

***PENN STATE BEHREND - SIGMA XI***

***2007***

***SIXTEENTH ANNUAL***

***UNDERGRADUATE STUDENT RESEARCH***

***AND***

***CREATIVE ACCOMPLISHMENT CONFERENCE***

***ABSTRACT BOOK***

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## BIOCHEMISTRY

**Preventing the Aggregation of Islet Amyloid Polypeptide in Rat Insulinoma Cells Using a Novel Beta-Sheet Breaker**

### Sarah Herrle (Melissa Barranger-Mathys), Mercyhurst College - Chemistry and Biochemistry

Islet amyloid polypeptide (IAPP), or amylin, is a 37-residue polypeptide that is co-secreted with insulin by pancreatic β-cells. IAPP self-associates, forms cytotoxic fibrils, and aggregates into a β-sheet conformation even at nanomolar concentrations. This aggregation is the main constituent of pancreatic amyloid, which is observed in patients with Type II Diabetes Mellitus. Because the aggregation of IAPP causes the death of β-cells, we are interested in inhibiting fibrillogenesis, thus preventing the cytotoxicity of aggregated IAPP. Research suggests that a class of compounds known as β-sheet breakers have the ability to alter the secondary structure of amyloid plaques, making them more soluble and unable to self associate and aggregate. Using insulinoma rat pancreatic β-cells from the islet of Langerhans, we are culturing the cells and observing the aggregation of IAPP. It is proposed that the addition of our novel β-sheet breaker, a five amino acid peptide, to pancreatic β cells will decrease the aggregation of IAPP observed using the immunofluorescent FITC tag and the fluorescence microscope. We expect to see a significant decrease in the aggregation of IAPP in the cells which have been grown with the β-sheet breaker compared to those without.

## BIOLOGY

**Effects of Natural Tumor-Suppressing Agent Matrine on Nuclear Coded Mitochondrial Genes in Mouse Tumor Cells as Detected by Microarray Analysis**

### Krysten Fritz, Carolyn Bazzoli, and Robert Disantis (Durwood Ray), Grove City College – Biology

The Chinese herb matrine has traditionally been used to treat a variety of diseases including hepatitis B and cancer, though the exact mechanism of its healing effects has been unknown. The goal of our study is to evaluate gene expression patterns following matrine treatment of three separate cell lines. All are derived from the NIH Swiss mouse: NIH/3T3 cells are immortalized non-tumorigenic, non-contact inhibited, and precancerous. The T2A cells are highly aggressive, non-metastatic cancer cells derived from transformation of the NIH/3T3 cells with human h-ras oncogene. The T4PA cells are highly aggressive, tumorigenic, and metastatic cancer cells derived from metastatic tumors generated in the nude mouse. Microarray analysis was used previously to detect RNA expression of 17,500 genes in the three cell lines. As a follow up, these cells are being treated with the compound matrine (0.1 mg/ml for four days), and the RNA expression measured with a 40,000 gene Affymetrix microarray. The vast majority of nuclear-coded mitochondrial genes in T4PA cells increase with matrine treatment. This is of particular interest because a significant step in tumor progression is the loss of mitochondrial function; hence, the observed increase in mitochondrial gene expression potentially indicates a reversal of cancer growth.

**Melanoma Tumor Antigen-Transduced Dendritic Cells Do Not Require Further Maturation for CD8 T Cell Activation**

Michelle Heid1,2 (Susan Sapone1 and Lisa Butterfield3), 1Gannon University, College of Science, Engineering and Health Science, 2University of Pittsburgh Summer Undergraduate Research Program, and 3University of Pittsburgh Cancer Institute - Biology

Dendritic cells can be transduced with adenovirus to present several melanoma tumor antigens, including MART-1, MAGE-A6, and tyrosinase. We wished to determine whether a multi-antigen adenovirus transduced dendritic cell strategy would be improved by inflammatory cocktail maturation of the dendritic cells post-transduction. This question was addressed by two methods: 1) testing tumor infiltrating lymphocyte activation by adenovirus transduced dendritic cells with and without maturation, and 2) testing activation of healthy donor T cells by adenovirus transduced dendritic cells with and without maturation. We found that both immature and mature dendritic cells are equally effective at stimulating anti-MART-1 specific CD8 T cell responses with respect to INF-γ, TNF-α, IL-2, GM-CSF, and granzyme B production, as measured by ELISPOT. The results were the same for multiple tumor infiltrating lymphocyte populations as well as healthy donor T cell activation. To test if multiple antigens expressed in dendritic cells would interfere with optimal T cell activation, dendritic cells transduced with single and multiple adenoviruses were tested for T cell activation. Our results suggest that dendritic cells transduced with multiple, different adenoviruses are as effective at expressing the MART-1 antigen as dendritic cells transduced with AdVMART1 adenovirus alone.

### Sequencing *Odocoileus virginianus (White Tailed Deer)* mtDNA d-loop

Natalie King, Chelsea Toth, and Daniel Reese (Durwood Ray and Frederic Brenner), Grove City College - Biology

A concern in deer management is that larger, older deer are preventing the younger deer from breeding, thereby limiting the gene pool. Our intention is to use mitochondrial DNA (for maternal) and nuclear genetic sequences (for maternal and paternal) to trace breeding history within deer populations. Mitochondrial DNA (mtDNA) was prepared by Perfectprep Plasmid Mini Spin Columns (Eppendorf) from *Odocoileus virginianus* fetal liver. Polymerase Chain Reaction (PCR) was employed to amplify the mtDNA d-loop using primers we designed from a previously published sequence of mtDNA d-loop. PCR products were evaluated by slab gel electrophoresis and purified using the QIAquick PCR purification Kit (Qiagen) spin column. Cycle sequencing reactions with BigDye Terminator Chemistry were run in triplicate for each DNA strand and purified to remove dye terminators by DyeEx Spin Kit (Qiagen). The samples were then sequenced using our ABI single capillary Prism 310 Genetic Analyzer. Our complete d-loop contig was compiled using Lasergene sequence analysis software (DNASTAR, Inc). Our data show western Pennsylvania’s *O. virginianus* haplotype GCC-A (Accession number EF061657) is a distinct haplotype. We have employed this preparation method to study the breeding patterns of a herd in the Cincinnati, Ohio area to determine mitochondrial genetic variability.

**Mitochondrial DNA Sequence Variations in Partial Sequences of the D-loop Region in Northern Bobwhite, Chukar Partridge, Ruffed Grouse and Ring-Necked Pheasant**

Ian Lamborn, Peter McPherson, Matthew Latini, and Joshua Haggan (Durwood Ray and Frederic Brenner), Grove City College - Molecular Biology

As part of an ongoing study of wildlife genetics, we have sequenced 413 bp of the non-coding D-loop region of the mitochondrial genome of the northern bobwhite (*Colinus virginianus*), chukar partridge (*Alectoris chukar*), ruffed grouse (*Bonasa umbellus*) and ring-necked pheasant (*Phasianus colchicus*) for genetic comparison. A consensus primer set was designed from previously published sequences of the mtDNA D-loop of six different gallinaceous species. This primer set was used to amplify and sequence an analogous 413 bp sequence from each bird species. Northern bobwhite mtDNA D-loop sequences have not previously been reported. As predicted by the current taxonomic classification by families and subfamilies, the northern bobwhite (family: Odontophoridae) exhibited less homology when compared to the other three species (family: Phasianidae). These data suggest that the mitochondrial D-loop can serve as an accurate preliminary genetic indicator of evolutionary relationship between species whose evolutionary history has not been pursued on the molecular level. Further characterizing the sequences and genetic differences within the mitochondrial genome, wildlife biologists will be able to more accurately define genetic relationships among gallinaceous species.

### The Effects of Nitric Oxide (NO) Donors and Inhibitors on hIK1

Alissa Mague, Megan Hammers, and Lacresha Huckabee (Heather Jones), Penn State Behrend, School of Science - Biology

The human intermediate conductance calcium (Ca2+)-activated potassium (K+) channel, hIK1, is a diverse membrane ion channel, playing essential roles in a variety of physiological functions including cell volume regulation and endothelial hyperpolarization. Nitric oxide is a potent vasodilator which allows for relaxation of the smooth muscle surrounding the capillary endothelial cells. Nitric oxide is produced from the amino acid arginine and oxygen through the reduction of inorganic nitrate and the nitric oxide synthase (NOS) enzyme. Since both hIK1 and NO are involved in endothelial cell vaso-regulation, I determined the effect NO has on hIK1. The effects of the NO donors SNAP and PAP-NONOate and the NOS inhibitor L-NMNA were examined, and hIK1 protein expression levels quantified. Human embryonic kidney (HEK) cells containing hIK1 were treated with drugs 24 hours prior to experimentation. Total protein was isolated and antibodies were used to measure the amount of hIK1 protein in the cell. Results showed that increased NO levels with the donor compounds increased total hIK1 protein expression when compared to untreated cells. The lowering of NO levels using the inhibitor decreased total protein expression. Localization of hIK1 at the cell surface is regulated and may be altered by various signaling molecules. Application of HEK cells with the inhibitor of NOS decreased hIK1 levels at the plasma membrane. These results suggest that NO plays an important role in the regulation of hIK1 expression relating to endothelial cell function.

### Zebrafish (*Danio rerio*) as a Model Organism for Fragile X Syndrome

Stacey Olechowicz (James Warren Jr.), Penn State Behrend, School of Science - Biology

Fragile X syndrome is the leading cause of inherited mental retardation in the United States, affecting every 1:4,000 males and 1:6,000 females. The syndrome is caused by defects in the fragile X mental retardation protein (FMRP), and in addition to mental deficits, individuals suffer from macroorchidism, mild facial deformities, flat feet, and connective tissue abnormalities causing hyperextensive joints. Zebrafish contain an ortholog to FMRP, called FMR1, along with its two autosomal homologs, FXR1 and FXR2. The objective of this experiment was to knockdown expression of the FMR1 gene in early zebrafish embryos using morpholinos (antisense oligonucleotides) to inhibit translation in cells. Zebrafish were injected with specific amounts of FMR1 and allowed to grow to desired stages. They were then fixed with 4 percent paraformaldehyde and stained with anti-acetylated tubulin to stain their axon tracts. Fluorescence and confocal microscopy was used to determine any abnormalities in the axon tracts. Embryos injected with the FMR1 morpholino contained abnormalities in the trigeminal ganglion and the radiating axons.

**Sustainability Practices through Fair Trade and Organic Certification Initiatives**

Stephen Oyler (Lola Deets), Penn State Behrend, School of Science - Biology

The research conducted verified conjectures based on prior informal readings, debates, and common knowledge about the benefits of Organic and Fair Trade Certification. In order to present and share research to raise awareness of environmental and economic sustainability through the Community Agroecology Network (CAN), researchers have performed extensive observational and statistically quantitative initiatives to further sustainability processes. Currently, research in less developed countries on Fair Trade and Organic Certification is being completed to improve lives and earnings for citizens, many of which are indigenous. By obtaining first-hand knowledge and photographs of agroforestry and sustainability research in Tacuba, El Salvador, the student will be able to share research, educate consumers, and promote environmental responsibility and awareness. The research will allow students to gain knowledge and experience to bring back and play a part in the agroforestry practices, while sharing information to promote sustainability around the globe. Establishing fair prices for all sellers will maintain lives at a realistic wage to support and benefit their communities and their families, as well as promote future sustainable (economic) incomes and crops (agricultural). Along with the benefits in El Salvador, the application of practices and methods could be used in local and domestic agriculture.

