral Foundations Theory

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As polarization between liberals and conservatives has become starker in recent years, so has polarization on environmental issues. Using moral foundations theory, this study examines whether appealing to a moral intuition prevalent among conservatives - ingroup loyalty - can persuade conservatives to support environmental protections. Respondents were presented with one of three treatments, climate change framed as harm to human life, climate change framed as a threat to one's ingroup, and a control, in order to test the following hypothesis: whether conservative respondents presented with the ingroup environmental argument will exhibit more favorable environmental attitudes than conservatives exposed to the harm and the control treatments. We find tentative support for this hypothesis, as exposure to the ingroup frame increased support for environmental protections among conservatives relative to the harm and control treatments. Climate change will pose increasing challenges to the United States, necessitating policy solutions from both Democrats and Republicans; these results raise the possibility of a new framing strategy for conservative environmental action.

64. Effects of Developmental Delay in Children Born to Young Mothers, Comparing the Gender of the Children, and How Occupational Therapy Interventions May Enhance Growth and Development

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Although enormous progress has been made in regards to healthcare and medicine, the rise in children with developmental delays still seems to increase. Research observed for this paper has shown that young mothers, ranging roughly from 10 to 24 years of age, contribute to the rise in underdeveloped children. Gender of the child is a factor to be considered when diagnosing a child with developmental delay. Boys are more likely to be at risk for delays in language, behavior, cognition, and social interaction compared to girls within the first year of life (Lehr, Wecksell, Nahum 2016). While rates of teen pregnancy continue to minimally decrease every year, research shows there is still a rise in underdeveloped children being born to young mothers and that education and healthcare services can enhance the growth and development of children with developmental delays. This research will explore how occupational therapy interventions can aide in the growth and development of children. Occupational therapy encourages rehabilitation through the performance of activities required for daily living. Occupational therapy has the potential to enhance a child's development through numerous evidence-based practices and frames of reference. Practices and services such as Sensory Integration, Early Intervention Services, and Visual Motor Interventions are just a few used to help children with developmental delay (Case-Smith, Frolek, and Schlabach 2013.) Sensory interventions are used frequently in pediatric occupational therapy sessions, focusing on integrating sensory information from the body and environment and how that contributes to emotional regulation, learning, behavior, and participating in activities (Leong, Carter, Stephenson 2015).