**Arbuscular Mycorrhiza Formation by *Nicotiana plumbaginifolia* and *Glomus intraradices* *in vitro*—A Role for Auxin**

### Katherine Restori (Catharina Coenen), Allegheny College - Biology

Arbuscular mycorrhiza (AM) is an obligate symbiotic relationship in which fungi of the order Glomales exchange nutrients and phosphorus with the roots of land plants. The goal of this study was to characterize the *in vitro* interaction between *Nicotiana plumbaginifolia* and *Glomus intraradices* as an experimental system to study the role of the plant hormone auxin in AM formation. To provide *G. intraradices* spores for this study, I initially characterized the influence of inoculum mass on spore production in a two-compartment co-culture system containing *Daucus carota* explants, and *G. intraradices*. Liquid media from a root-free compartment of the cultures, which contained exclusively fungal mycelia at various stages of development were then tested for auxin activity in a bioassay system. Bioassays were based on activation of the auxin-responsive *GH3* promoter linked to a luciferase reporter gene and transformed into *N. plumbaginifolia*. While this assay system reliably detects auxin concentrations down to 1 micromolar, no auxin production was detected in fungal culture media. Because the possibility remains that the fungus may only secrete auxin locally inside host roots, I am now using seedlings expressing a beta-glucuronidase reporter gene to characterize *GH3* promoter activation in roots of seedlings at various stages of colonization.

**Topographic Factors and Local Variations in Grasshopper Communities of Central Texas**

Sara Rex (J. Michael Campbell), Mercyhurst College - Biology

This research focuses on the relationship between grasshopper communities and topographic factors affecting microclimate. Qualitative sampling of insect populations via sweep netting was carried out on August 16-19, 2006 at ten different sites on Fort Hood, a military base near the northwest corner of the Edwards Plateau of Texas. Previous studies at Fort Hood have demonstrated distinct differences in vegetation between north- and south-facing slopes; this study examines how families and species of the grasshoppers vary among: 1) dry, sparsely vegetated southwest facing slopes, 2) more densely vegetated north facing slopes, and 3) open exposed sites with no slope association. Counts of the dominant grasshopper species and families summed for three sites in each topographic category and a single reference site in a moist riparian area were analyzed by Chi-square contingency test. Results provide insight into the relationship between local features of the landscape and one of its prevalent insect groups.

**Comparative Assessment of Ground Beetle Communities in Peripheral Farmland Soils in Western Erie County, Pennsylvania**

Joseph Slepko (J. Michael Campbell), Mercyhurst College - Biology

Ground beetles (Coleoptera: Carabidae) are important generalist predators in a variety of habitats where they prey on many kinds of pest insects. Maintaining such a population of pest predator organisms could greatly improve the heath of many crops without completely destroying delicate food webs with man-made pesticides. Pitfall traps were used to sample ground beetle populations at an active farm operation in western Erie County, Pennsylvania during the summer of 2006. Sampling was carried out to determine how abundance varied among three macro-habitats: a corn field managed by traditional methods involving chemical use, an abandoned corn field that had not been used or treated with chemicals for several years, and a forest ecotone adjacent to a chemically-treated corn field. Winter sampling of ground beetles was also carried out in the abandoned corn field to determine how the burrowing depth of over-wintering populations can be affected by mild versus extreme cold winter conditions. An abundant and diverse community of soil arthropods was found in the abandoned corn field site compared to the other two macro-habitats. During the winter sampling both adults and larval forms of ground beetles occurred at depths down to 30 cm in the soil.

## Viral Abundance in the Beach Waters of Presque Isle State Park

Cody Smith (Steven Mauro), Mercyhurst College - Biology

Last year, over 40 beach closures at Presque Isle State Park in Erie, Pennsylvania occurred as a result of high levels of aquatic bacteria. Similar problems were reported nationwide, accounting for thousands of beach closures. This alarmingly high incidence of beach water contamination has caused great concern for public welfare, providing an impetus for a closer examination of the identity and abundance of microbial fauna that are present in recreational swimming waters. To address this concern, we have used epifluorescence microscopy to enumerate viruses in the water of several beaches at Presque Isle State Park throughout the fall and winter seasons of 2006/2007. Our results indicate high viral titers at all sites sampled, typically averaging over a million viral particles per milliliter of water sampled. There was both spatial and temporal variability in total viral abundance that did not correlate with numbers of *E.coli* and *Enterococcus* bacteria, which are often used as indicators of microbial contamination. This study highlights the importance of incorporating viral in addition to bacterial sampling protocols to gauge the overall safety of recreational waters for human occupancy.

**The Effect of Road Salt, NaCl, on Life History Characteristics of *Chironomus riparius* (Diptera, Chironomidae)**

Mark Stauffer and Shannon Rupprecht (Pamela Silver), Penn State Behrend, School of Science - Biology

Road salt, NaCl, has adverse effects on organisms in wetlands. Road salt enters wetlands in winter, but the interactive physiological effects of salt and temperature on aquatic organisms are poorly understood. We measured survival of *Chironomus riparius* larvae in a factorial-design study to determine the joint effects of temperature (0.1, 5, 10, and 25°C) and salt (0, 5, 10, and 20‰) on benthic invertebrates. We reared 3rd-instar *Chironomus* larvae in the laboratory. *Chironomus* larvae were acclimated in the mesocosms for four days before adding the salt and were fed a TetraMin suspension. Survival decreased as temperature (*F*3,30 = 25.92, *p* < 0.0001) and salinity (*F*3,30 = 12.10, *p* < 0.0001) increased, and there was no significant interaction between salinity and temperature (*F*9,30 = 1.73, *p* = 0.1244). At 5° C, low concentrations of salt tended to increase survival, whereas at higher temperatures, all concentrations of salt negatively affected survival. Low salt concentrations may protect larvae against freezing at winter temperatures and increase survival if the salt is flushed from the wetland before the spring thaw. Conversely, salt that reaches wetlands during early spring storms may be very detrimental to survival.

## CHEMICAL ENGINEERING

### New Type of Microwire-Based Magnetorheological Fluid with Enhanced Properties

Jeffrey Krug and Joshua Karli (Richard Bell), Penn State Altoona - Chemical Engineering

Magnetorheological fluids (MR) have the ability to quickly change from a liquid to a semi-solid and back through the application and removal of a magnetic field. Industrial MR fluids are suspensions of magnetic microspheres in a viscous carrier fluid. The suspension freely flows in the absence of a magnetic field. Once a magnetic field is applied, the spheres align to create a rigid semi-solid with a field strength dependant yield stress. One obstacle in using spherical particles is the settling that occurs when the fluid is not in use. When settled, the fluid does not act as a MR fluid, and complete remixing is required for predictable results. In this study rod-shaped microwires were suspended in silicone oil and their magnetorheological and settling properties were examined. With the magnetic field applied, the microwire-based fluids behave similarly to that of the sphere-based fluids. The two types of fluids display the same maximum yield stress, but the microwire-based fluids display a more responsive yield stress at lower magnetic fields. Most impressive is that the settling properties of these fluids are greatly reduced. After 24 hours, the microspheres settled out of the fluid, while the microwires showed no signs of settling after several months.

## CHEMISTRY

**Oxidation of Arylalkanones with 1*H*-1-Hydroxy-5-methyl-1,2,3-benziodoxathiole 3,3-Dioxide in Water; a ‘Green’ Synthesis of Arylketols**

Michelle Borkovec (Michael Justik), Penn State Behrend, School of Science - Chemistry

1*H*-1-hydroxy-5-methyl-1,2,3-benziodoxathiole 3,3-dioxide, has the all the oxidizing features of [hydroxyl(tosyloxy)iodo]benzene, a popular, mild oxidant used in modern organic synthesis, yet can be quantitatively recovered, recycled, and re-used. The investigation studied the α-hydroxylation of aryl ketones to aryl ketols using this reagent. In the first phase of the investigation, reaction conditions were ‘balanced’ for both optimized electrophilic attack of the reagent and subsequent SN2 displacement by water. In the second phase, various substrates were used to explore the scope and generality of the reaction using this reagent. It was found that ketols could be prepared using this method in moderate to high yield, with ease of workup and recovery of the reduced reagent. This oxidation is an attractive alternative to standard preparations of this important functional group.

## Synthesis and Photochemistry of Furoin and Acetyl Furoin

Joey Braymer (Naod Kebede), Edinboro University of Pennsylvania, School of Science, Management and Technology - Chemistry

Furoin, a compound belonging to the class of acyloins, is an interesting compound and was studied because of its photoprotecting abilities. In order to understand how furoin acts as a protecting compound, acetyl furoin was synthesized. By using IR and 1H NMR techniques, the synthesis of acetyl furoin was confirmed. The steady state photochemistry of the synthesized product was then carried out by irradiating acetyl furoin at 254 nm. The time-lapse photolysis was monitored by UV-Vis spectroscopy and gas chromatography which showed consumption of acetyl furoin and formation of a new product. It was observed that furoin does provide protection to a small molecule and then it is deprotected using ultraviolet light. The synthesis of furoin, acetyl furoin and the photodeprotection study will be presented.

## COMMUNICATION

**Signs of the Feminine Ideal: An Analysis of Shoes in the Cinderella Fairy Tale**

### Ashley Bolton (Ishita Sinha Roy), Allegheny College - Communication Arts

Although numerous studies have examined femininity through both the history of fairy tales and footwear, the symbolism of shoes in fairy tales has been largely overlooked by communication scholars. However, this signification has material consequences for women by restricting their role in the public sphere. My paper explores how women’s shoes in the fairy tale *Cinderella*, and its contemporary film versions, function as signs that both reinforce and contradict dominant notions of idealized white femininity in patriarchal society. Through my analysis I argue that shoes have become cultural boundary markers of western femininity. What makes my research imperative for communication scholarship is how cultural artifacts, such as shoes, are gendered and produce myths that fix women within the normative realm of the private sphere. Simultaneously, if shoes can embody hegemonic patriarchal values, they can equally function as counter-hegemonic vehicles of feminist discourse. What my study therefore advocates is awareness about the ideological significance of cultural artifacts and the myths they generate, in order to change women’s lives and their participation in the public sphere.

## COMPUTER SCIENCE

**Creation and Analysis of Artificial Intelligence Solvers for the Game Quoridor**

Jeremy Alberth (John Bonomo), Westminster College - Computer Science

The board game Quoridor is an abstract strategy game whose layout begins with two pawns on opposite sides of a 9x9 board with an objective of reaching the opposite side. A player may move his pawn to make progress on a path that leads to his goal side of the board or place a wall to impede the progress of his opponent’s pawn. The first player to reach his goal side of the board wins the game. We will describe the creation of several artificially intelligent players for the game as well as an analysis of the performance of these players against each other. The computer players involved make use of the minimax strategy with alpha-beta pruning and a depth cutoff, employing varying heuristics to determine the value of a board to the player. Since the Quoridor game tree has a large branching factor, we explored techniques to restrict the moves considered and thus increase the depth searched by computer players.

### Robotic Mapping and Path Following

Dewey Black, Greg Lutz, and Zack Marrapese (Charles Burchard and Gary Walker), Penn State Behrend, School of Science - Computer Science

Because robotic vacuum cleaners do not know the size and layout of their environment before performing their task, they operate slowly, move inefficiently, and must rely on many sensors for guidance. This project involves a system that can make these robots quicker, more efficient, and rely on fewer sensors by mapping the environment and then identifying a path of complete coverage through the environment.

## Vojisto: A Linux Distribution for Flash Party Networks

Colin Dean (C. David Shaffer), Westminster College - Computer Science

LAN party administrators need a quick, lightweight, yet scalable router appliance to facilitate communication between gamers' computers. I will describe Vojisto, a Linux-based router operating system specifically designed for the LAN party environment. In building Vojisto, I investigated the Linux kernel boot process as well as the process of building an extremely lightweight filesystem in a cross-compiled environment. Vojisto loads entirely into the system's RAM, thus eliminating the bottlenecks of CD, HDD, or floppy-based operating systems. It features a web-based administration panel from which the user may adjust the operating system's settings and backup the configuration so that it may be restored when the router is restarted.

**An Analysis Framework for Cellular Phone Viruses**

Michael Lenhart and Justin Lee (Jungwoo Ryoo), Penn State Altoona - Computer Science

Not long ago, a cellular phone was regarded as a mobile communication device mainly for business people. Today, it plays many important roles for an individual, not just as a personal voice communication device but also as a multi-function/multi-media data communication and entertainment device. Roughly one out of every six people on the globe bought a cellular phone in 2005. While the convenience and entertainment values a cellular phone brings are enormous, it also presents unprecedented threats to the security and privacy of a person's life. Particularly, a new generation of hackers create malware specifically designed for cellular phones. They steal valuable information stored in the cellular phones and often disrupt personal productivity. As people depend more on their cellular phones, the stakes will become higher. After conducting a thorough literature survey, the authors find that there is little research on various cellular phone viruses and their implications toward the conventional protection mechanisms. To address this problem, they develop a comprehensive taxonomy of cellular phone viruses and an analysis framework. By using the taxonomy and the framework, the authors identify deficiencies in the existing antivirus solutions and develop a set of novel solutions of their own.

### SEED – Scriptable Extensible Emulator and Debugger

Ryan Moore (C. David Shaffer), Westminster College - Computer Science

Software based microprocessor simulators are becoming increasingly accurate (in terms of timing) and faster. Retargetable simulators provide a base set of tools upon which simulators for other architectures can be built. These retargetable simulators are interesting because they allow for developed tools, testing software, and performance measurements for one architecture to be relatively easily integrated into the simulation of another architecture. This reduces the impact of switching architectures on the developer. However, retargetable simulators have varying levels of flexibility in their scripting capabilities and support (if it exists at all) for the simulation of hardware external to the main processor being simulated. In this presentation I will describe SEED, a retargetable simulator for RISC architectures, which is designed to be flexible with its scripting language, and which provides an API for the simulation of arbitrary hardware that interfaces with the main processor. Furthermore, a temperature monitoring and alarm project will also be discussed, which is simulated using SEED.

## ECONOMICS

**Why Do Some Products Vary More in Price from Place to Place than Others?**

Alexander Kazmierczak (James Kurre), Penn State Behrend, Sam and Irene Black School of Business - Economics

Nearly everyone is aware that gasoline prices vary from place to place, and that housing is much more expensive in some places than others. It appears that some goods vary more in price through space than others. What causes this? This project seeks to identify the factors that cause some types of goods to have low spatial price variability while others have great variability. This research makes use of a unique database of prices consisting of 61 items over approximately 300 urban areas. The first step in this research is to measure each product’s spatial price variability, measured by the coefficient of variation (COV). The data verify empirically that some goods have significantly more spatial price variation than others, with the COV of some products being nearly seven times as great as that of other products. The ultimate goal is to explain these variation differences. The model that results focuses on the transportability of the products and the possibility of arbitrage through space when prices are different in different places. The hypothesis is that products that are transportable more easily and cheaply will have lower price variability across space. After identifying a suitable measure of transportability, a regression model is estimated for approximately three dozen products to measure the impact of transportability.

## ENVIRONMENTAL SCIENCE

### Effectiveness of Ultrasound for the Control of Dreissenid Mussel Colonization

Erin Brown (Johnson Olanrewaju and Rick Diz), Gannon University, College of Science, Engineering and Health Science - Environmental Science

For the past two decades, Dreissenid mussel species such as zebra and quagga mussels have had a profound impact upon the Great Lakes Region. Much effort has been put forth to develop methods to reduce populations and prevent biofouling. Presently, control methods involve chemical treatment as well as mechanical removal methods. These methods are costly and/or pose a threat to the surrounding ecosystem. Therefore, a method was developed using ultrasonic sound to cause distress in mussels with the goal being mussel death. Specific ultrasonic parameters and physical parameters were varied in the experiment in order to demonstrate the impact of ultrasound upon mussels. Results will show the impact ultrasound can have upon mussel species for control of mussel populations.

**Synthesis of Iron Phosphate/Iron Oxide Pellets for the Treatment of Heavy Metal Contaminated Water**

Stephenee Hall (Rick Diz), Gannon University, College of Science, Engineering and Health Science -Environmental Science

The purpose of this study was to synthesize iron phosphate/iron oxide pellets for the treatment of water contaminated with toxic heavy metals. Iron phosphate was precipitated using various methods and then coated with iron oxide. For each method, particles produced were examined with a scanning electron microscope to determine size and shape properties. Then, the ability of these particles to reduce heavy metal concentrations in simulated contaminated water was determined. Applications of the use of such particles include the treatment of drinking water, industrial wastewater, and contaminated groundwater. The presentation will cover the process in which the crystals were formed and heavy metal removal efficiencies.

### Evaluation of the Growth Kinetics of Algal Species for Use in the Production of Biodiesel

Zachary Runk (Rick Diz), Gannon University, College of Science, Engineering and Health Science - Environmental Science

Biodiesel is a clean burning alternative fuel, produced from domestic, renewable resources. *Spirulina platensis* is one species of green algae that is a candidate in providing biodiesel as a replacement for petroleum diesel. It has been suggested that supplementing natural sunlight with artificial light can more than return the energy investment in enhanced biomass production. Thus, this study was designed to investigate the growth rates of *S. platensis* under various light/dark cycles. The algae were studied in two different enclosurements that had florescent lights attached to the top of the enclosurement to allow for growth. Nutrient requirements were also determined. Results will aid in the design of algal growth chambers to maximize biomass production while minimizing energy investment.

**Acoustic Energy Enhanced Bacterial Transport in a Porous Medium**

Wesley Willow (Rick Diz), Gannon University, College of Science, Engineering and Health Science - Environmental Science

Bioremediation is an accepted low cost method of ground water remediation with the ability to degrade low concentrations of pollutants with little disturbance to the site. This is accomplished by *in-situ* biological transformation of organic pollutants into inorganic materials. One inhibitor of bioremediation is the access of bacteria to a pollutant, as the bacteria added to a system tend to cling to the surfaces of subsurface particles. There may be several ways to overcome these binding forces to enhance the transport of bacteria for bioremediation. One possible application is acoustic energy, as it has been shown effective in the laboratory and industry to remove scale and fouling and to remove bacteria from teeth. The use of acoustic energy to enhance the transport of bacteria in a porous medium has been tested by the use of a column at constant head. The addition of acoustic energy used was ultrasonic, tested in pulse and constant modes. Data have been analyzed in the form of a break through curve (C/Co vs. Time) using a plate count method to obtain concentrations. Results will be presented.

## MARKETING

**Patient Satisfaction: A Gender Perspective**

Sean Chenard and Derek Candela (Syed Andaleeb), Penn State Behrend, Sam and Irene Black School of Business - Marketing

Patient satisfaction has been studied in considerable detail in hospitals. To deliver higher patient satisfaction it is important to determine whether a gender perspective is important in shaping hospital service strategy. Based on the SERVQUAL framework that has been used extensively in explaining satisfaction, this study attempts to answer whether the SERVQUAL factors affect patient satisfaction depending on the gender of the patient. The study was conducted by surveying recent patients of hospitals in the Erie, Pennsylvania area. These factors were assurance, cleanliness, responsiveness, relations, and procedures. The study concluded that there are differences in needs of male and female patients that need to be considered by hospitals to deliver higher levels of patient satisfaction.

### Student Satisfaction with Professors

Megan Ferrie and Elizabeth Fletcher (Syed Andaleeb), Penn State Behrend, Sam and Irene Black School of Business - Marketing

The research was conducted to explain students’ satisfaction with their professors. The explanatory variables included teachers’ knowledge, communication, atmosphere, organization, effectiveness, attentiveness, and fairness. We also tested whether the gender of the teachers and students moderated the results. The sample for this study was composed of a random sample of Penn State Behrend students in addition to a sample of Mercyhurst, Gannon, and Edinboro students taken at the convenience of the researchers. All surveys were conducted in less than one week. There were 267 respondents altogether. After analyzing and interpreting the data, we discovered the factors explaining student satisfaction were Effectiveness and Fairness, while the factor with the weakest correlation was Atmosphere. Implication of the study showed that the strongest explanation to satisfaction among males and females was Fairness. This shows that a professor should always focus on Fairness towards students to assure greater student satisfaction. By conveying clear explanations, exhibiting equality, and showing consideration, professors can increase overall student satisfaction.

**The Different Effects of Male and Female Doctors on Patient Satisfaction**

Justin Munson and Andre Pranckevicius (Syed Andaleeb), Penn State Behrend, Sam and Irene Black School of Business - Marketing

Patient satisfaction has long been a concern for hospitals. To achieve higher patient satisfaction hospitals undergo many revisions and upgrades in procedures, layouts, and staff. Given the fact that every patient is different, and has different preferences, it becomes increasingly difficult to determine which changes will bring more satisfaction. As opposed to attempting to determine which factors will increase satisfaction for every patient’s visit, this study attempts to answer which factors differently affect patient satisfaction depending on the gender of their primary doctor. The study was conducted by surveying recent patients of hospitals in the Erie, Pennsylvania area. The survey was designed to analyze a patient’s satisfaction among different factors. These factors were assurance, cleanliness, responsiveness, relations, and procedures. The study concluded that for both male and female doctors, patients are concerned with the assurance, responsiveness, and relations. However, when a female is the primary doctor, patients tend to become concerned with the procedures as well.

### Total Quality Management in the Classroom

Ross Zambanini (Syed Andaleeb), Penn State Behrend, Sam and Irene Black School of Business - Marketing

Given the sums of money at stake, it is no wonder that current trends in managerial focus have been oriented on Total Quality Management (TQM). This focus on quality is not limited to traditional businesses. Increasingly, institutes and universities are measuring TQM as it pertains to attracting and retaining students and faculty. Specifically, what variables explain student satisfaction with professors and are they subject to change? Using seven major constructs, a series of 58 independent regression models were built to track students’ mindsets as they progressed from their freshmen to senior year. Results produced a reliable model that suggests students naturally mature throughout the educational process, putting more emphasis on constructs valued by the working world and less on their own needs for entertainment. Whereas such findings are intuitive, the models presented do suggest that the opposite is occurring in classrooms. Namely, as class sizes decrease from intro-level freshmen courses, classes become more intimate and more entertaining, often distracting from those variables students value most.

## MATHEMATICS

**Summing an Infinite Series Using Residue Theorem**

Sarah Orris (Boon Wee Ong), Penn State Behrend, School of Science - Mathematics

Several different methods exist to find the summation of an infinite power series. For a foundation to researching the method using residue theorem, we have computed summations using both Laplace transforms and Fourier series. We have made several steps toward summing an infinite series with three variables. The residue of function at a pole of integer k of order one was investigated.

**Vertex Replacement Layouts**

Joseph Pleso (Michelle Previte), Penn State Behrend, School of Science - Mathematics

The focus of this talk will be methods of displaying graphs generated by vertex replacement rules in an aesthetically pleasing way. Discussion will include a variety of methods that can accomplish this task. It can be shown that assigning coordinates to |**V|** vertices connected by |**E|** edges in an optimum manner is **NP-HARD** and requires between **Θ (|V| log |V|+ |E|)** and **Θ (|V2|+ |E|)** time.Applications of this work include fractals, data compression, and cell growth. While only graphs that can be embedded in the plane are currently being considered, future plans include considering other graphs not meeting that criterion.

## The Game of Go and Surreal Analysis

Joseph Pleso (Paul Olson), Penn State Behrend, School of Science - Mathematics

The focus of this talk will be the application of surreal analysis to the game of Go. Similar analyses have been conducted on Go before, specifically the later stages of the game; however, this research will employ surreal analysis on earlier parts of the game by extrapolating the current theory. Motivated by the lack of a superior computer algorithm, this technique will allow a larger class of positions to be analyzed. It is believed that with a better understanding of more positions, a more advanced artificial intelligence (AI) can be constructed. Thus, this research aims to improve existing Go algorithms by extending the surreal analysis of Go. The results of this technique will be presented and explained.

### A Coupled Oscillator Model Applied to the Spinal Cord of a Sea Lamprey

Jeremy Sopko (Joseph Previte), Penn State Behrend, School of Science - Mathematics

This research will expand upon recent research done on pattern formation of coupled oscillators. This project will seek to model the neuron electric activity in a sea lamprey spinal cord. This will expand on current models that involve linear chains of neurons with external forcing only occurring at the ends of the chain. The research will allow for forcing along any neuron in the spinal cord and allow variable coupling and intensity among the neurons, rather than nearest neighbor coupling that previous models used. We will then analyze the stable structures of resulting differential equations in the attempt to find Hopf bifurcations in the model. To carry out this research relevant biological data will be received. With a system as large and as variable as this we will only analyze unique cases that arise from the data to find relevant results.

**Realtime Failure Forecasting for Flat, Ball-Nose, Roughing, and Tapered Endmills Using an Accelerometer**

Christopher Suprock1 (John Roth1 and Lawrence Downey2), Penn State Behrend, 1School of Engineering and 2School of Science - Mathematics

In this paper, flat, ball-nose, roughing, and tapered endmilling tools are investigated for their respective wear trends. These curves are contrasted with the trend exhibited by traditional flat endmills. To isolate the wear behavior of the various tool geometries, an autoregressive-based monitoring algorithm is used to track the tool's condition using a tri-axial accelerometer. An accelerometer is used due to its low cost and since it does not limit the machining envelope. To demonstrate repeatability, eight life tests were conducted (two life tests for each type of endmill). The technique discussed herein successfully identifies impending fracture or meltdown due to wear in all cases, providing sufficient time to remove the tools before failure is realized. Furthermore, the algorithm produces similar trends capable of forecasting failure, regardless of tool geometry, in all cases, without requiring algorithm modifications or prior information regarding the cutting conditions.

**The Introduction of Multi-Univariate Autoregressive Modeling and Comparison to Multivariate Autoregressive Models**

Christopher Suprock1 (John Roth1 and Lawrence Downey2), Penn State Behrend, 1School of Engineering and 2School of Science - Mathematics

When employed in real-time data analysis, traditional fixed-order multivariate autoregressive models are heavily limited by computational capacity. As a result, a faster technique called multi-univariate autoregressive modeling has recently developed by Suprock et al. in order to make real-time observations of the model's frequency spectra. Because of the effectiveness demonstrated by this new technique, this work will investigate the differences in frequency spectra produced from traditional fixed-order multivariate autoregressive models as compared to those produced from multi-univariate autoregressive models. Empirical differences in these frequency spectra will be explained by contrasting the analytical processes of both methods. Benefits and disadvantages of both methods will be noted and described.

## Hopf Bifurcations on a Scavenger/Predator/Prey System

Malorie Winters (Joseph Previte), Penn State Behrend, School of Science - Mathematics

The basis of this research is to determine the dynamics of a system when a scavenger is introduced onto a Lotka-Volterra predator/prey model. Using Routh-Hurwitz analysis, we found conditions that guarantee the existence of a Hopf bifurcation. Bifurcation diagrams were then used to find parameter values for which the system exhibits two stable structures simultaneously (a stable limit cycle and a stable, fixed point). This represents a biologically relevant model because it displays extinction and persistence of all three species for various parameter values.

## MECHANICAL ENGINEERING

**Design of a Graphical User Interface for a Complex Human Circulatory System Model in Matlab**

## Jason Cecchetti (Yi Wu), Penn State Behrend, School of Engineering - Mechanical Engineering

Medical research has shown that there are many variables affecting the performance of the human heart. The purpose of this research was to develop a Graphical User Interface (GUI) to provide a user-friendly way to access a complex human circulatory model in Matlab. Its objective was to allow a user who is unfamiliar with the complex Simulink model to be able to input desired parameters, run the program, and obtain the response of the circulatory system through the GUI’s output. Essentially, the GUI would allow the user to assign values to the input variables in the Simulink model, simulate the file, and select desired results to be displayed in the GUI window. From these results, the user would be able to determine whether or not a left ventricular assist device (LVAD) was necessary to increase blood flow based on the heart’s performance. The results produced a successful GUI capable of completing the tasks desired above.

**The Effects That Cryogenic Treatments Have on Tool Acceleration as it Relates to Workpiece Surface Finish and Tool Wear**

David Irvin (John Roth), Penn State Behrend, School of Engineering - Mechanical Engineering

Recent research has shown that cryogenically treating tools can lead to longer tool life while producing exceptional workpiece surface finish. Furthermore, it is believed that tool wear and workpiece surface finish are directly controlled by tool acceleration during manufacturing processes. Therefore, the purpose of this research was to study the effects that cryogenics treatment had on tool acceleration as it related to workpiece surface finish and tool wear. Three different cryogenic recipes for tungsten-carbide lathe inserts were tested using turning operations at three different constant surface speeds. Comparing the results to baseline tests showed that the effects of cryogenic treatments varied. First, the effectiveness of cryogenic treatment depended upon the recipe used. Two recipes resulted in decreased tool acceleration, leading to increased tool life and superior workpiece finish. However, one recipe caused higher tool acceleration magnitudes resulting in decreased tool life and poor workpiece finish. Second, the effectiveness of cryogenic treatment depended upon turning surface speed. As surface speed increased, tool acceleration magnitudes approached those present during baseline tests at the same speed, resulting in diminishing effectiveness. Therefore, the analysis shows that cryogenic treatments affect tool acceleration variably, directly corresponding to changes in tool life and workpiece surface finish.

### Effect of DC Current on the Formability of Ti-6Al-4V

Thomas Kronenberger and Carl Ross (John Roth), Penn State Behrend, School of Engineering - Mechanical Engineering

Recent research has demonstrated that the mechanical properties of metallic materials are altered when an electrical current is passed through the material. These studies suggest that titanium, due to its low formability and potential for dramatic improvement, should be subjected to additional study. The research presented herein further investigates the use of electricity to aid in the bulk deformation of Ti-6Al-4V under tensile and compressive loads. Extensive testing is presented that documents the changes that occur in the formability of titanium due to the presence of an electron wind at varying current densities. Using carefully designed experiments, this study also characterizes and isolates the effect of resistive heating from the change due to the electrical flow alone.The results demonstrate that the presence of an electrical current within the material during deformation can greatly decrease the force needed to deform titanium while also dramatically enhancing the degree to which it can be worked without fracturing. Isothermal testing further demonstrates that the changes are significantly beyond that which can be accounted for due to increases in the titanium’s temperature. The results are also supported by data from tests using pulsed and discontinuously applied current. Furthermore, current densities are identified that cause an apparent superplastic behavior to occur. Overall, this work fully demonstrates that an electrical current can be used to significantly improve the formability of Ti-6Al-4V and that these improvements far exceed that which can be explained by resistive heating.

### Failure Forecasting Method for Curvilinear Endmilling

Christopher Suprock1 (John Roth1 and Lawrence Downey2), Penn State Behrend, 1School of Engineering and 2School of Science - Mechanical Engineering

In this paper, a universal endmill condition monitoring technique is presented for curvilinear cutting. This algorithm operates without the need for prior knowledge of tool conditions, tool type, or part geometry. This technique is based on an autoregressive-type monitoring algorithm which is used to track the tool's condition using a tri-axial accelerometer. An accelerometer is used due to its low cost and since it does not limit the machining envelope. To demonstrate repeatability, six life tests were conducted (two life tests for each cut geometry). The technique discussed herein successfully identifies impending fracture or meltdown due to wear in all cases, providing sufficient time to remove the tools before failure is realized. Furthermore, the algorithm produces similar trends capable of forecasting failure, regardless of tool type or part geometry. Success is seen in all cases without requiring algorithm modifications or prior information regarding the cutting conditions.

## PHYSICS

**Modeling Magnetic Particles in a Non-Magnetic Medium Flow**

Charles Barr (G. William Baxter), Penn State Behrend, School of Science - Physics

In the medical field there is a great need for an effective targeted drug delivery system. One of the current methods that is considered quite promising is the use of magnetic materials and shaped magnetic fields. The goal of our research is to create a model of the interactions of these particles with the medium, the environment and each other. This model is in the form of a molecular dynamics simulation program. Our strategy is to first create a model that displays the behavior we expect in simple systems, and then expand this model to cover situations that are too complex to analyze directly. Using this type of model it can be determined what types of particles and magnetic fields are best suited for targeted drug delivery systems.

## PSYCHOLOGY

**Evaluation of the Mentoring for Post Secondary Education (MEPSE) Program**

Shannon Beaver (Daniel Lago), Penn State Altoona - Psychology

Mentoring for Post Secondary Education (MEPSE) is a program that was developed as an outgrowth of a grant under U.S. Department of Housing and Urban Development (HUDCOPC-PA-04-630). MEPSE has used student volunteers and local professionals to assist residents of a public housing project (Fairview Hills) to apply for college admission and obtain financial assistance over the past 18 months. Through this research we are refining this program to sustain it at the Altoona College and provide a model for other colleges. The author began this program in her role as a work-study student associated with this grant. The researchers designed an evaluation that uses four simple standardized surveys to assess the opinions of participant groups, PSU administrators, PSU student volunteers, Altoona Area School District professional staff, and Fairview Hills residents. The participant groups were asked their opinions of the program during individual face-to-face interviews with the principal investigator. Attendance or participation activities were also summarized. Results focus on success rates and reasons for not completing the program; refinements must emphasize more consistent personal relationship support and frequent contact. Young adult women have been most successful in attending college based on our findings. Our revised program manual reflects these priorities.

## The Effects of Background Music on Studying

Alicia Dunbar, Bethany Hanus, and Megan Hoffman (Jennifer Trich Kremer), Penn State Behrend, School of Humanities and Social Sciences - Psychology

This study evaluated the effect of background music on college students’ ability to remember information in a simulated study situation. Male and female participants from Penn State Behrend completed a reading discourse task (subsection of the GRE) while being exposed to one of five normed music conditions (familiar vocal, unfamiliar vocal, familiar instrumental, unfamiliar instrumental, or silence). Researchers also assessed working memory capacity and personality. To conserve power, analyses were divided into four separate 5 x 2 ANOVAs: 5 (condition) x 2 (personality), 5 (condition) x 2 (study habits), 5 (condition) x 2 (working memory), and 5 (condition) x 2 (gender). The effect of condition was also investigated independent of other variables using an ANOVA. Results showed no statistical difference for reading discourse scores between conditions, working memory capacity, gender or typical study habits. An interaction of personality was significant in that extroverts scored higher than introverts during reading discourse.

**Evaluating the Effectiveness of a Middle School Mentoring Program**

Christopher Engelhardt, James Hodge, and Bobby Staaf (Charisse Nixon), Penn State Behrend, School of Humanities and Social Sciences - Psychology

Previous research has demonstrated modest outcomes for mentoring programs (DuBois, Holloway, Valentine, & Cooper, 2002). Even though the research may be equivocal, over 70 percent of youth list someone other than a parent as someone they see as a role model. Therefore, the aim of the current study was to determine if local middle schools’ mentoring programs were effective in promoting positive developmental outcomes. To this end, previous research has also demonstrated that middle school mentoring programs are more effective if they include more “best practices.” The current study employed a number of these best practices (e.g., planned frequency of meetings, structured activities for mentors and youth, etc.). Participants in both mentoring groups and control groups were evaluated on connectedness, relationships, self-efficacy, and empathy. Participants only in the mentoring group were also evaluated based on relationships with their respective mentors. These variables were selected because: 1) Ophelia (the body organizing the mentoring program) suggested these were the variables most likely to change and 2) these variables have been linked to positive developmental outcomes. Although not all the data have been collected, baseline results indicate no differences in connectedness, empathy, self-efficacy, and positive relationships between the mentoring group and control group.

## Individual Attitudes Related to Actors in Love Scenes

Briana Grimes, Kerry Lope, and Ellyssia Johnson (Victoria Kazmerski), Penn State Behrend, School of Humanities and Social Sciences - Psychology

This study analyzed the attitudes that individuals possess about non-white actors portrayed in love scenes. The Implicit Association Test (IAT) was used to assess the attitudes held by participants relating to race. Previous research has shown that individuals identify and acquire higher memory recognition towards faces of their own race. We predicted that individuals will prefer viewing love scenes consistent with their own race and will feel uncomfortable viewing interracial love scenes. We also predicted that females and individuals with less sexual experience will view scenes as less intimate. This research is useful because it can be applied to understand and diminish social prejudices.

**An Evaluation Relational of Aggression among Elementary and Middle School Students**

Elizabeth Kiefer, Megan Hoffman, and Elizabeth Sansone (Charisse Nixon), Penn State Behrend, School of Humanities and Social Sciences - Psychology

Relational aggression is becoming an increasing problem in many schools, and likewise is being accompanied by the development of intervention programs targeting this socially damaging behavior. The focus of the current study was to examine effectiveness of one such program, the CASS© (Creating a Safe School) program, in both elementary and middle schools. Students were asked to fill out surveys both before and after an intervention took place, reporting frequency of occurrences of both relational and physical aggression. Data were analyzed in terms of programmatic effects as well as grade and gender differences. No significant effects were found overall when all students were analyzed, however, a significant decrease in relational aggression was found within those students who were labeled as “aggressors.” Physical aggression was used as a control for relational aggression due to the fact that since the program did not directly target physical aggression, it should remain stable over time. Implications of results are discussed in terms of improvement to future intervention programs.

**The Impact of Social Comparisons and Perfectionism on Female Body Dissatisfaction: Which Has The Greatest Influence?**

Jodie Kitchener and Amber Kunitsky (Victoria Kazmerski), Penn State Behrend, School of Humanities and Social Sciences - Psychology

Theory and research have suggested that perfectionism and making social comparisons are related to female-body dissatisfaction, but perfectionism has seldom been a main factor examined. College females at Penn State Behrend completed scales to measure body dissatisfaction, perfectionism, and social comparisons. Participants were split into three groups and exposed to photographs of thin women, overweight women, or a control group of unrelated photographs before the tests were administered. Our hypothesis was that females’ body images are more negatively impacted by their social influences than by perfectionism. We also predicted that the group shown the thin female photographs would have higher body dissatisfaction scores. The importance of this research is to further knowledge about female body dissatisfaction and how it can be related to perfectionism and social comparisons.

**Family Violence and its Effects on Social Interactions**

Andrew Scheller, Allison Palermo, and Matt Ogden (Victoria Kazmerski), Penn State Behrend, School of Humanities and Social Sciences - Psychology

Previous research focused on prior exposure to family violence and its effect on social interactions on incarcerated adolescents. However, current understanding of research primarily focuses on individuals who are currently in jail or who have mental disabilities such as clinical depression or severe anxiety. To balance out research in this area we plan to complete the same research among a normative sample, which will expand generalizability. We hypothesize that an individual who has experienced a greater level of violence will respond more aggressively in social situations. Situations include school, work, sports, leisure activities, and confrontations with unknown individuals. Such situations are common everyday experiences, in which people are provided with the power of choice. We also hypothesize that high and low extremes of social aggression (social interaction questionnaire) and high and low extremes of prior exposure to family violence (PAQ-R) will show a significant direct relationship. This will show that participants who have greater exposure to family violence will score higher on the social aggression questionnaire.

### Stress and Perceived Authority in the Milgram Paradigm

Bethany Slomski and Kyle Johnston (Jennifer Trich Kremer), Penn State Behrend, School of Humanities and Social Sciences - Psychology

With the topic of obedience to authority being thrust into the spotlight by the Abu Ghraib scandal, more exploration in this area is needed. Researchers believe that this behavior is based on the perception of social power. French and Raven's (1959) classic formulation suggest that there are six types of power associated with social influence. These six types of power provided characterization to different authority styles. Perhaps the most influential study completed on authority was the Milgram (1963) behavioral study of obedience. Although there were great social implications learned from Milgram's study, due to current ethical guidelines, replication of such an experiment would be impossible. By replicating a study completed by Blass and Schmitt (2001), which asked participants to view a video of the Milgram experiment, research was completed in the area of perceived power in the Milgram (1963) paradigm, without posing traumatic risks to participants. Also, through the use of a stress assessment, the Dundee Stress State Questionnaire, stress before and after viewing the video clips were considered to assess if any stress was caused by viewing the video. It was found that stress was experienced, and expert, coercive, and legitimate were the most frequent responses for perceived authority.

**Brain Changes in Attention Based on Musical Experience**

Andrew Walker, Kristin McQueeney, and Angela Speck (Victoria Kazmerki and Dawn Blasko), Penn State Behrend, School of Humanities and Social Sciences - Psychology

Recent studies suggest that musical training also may impact general cognitive processes. For example, increases in IQ have been observed in children who took instrumental music lessons relative to an alternative activity. We investigated the influence of musical experience on attentional interference using two tasks; the classical visual Stroop task (color/word), and a novel timbre judgment task where the tone of a brass or string instrument is integrated with a voice saying “brass” or “string.” Participants judged timbre and ignored the word. Event-related brain potentials (ERPs) were recorded during both tasks. There was evidence of Stroop interference regardless of musical experience, with participants responding slower and less accurately to incongruent vs. congruent stimuli. Highly trained musicians were better at the timbre judgment task. There ERPs showed greater negativity to congruent trials relative to incongruent trials. Those with less musical experience showed a late posterior positivity (1000ms) for congruent in comparison to incongruent trials. Source analysis suggested primary activity in left frontal cortical regions are important in executive functions and attentional inhibition. There were also effects of musical experience in ERPs recorded to the visual Stoop task, implying that there may be general cognitive benefits of musical training.

## SOCIOLOGY

**Keeping the Faith**
Elizabeth Gargano (Kathleen Mastrian), Penn State Shenango - Sociology

People have had faith in a higher power since the beginning of time. Where does this faith come from? How it is maintained? Why do people continue to believe in a higher power? This qualitative research project explores the personal experience of faith regardless of religious affiliation. Literature review revealed no prior qualitative research study on the maintenance of faith. The researcher will interview 15 – 20 individuals of different faiths by asking nine open-ended questions to determine how and why they are maintaining their faith. The data will be analyzed to ascertain if there are patterns that emerge from the maintenance of faith. The results of this study will be of interest to members of the clergy and faith-based organizations.

### Breaking from the Closet

Benjamin Haag (Kathleen Mastrian), Penn State Shenango - Sociology

Although homosexuality is starting to gain acceptance, the process of coming out may still have some negative consequences. These consequences may come from someone the person knows well or from a distant acquaintance. The consequences may include not being friends with that person anymore, intolerance, and even hate crimes. Previous literature suggests that homosexuals may keep those around them at a distance as a result of a fear of being rejected when their sexual orientation is known. The purpose of this qualitative study is to explore the process of coming out, and to identify and describe common experiences, both negative and positive. “Coming out” means recognizing homosexuality in one’s self as well as disclosing sexual orientation to others. The study will encompass a variety of situations such as coming out to family, friends, and co-workers. Results of this study will be useful to counselors, college personal, and LGBT organizations.

## BIOCHEMISTRY

**Investigation of Anti-Aggregation Properties of a Novel Beta-Sheet Breaker**

Amy Opest and Christina Stewart (Melissa Barranger-Mathys), Mercyhurst College - Biochemistry

Alzheimer’s disease is associated with a high amount of memory loss, confusion and personality changes in older adults. It is believed that the aggregation of the β-Amyloid peptide into fibrils is a major cause of these symptoms. These fibrils, or plaques, aggregate into a β-sheet conformation. The waxy plaques are known to be toxic to neuronal cells, thus explaining their connection to Alzheimer’s disease. The purpose of this research is to design and synthesize a β-sheet breaker peptide using solid phase peptide synthesis. The anti-aggregation properties of this penta-peptide have been investigated using the fluorescence indicator, thioflavin T. This peptide has shown promise in its ability to reduce the amount of -sheet conformation in -insulin. Discernibly, this type of β-sheet breaker may be able to be utilized for the treatment of Alzheimer’s disease in the future.

## The Synthesis of a Novel -Sheet Insulin Breaker

Joshua Veith and Amy Opest (Melissa Barranger-Mathys), Mercyhurst College - Biochemistry

The biochemical characteristics of Alzheimer’s disease have inspired current research to explore methods of disrupting the amyloid plaques associated with the disease. One method has been to design and synthesize 5-6 amino acids in a peptide chain called -sheet breakers. In our research, -sheet insulin is being used to mimic amyloid beta proteins which are found in high concentration in the brain of Alzheimer’s patients. Methods of -sheet breaker synthesis have included the formation of *in situ* amino acid fluorides for the addition of Aib as well as HOBt activation for all other amino acids. “Aib Heavy 6-5” with the sequence Leu-Pro-Aib-Aib-Aib-Asp-NH2 is our most recent -sheet breaker. It is being tested for its ability to penetrate and break apart -sheet insulin. Tests are being done with dependent variables of concentration and solvent. The presentation will discuss the various methods used to synthesize and characterize the -sheet breakers as well as its inspiration from Alzheimer’s disease.

## BIOLOGY

**2,4-Diacetylphloroglucinol, an Antibiotic Produced by Biocontrol Bacteria, Alters Plant Root Development**

Jessica Brazelton1 (Catharina Coenen1 and Brian McSpadden Gardener2), 1Allegheny College and 2Ohio State University - Biology

Naturally occurring biocontrol strains of the soil bacterium *Pseudomonas fluorescens* can stimulate crop root growth and reduce the need for fungicides by excluding pathogens from the rhizosphere. Root growth stimulation has been attributed to the production of the plant hormone auxin, whereas biocontrol activity against pathogens depends in part on production of the antibiotic 2,4-diacetylphloroglucinol (DAPG). Twenty-four biocontrolstrains of *P. fluorescens* from Ohio soils failed to produce auxin at concentrations detectable by either Salkowsky assays or by a sensitive bioassay based on activation of the auxin-responsive *GH3* promoter. Supernatants from all strains inhibited activation of the  *GH3::luciferase* construct in tobacco hypocotyls, suggesting that DAPG produced by these strains inhibits auxin action. DAPG inhibited primary root growth in tomato seedlings at the same concentrations that inhibited auxin-induction of *GH3*-promoter in tobacco hypocotyls. However, lower concentrations of DAPG increased the number and length of lateral roots in tomato seedlings, and inoculation of tobacco seedlings with *phlD+* *Pseudomonas* strains also increased activity of the *GH3* promoter *in vivo*. Lateral root induction by DAPG was absent in the auxin-resistant *diageotropica* mutant of tomato. Our results suggest that DAPG regulates plant root development at least in part through complex interactions with auxin signaling.

**Generation of ndp1 Knockout Mutants in *A. thaliana***

W. Clay Campbell, Joshua Meyer, and Frank Pagel (Michael Campbell), Penn State Behrend, School of Science - Biology

The nuclear NDP1 gene encodes a 420 amino acid polypeptide which is found in the mitochondria of higher plants though the function is unknown. The nuclear coding region of the OHP2 protein, found in chloroplasts, overlaps the last eight amino acids of NDP1 on the complementary DNA strand at the 3’ end resulting in *cis*-antisense transcripts. The *cis*-antisense relationship between the NDP1 and OHP2 genes implies that antisense transcription levels might regulate the expression of NDP1 and OHP2, a relationship which would represent the first regulatory mechanism between mitochondrial and chloroplast genes found. Therefore, the first goal will be to determine the function of NDP1 on the model organism *Arabidopsis thaliana*. To this end, ndp1 knockout mutants were obtained from Syngenta Corporation. These mutants displayed little chloroplast movement and a 93 percent reduction in growth rate making them difficult to study. To ensure that the phenotype was due to the loss of NDP1 and to eliminate the problems associated with the incredibly slow growth rate, an attempt is being made to develop ndp1 knockout mutants by exposing the developing ovules of *A. thaliana* to *Agrobacterium* containing RNAi NDP1 plasmids by the floral dip method and selecting transformants by exposure to hygromycin.

**An Investigation of the Nitrogen-Fixing Bacteria in Bluff Sediments along the Pennsylvania Lake Erie Shoreline**

## Mark Fahmey (Steven Mauro), Mercyhurst College - Biology

A previous study by Mercyhurst College has established the low number of soil bacteria in the rapidly eroding bluffs along Lake Erie. The bacteria of the bluff sediments were also shown to have large differences in functional diversity when compared to the bacteria in the adjacent, bluff-top soils. In the current project, a quantitative study was conducted comparing the nitrogen-fixing bacterial community in the sediments of the bluff face to the nitrogen-fixing bacteria living in the relatively undisturbed forest soil at the bluff top. These bacteria may be ecologically important to plant growth on the nitrogen-poor bluff sediments. A soil extraction of the bacteria was plated on a nitrogen-free medium to select for and quantify nitrogen-fixing bacteria. This analysis indicated that bluff-face sediments contained significantly fewer nitrogen-fixing bacteria than bluff-top soils. Therefore, reclamation plantings on the bluff face may require inoculation with nitrogen-fixing bacteria. Also, bacterial samples will be analyzed for expression of the nitrogenase gene (nifH). RNA was isolated from both bluff-face and bluff-top bacterial extracts and will be analyzed by reverse transcription real-time Polymerase Chain Reaction to quantify the expression of the nifH gene.

**Analysis of the Activity of the Necdin-like Gene in Zebrafish (*Danio rerio*) Embryology**

Amanda Harmon and Stephanie Burbules (James Warren Jr.), Penn State Behrend, School of Science - Biology

Prader-Willi Syndrome (PWS) is a genetic disorder caused by a paternal deletion on chromosome 15q11-13 characterized by an insatiable desire for food causing obesity. The Necdin gene (NDN) is a maternally imprinted gene on chromosome 15 which causes PWS-like symptoms in mice and is involved in the control of permanent arrest of growth for post-mitotic neurons. A student of Dr. Warren’s lab in 2003 discovered a NDN-like gene (NDNL) in zebrafish (*Danio rerio*). Our current research uses zebrafish to study the phenotypic changes resulting from the deletion of the NDNL gene. Morpholino phosphorodiamidate oligonucleotides (MOs) are used which “knock down” gene expression by blocking RNA transcription. The zebrafish embryos are injected with MO against NDNL at the time interval from 1-8 cell stage. An MO to the gene Chordin which contained a fluorescent dye was used as a control of the microinjecting technique. Injections with NDNL MOs produced both morphological and neurological alterations. The NDNL-injected embryos contained curved trunks as well as stunted development compared to normal embryos. A DASPEI lateral line staining was done on the injected embryos suggesting that the deletion of the NDNL gene results in disarrangement of neurons along the lateral line.

## Sequencing *Odocoileus virginianus (White Tailed Deer)* mtDNA d-loop

Natalie King, Chelsea Toth, and Daniel Reese (Durwood Ray and Frederic Brenner), Grove City College - Biology

A concern in deer management is that larger, older deer are preventing younger deer from breeding, thereby limiting the gene pool. Our intention is to use mitochondrial DNA (for maternal) and nuclear genetic sequences (for maternal and paternal) to trace breeding history within deer populations. Mitochondrial DNA (mtDNA) was prepared by Perfectprep Plasmid Mini Spin Columns (Eppendorf) from *Odocoileus virginianus* fetal liver. Polymerase Chain Reaction (PCR) was employed to amplify the mtDNA d-loop using primers we designed from a previously published sequence of mtDNA d-loop. PCR products were evaluated by slab gel electrophoresis and purified using the QIAquick PCR purification Kit (Qiagen) spin column. Cycle sequencing reactions with BigDye Terminator Chemistry were run in triplicate for each DNA strand and purified to remove dye terminators by DyeEx Spin Kit (Qiagen). The samples were then sequenced using our ABI single capillary Prism 310 Genetic Analyzer. Our complete d-loop contig was compiled using Lasergene sequence analysis software (DNASTAR, Inc). Our data show western Pennsylvania’s *O. virginianus* haplotype GCC-A (Accession number EF061657) is a distinct haplotype. We have employed this preparation method to study the breeding patterns of a herd in the Cincinnati, Ohio area to determine mitochondrial genetic variability.

**Analysis of Shiga Toxin Bene Distribution in Deer Fecal Matter**

Whitney Kistler (Steven Mauro), Mercyhurst College - Biology

Shiga toxin is a human pathogen that contaminates food and water supplies. The main carrier of shiga toxin is a strain of *E.coli* commonly found in animal fecal matter, which is thought to be the main reservoir for these strains of pathogenic bacteria. Recent shiga toxin dependent illness has been reported from consumption of deer meat, suggesting that deer may be an environmental reservoir for shiga toxin producing *E.coli*. To test this idea, we have isolated DNA from deer fecal matter and probed for the presence and amount of the shiga toxin gene in the DNA recovered using both nested PCR and quantitative real-time PCR. Our results indicate the presence of the shiga toxin gene in a number of the isolated samples, suggesting that shiga toxin producing *E.coli* is present in deer fecal matter. We are currently in the process of culturing the bacteria in recovered samples so that individual strains of shiga toxin *E.coli* can be isolated and analyzed more thoroughly.

**Examination of NDP1 and OHP2 Interaction in ndp-in1 and ndp-sy *Arabidopsis thaliana* Mutants**

Joshua Meyer and Frank Pagel (Michael Campbell), Penn State Behrend, School of Science - Biology

Overlapping genes are rare in eukaryotes. In the plant *Arabidopsis* *thaliana* the genes NDP1 and OHP2 overlap at the 3’ end. Overlapping should result in double-stranded RNA products in the 3’ region of NDP1 and OHP2 and create a reduction of gene expression via processing by the Dicer protein. OHP2 encodes for a chloroplast protein associated with the light harvesting system. The NDP1 gene product has no known function but is predicted to encode for a mitochondrion protein. Our goal is to determine the interaction of NDP1 and OHP2 and the function of the NDP1 gene product. Transcript levels for both genes were measured over a 24-hour cycle using RT-PCR. Results showed OHP2 being more influenced by the circadian light cycle. We have isolated two knockout mutants of NDP1 one of which (ndp-sy) exhibits a reduced growth rate, sensitivity to high light, and inability to move chloroplasts. Genotypic analysis of the second mutant (ndp-in1) has revealed heterozygous plants exhibit a reduced growth rate similar to ndp-sy. F1 and F2 generations of ndp-in1 are currently being scored for homozygosity. Comparison between ndp-in1 and ndp-sy mutants will then be performed for analysis of the NDP1/OHP2 interaction and function of the NDP1 gene.

## An *in vivo* Analysis of the FXR1P Gene in Zebrafish

Julie Miller (James Warren Jr.), Penn State Behrend, School of Science - Biology

Fragile X Syndrome is the leading cause of inherited mental retardation in humans, affecting approximately 1 in 4,000 males and 1 in 6,000 females. This syndrome is caused by defects of the FMR-1 gene. The FMR-1 gene, along with its two autosomal homologs (FXR1 and FXR2) produce RNA binding proteins that are thought to regulate gene expression in the developing embryo, although their precise role in normal development is unknown. Zebrafish were used as a model system to decipher what roles the Fragile X gene family may play in normal development. The objective of this experiment was to perturb the expression of the Fragile X gene family through the use of morpholinos (antisense oligonucleotides) which inhibit translation within the cells. Zebrafish were injected with the FXR1P morpholino between the one and eight cell stages. The injected embryos and control embryos were allowed to develop overnight to 18, 24, 48, and 72 hours post fertilization. Survivorship was counted, gross abnormalities were documented and the embryos were fixed in paraformaldehyde. The embryos injected with FXR1P morpholino were viewed under the microscope looking for abnormalities, especially those involving somite development, and development of the head and tail region.

**Flower Mutants in Tomato: Characterization and Gene Identification**

Daryl Nowacki, Adam Rhodes, and Kaile Taylor (Yi-Hong Wang and Michael Campbell), Penn State Behrend, School of Science - Biology

Flower formation and plant reproduction are important economic traits; flowering plants provide all the food we consume, in addition to their aesthetic values as flowers are the plant organ that leads to the production of seed/fruit. To serve its reproduction purposes, the flower has a very efficient structure: in most flowers, the male-functioning stamens and female-functioning carpels are placed side by side, surrounded by sepals/petals to facilitate pollination. Altered flower morphology usually causes reduced fertility or total sterility which will produce a reduced yield. In addition to partial or complete sterility, the number of flowers on a plant and flowering time is also a factor in determining yield. Through T-DNA insertion and activation tagging, we have generated three tomato (*Solanum lycopersicum* L.) mutants that display altered flower structure, one with reduced flower number and delayed flowering time. The mutants with altered flower structure have leafy sepals and apparently normal-sized petals/stamens in some late flowers but miniaturized petals/stamens in early flowers. Petals in the late flowers with normal-sized petals/stamens/carpels that produced parthenocarpic fruits resemble leaves in terms of vascular vein patterns. The mutants with reduced number of flowers and delayed flowering time also set fewer fruits because of lower fruitset.

**The Effects of Growth Factors on hIK1 Protein Expression Levels in Transfected HEK Cells**

Kellie O’Rourke and Alissa Mague (Heather Jones), Penn State Behrend, School of Science - Biology

The calcium (Ca2+)-activated potassium (K+) channel, hIK1, is a human intermediate conductance ion channel that has roles in physiological functions including epithelia transport, cell volume regulation, cancer development, and cell growth and proliferation. Due to hIK1’s role in cell growth, I examined the effects of the epidermal growth factor (EGF), fibroblast growth factor (FGF), and tumor necrosis growth factor alpha (TNF-α) on channel protein expression. The protein level was measured by treating human embryonic kidney (HEK) cells containing hIK1 with these growth factors 24 hours prior to analysis. Protein was isolated and antibodies were used to detect hIK1. From the total isolated protein the relative thickness of the treated cell bands compared to the untreated HEK cells determined if total hIK1 protein expression was increased or decreased. It was found that EGF increased hIK1 expression and TNF-α decreased hIK1 protein levels. These results suggest that growth factor interactions with hIK1 are mediating the channel’s role in cell growth and proliferation. Further research will examine the role of these growth factors on hIK1 localization at the cell surface and on channel function using patch-clamping analysis.

## Sequence Analysis of Shiga Toxin Producing Bacteriophages

Nicole Ruffo (Steven Mauro), Mercyhurst College - Biology

Shiga toxin-producing *E.coli* (STEC) are human pathogens present in contaminated food and water. The main virulence factors of STEC are shiga toxins (stx), proteins that are damaging to Eukaryotic cells, culminating in diarrhea, hemorrhagic colitis, and hemolytic-uremic syndrome. Over 200 STEC serotypes have been identified, including O157, which is responsible for approximately 200,000 infections and 250 deaths annually in the United States, including illnesses reported from contaminated spinach and Taco Bell products. The majority of stx genes reside on bacteriophage genomes that infect *E.coli,* providing a transferring mechanism to explain the diverse and ubiquitous nature of environmental STEC strains. Despite the importance of bacteriophages in the presence and dissemination of stx, there is a dearth of information that allows characterization of these viruses. Our work focuses on DNA sequence analysis of operator sites, the repressor gene, and the shiga toxin gene (which are the main genetic elements necessary for stx expression) between different stx positive bacteriophages. This comparison reveals several portions of DNA in each comparative study that are highly conserved, information useful for the development of drugs that are efficacious for all of the different types of STEC that cause disease.

**Anthocyanin Acid-Base Lab Development: Research and Outreach**

Leisl Soergel (Carley Hopwood), Penn State Behrend, School of Science - Biology

Innovative and cutting edge science laboratory exercises can be generated through collaboration between high schools and undergraduate institutions. In the spring of 2006 at Penn State Behrend, a series of labs were created for the science classroom. The goal was to make an exercise that students could execute that improved their laboratory skills, taught them science, and related to their lives. Grapes became the lab’s focus because of Erie’s ties to the grape industry. Research on the pH indicator property of the grape pigment, anthocyanin, was used to develop an exercise that explored the interaction between the anthocyanin molecule and the relative pH of household items. A lab for upper-elementary students, high school students, and a teacher’s edition were created. The exercise was executed in two tenth-grade applied chemistry classes at North East High School, home of the “grape-pickers,” in North East, Pennsylvania. Student questions and suggestions were used to produce a revised lab. The updated lab was reviewed, and can now be incorporated into the high school classroom. Through the process of developing the lab, teaching it to students, and making revisions, I have gained knowledge and experience that I intend to use as a high school science teacher.

**Role of Chaperones HSP70 and HSP90 Binding to Proteins in Trafficking and Cell Surface Expression of hIK1**

Colleen White and Benjamin Kuhn (Heather Jones), Penn State Behrend, School of Science - Biology

The human intermediate conductance potassium channel (hIK1) is part of the KCNN gene family; it plays an important role in many physiological functions. This channel is vital for proper epithelial cell function including Cl- secretion across both the intestines and airway. In order to be utilized properly hIK1 must be localized at the cell surface. The ability of proteins to traffic properly to the cell surface requires that they be properly folded in the endoplasmic reticulum. I investigated hIK1 trafficking by determining which intracellular chaperones co-assemble with channel and mediate its localization. I used co-immunoprecipitation to assess whether hIK1 associates with the two chaperones HSP70 and HSP90. Total protein from human embryonic kidney (HEK) cells was extracted and antibodies specific for hIK1 were used to isolate the channel. Protein was then run on a western blot and antibodies for each chaperone were used. The presence of a band demonstrates that both hIK1 and chaperone assembled together in the immune complex. Initial results showed that HEK cells expressed both HSP90 and HSP70. Secondly, I saw that HSP70 and HSP90 co-assembled with the hIK1 protein. These results suggest a role for HSP70 and HSP90 in the proper trafficking of hIK1 to the plasma membrane.

## CHEMISTRY

**Studies toward the Functionalization of the Isoxazole Carbon-Carbon Double Bond**

Robert Blanner III (Martin Kociolek), Penn State Behrend, School of Science - Chemistry

While there are numerous methods for the synthesis and opening of isoxazoles, the chemistry of the isoxazole carbon-carbon double bond has not been well documented. Isoxazoles have proven to be useful intermediates in the synthesis of a number of biologically interesting molecules. The focus of this research is the use of functionalized isoxazoles as precursors for the synthesis of biologically important alpha-hydroxy-beta-amino acids. The importance of alpha-hydroxy-beta-amino acids can be attributed to their well-documented biological activity. These amino acids have been utilized in the synthesis of a number of biologically significant compounds including anti-HIV, anti-cancer, and anti-bacterial agents. A key step in the synthesis of alpha-hydroxy-beta-amino acids involves the functionalization of the monosubstituted isoxazoles. A new synthesis of isoxazoles substituted at the 3-position from silyl isoxazoles has been developed. The results of the investigations into the chemistry of the carbon-carbon double bond of monosubstituted isoxazoles will be presented.

**A Model of the Crystal Structure of Cellulose Using Monte Carlo Simulations**

### Timothy Cunningham (Ron Brown), Mercyhurst College - Chemistry

Ethanol has received much recent attention as an alternative to fossil fuels in transportation applications. Although ethanol can be produced from a large variety of vegetation, including agricultural waste, a major drawback is the inefficiency associated with the breakdown of cellulose. The presence of water between cellulose strands is one potential source of this inefficiency. In order to better understand this system, a model of a cellulose crystal structure was created using a Monte Carlo algorithm. The model is designed to allow the user to input variables including number of glucose units per cellulose strand, the parameters describing interactions between strands, and temperature of the system. Initially, each individual strand is randomly placed within a user-designed sample space. The sample space is treated with three-dimensional periodicity to model the bulk structure. The energetics between glucose units on different strands in various configurations are calculated using a Lennard-Jones energy potential. Configuration space is sampled via the Monte Carlo Metropolis algorithm, allowing for: (1) addition, (2) deletion, and (3) movement of individual strands. Further work is being performed to allow for freer movement of both the strands and the hydrogen-bonding between the molecules.

**A Regional Analysis of Polycyclic Aromatic Hydrocarbons Adsorbed to Particulate Matter**

Katie Freeman (Weslene Tallmadge and Michelle Homan), Gannon University - Chemistry

Polycyclic aromatic hydrocarbons (PAHs) are a class of compounds associated with incomplete combustion from sources such as vehicles, wood-burning stoves, incinerators, and industrial processes. These compounds may be distributed in air, water, and soil in varying proportion. In Erie County, the presence of PAHs affects the quality of the environment. The delicate ecosystem of Presque Isle Bay (PIB) is affected by the presence of PAHs prompting the EPA to classify PIB as an Area of Concern (AOC); one mode of contamination is dry deposition of PAHs into the bay. The overall goal of this study is to determine the identity and concentration of PAHs, adsorbed to particulates in the air of the downtown Erie region with an estimation of the loadings to PIB by dry deposition. Relative abundances of PAH compounds adsorbed onto particulates will be used to estimate source loadings to the atmosphere. The results will include the concentration of PAHs in particulate form in the ambient air in the Erie area, an estimate of PAH flux into Presque Isle Bay by dry particle deposition, and an analysis of the precision of the sampling method.

**Characterization of a Water-Hexafluorobenzene Complex in Nitrogen Matrices at 17 K Using Matrix Isolation Infrared Spectroscopy**

Daniel Irwin (Jay Amicangelo), Penn State Behrend, School of Science - Chemistry

Matrix isolation infrared spectroscopy was used to characterize a complex between water (H2O) and hexafluorobenzene (C6F6). Co-deposition experiments with H2O and C6F6 were performed at 17o K using nitrogen matrices. Sample to matrix concentrations ranged from 1:200 to 1:800 for the C6F6 samples, and 1:200 to 1:6,000 for the H2O samples. New infrared bands attributed to the complex (H2O·C6F6) were observed near the asymmetric stretching, symmetric stretching, and bending regions of the water monomer. Identification of the new infrared bands to those of the complex were established by comparing the co-deposition spectra with the spectra of the individual monomers by performing experiments with isotopic water (D2O), and by matrix annealing experiments (warming to 30 o K and refreezing to 17 o K). Quantum chemical calculations were also performed at the B3LYP/aug-cc-PVDZ and MP2/aug-cc-PVDZ levels of theory for the H2O·C6F6 complex to obtain theoretical support for our infrared assignments. The optimized geometry of the complex was calculated and vibrational frequency analyses were performed for the optimized geometries. The calculations predict the H2O vibrational frequencies in the H2O·C6F6 complex to be shifted with respect to the H2O monomer by similar magnitudes as to what we observe experimentally, lending support to our assignments.

**Synthesis of Substituted 1-Benzoxpein Derivatives from 3-Carboxyisoxazoles**

### Matthew Jackel (Martin Kociolek), Penn State Behrend, School of Science - Chemistry

The 1-benzoxepin ring skeleton has been found in a variety of natural and unnatural biologically active molecules, including those which show antifungal and ubiquinone oxidoreductase inhibiting properties. This work focuses on expanding the known methodology for the synthesis of the benzoxepin ring system. Appropriately substituted 3-bromoisoxazoles have been readily opened by ferrous chloride tetrahydrate yielding beta-cyanoketones, which have been found to undergo intramolecular condensation followed by a dehydration to give 1-benzoxepins in good yields. The analogous ring opening/cyclocondensation of 3-carboxyisoxazoles was also investigated. Appropriate carboxyisoxazoles were synthesized by base hydrolysis of the corresponding isoxazole ethyl esters. The resulting acids undergo decarboxylation followed by the opening of the isoxazole ring to give beta-ketonitriles. The resulting enolates spontaneously cyclize to give benzoxepins. The ongoing progress of the application of this method and similar tandem methodology to synthesize a series of benzoxepins will be discussed.

**The Mass Spectral Fragmentation Mechanism of Wood Volatiles**
Katie Krise and Edward Motea (Timothy Laher and Michael Bucholtz), Gannon University - Chemistry

The mass spectral fragmentation of eleven wood volatiles has been studied.  The alcohols are aromatic or cyclohexyl derivatives found in wood.  In addition, the fragmentation of diols and three esters have been proposed.  Common fragments were found for several of the volatiles.  Molecular modeling of several common peaks leads to energy minimized structures for explaining peaks.

**Synthesis and Investigation of the Photochromic Properties of Platinum(II) Complexes with Tridentate**

**Schiff-Base Condensates**

## Andrew Law (Alan Jircitano), Penn State Behrend, School of Science - Chemistry

2-Aminobenzaldehyde (oab) is an interesting molecule that undergoes a variety of self-condensation reactions, depending on the absence or presence of a metal ion. Reaction with aqueous Pt(II) produces a dimeric Schiff-base condensate, [N-(2-aminobenzylidene)anthranilaldehydato-O,N,N']chloroplatinium(II) (Pt(AAA)Cl) (I). The complex is unusual in that it is photochromic in coordinating solvents. In acetonitrile, for example, the solution is orange-red in the dark and purple when exposed to light. The coordinated aldehyde is displaced by the solvent in the dark and reattaches in the light. In this study, an analogous complex was synthesized with a phenolate *trans* to the coordinating aldehyde. N-(2-hydroxybenzylidene)anthranilaldehyde was formed by the manganese(IV) oxide oxidation of the Schiff-base condensate of salicylaldehyde (and derivatives) with 2-aminobenzyl alcohol. The dark purple complexes, [N-(2-hydroxy-n-(R)benzylidene)anthranilaldehydato-O,N,O']chloroplatinium(II) (Pt(R-HAA)Cl) (II) were formed from the direct combination of Pt(II) with the ligands in water. The ligands and complexes were all characterized by IR and NMR and the photochromic reactions of the platinum(II) complexes are being investigated.

**Characterization of the Transient Intermediates Si-N2 and H2Si-N2 Using Matrix Isolation Infrared Spectroscopy**

Cyndi Lee (Jay Amicangelo), Penn State Behrend, School of Science - Chemistry

Matrix-isolation infrared spectroscopy was used to characterize short-lived reaction intermediates that may be related to the production of silicon nitride thin films (Si3N4) using chemical vapor deposition methods. Experiments were performed by depositing mixtures of silane (SiH4) in nitrogen (N2) gas onto a CsI window at 12 o K while simultaneously photolyzing the mixture with vacuum-ultraviolet radiation using a hydrogen resonance lamp (121 nm). The photolysis products were characterized using infrared spectroscopy. Two primary transient species were identified in these experiments: Si-N2 and H2Si-N2. The identification of these two transient species was established by comparison to un-reacted SiH4/N2 by performing experiments with isotopic reagents (SiD4, 15N2) by performing matrix annealing experiments (warming to 20 o and 30 o K and refreezing to 12 o K), by performing mercury-xenon lamp photolysis experiments (254 nm light), and by comparison to theoretical calculations (Gaussian 03W).

**A Study of Seventeen Coumarin Dyes Using High Pressure Liquid Chromatography and Electrospray-Mass Spectrometry**

Stephanie Pollin and Brandy Brensinger (Michael Bucholtz), Gannon University, College of Science, Engineering and Health Science - Chemistry

Coumarin dyes are a diverse family of dyes containing the coumarin functional group and a primary, secondary, or tertiary amine. Most of these dyes are fluorescent and the analysis of dyes, especially in fabrics and fibers, is of forensic interest. The analysis methods employed here are high pressure liquid chromatography (HPLC) and electrospray – mass spectrometry – mass spectrometry (ESI-MS-MS). A gradient elution by HPLC has been developed to separate seventeen coumarin dyes. This study then examines conditions for formation of the (M+H+) peak from ESI-MS and that parent peak’s collision-induced dissociation (CID). The coumarins were studied for their fragmentation patterns in ESI-MS-MS and mechanisms of dissociation are proposed.

## Guest-Host Saturation Limits Using Absorption Spectroscopy

Adam Rich (Jennifer Holt), Penn State Behrend, School of Science - Chemistry

The different sizes of host molecules can be used to study how the binding of the guest molecule changes with respect to the volume available. In this study, α, β, and γ cyclodextrins were used as host molecules due to their basket-like structure with pore sizes of 5.7, 7.8, and 9.5 Ǻ, respectively (Steed, J.W., Atwood, J.L., Supramolecular Chemistry, John Wiley & Sons: New York, 2000). Brooker’s merocyanine dye was chosen as the guest molecule because it is easily measured using UV-Vis spectroscopy and is very sensitive to its environment. The equilibrium binding of the dye molecules was determined by observing peak shifts in the absorption spectra of the complex. The degree of complexation and saturation limit, or the maximum amount of dye the host molecules could complex, were also determined by the shifts in the absorption spectra. The difference in saturation limits gave insight as to how the dye was binding to the cyclodextrin, internally or externally. Conclusions reached were that the dye bound to the β cyclodextrin internally, while it capped both α and γ cyclodextrins. Another area of interest was forming solid state complexes in order to compare the degree of complexation in solid state versus in solution.

## Synthesis of Novel Thioanhydrides

Kevin Schneider (Jack Williams), Mercyhurst College - Chemistry

Recent research has shown the advantage of sulfur-containing compounds in the diet. Substances such as diallyl sulfide, alliin, and allicin have been proven to act as antioxidants, helping to prevent the formation of cancerous cells. A group of sulfur-containing compounds that had yet to be fully analyzed for its effects as possible antioxidants are thioanhydrides. Also, thioanhydrides are currently employed as pesticides, lubricating oil additives, reagents in polymerization reactions, and as part of a rubber plasticizing procedure. The breadth of applicability for thioanhydrides makes the synthesis of new compounds a potentially beneficial endeavor. By employing a process of reacting sodium sulfide with an anhydride followed by a subsequent purification regime, we have successfully isolated various thioanhydrides. Additionally, we have been working toward synthesizing thioanhydrides never before created. By testing these compounds for medical benefits, toxicity, or potential as catalysts, it is possible to discover useful new sulfur compounds.

**Insertion of Merocyanine Dyes into Silicalite-1 Hosts**

Casandra Sheldon (Jennifer Holt), Penn State Behrend, School of Science - Chemistry

Host-guest chemistry involves a host lattice that provides a cavity for a guest molecule to be inserted. The resulting composite material has novel nonlinear optical properties not observed in the two original species due to the orientation of the guest molecules within the host. The focus of this project is the insertion of Brooker’s merocyanine dye in hydrothermally synthesized zeolites Silicalite-1 hosts, either as a powder or aligned onto a glass template. The dye loading of the merocyanine dye within the zeolite was measured using fluorescence spectroscopy. Nonlinear optical response has been qualitatively observed using a high power Nd:YAG laser. Solvent effects on the degree and rate of insertion of dye, using various polar solvents have also been characterized by spectroscopy. Theoretical models of dye loading have been developed based on pore size and structure in the Silicalite-1 host. These effects may lead to a better understanding of the interactions between dyes and zeolites.

## COMPUTER SCIENCE

## Robotic Mapping and Path Following

Dewey Black, Greg Lutz, and Zack Marrapese (Charles Burchard and Gary Walker), Penn State Behrend, School of Science - Computer Science

Because robotic vacuum cleaners do not know the size and layout of their environment before performing their task, they operate slowly, move inefficiently, and must rely on many sensors for guidance. This project involves a system that can make these robots quicker, more efficient, and rely on fewer sensors by mapping the environment and then identifying a path of complete coverage through the environment.

**The Behrend Optimized Scheduling System**

Ryan Buzzanca, Jonathan Grier, and Aaron Thomas (Mehmet Malcok and Gary Walker), Penn State Behrend, School of Science - Computer Science

For many departments at Penn State, configuring an optimized schedule is a time consuming process. An application that can reduce the amount of manual tasks by streamlining and automating this process will be beneficial. The main goal of this application is to generate a schedule that fulfills the predefined requirements of the department.

## Biometric Identification for Prescription Drug Dispensing Control

Dara Nielsen, Jacob Gariepy, and Mitch Miller (Gary Walker), Penn State Behrend, School of Science - Computer Science

Physicians and Pharmacists put their licenses on the line every time they give or fill a prescription for class 2, class 3, or class 4 drugs. This problem is solvable by creating a drug dispensing control system. Fingerprint and facial recognition will be used to identify customers who need class 2, class 3, or class 4 drugs. These methods of identification will be used as control measures to prevent fraudulent abuse of medications.

**The Electronic Voting Machine**

Michael Snyder and Paul Casillo (Mehmet Malcok and Gary Walker), Penn State Behrend, School of Science - Computer Science

There is a federal mandate that by the 2008 presidential election all 50 states must use some form of electronic tabulation. The integrity of our country’s election process is the very essence of our democratic infrastructure. It is imperative that accuracy, security, and reliability be considered the highest priority and be assured before the next national election. The current voting system relies on the user’s ability to follow instructions written on the screen. Past elections have shown that the name on the first position in a contested primary election has an eight percentage point advantage. The current system makes no effort to reassure the voter of the systems, or its security. Our system will incorporate a new user interface which will have easy-to-follow instructions. The ballot positions will be randomly generated with each vote cast. Our system will incorporate a dual purpose real-time database. The voting system database will provide a paper trail for vote auditing. In conjunction with the randomly assigned number on the receipt the voters will be able to check the legitimacy of the voting system via web interface displaying the tabulated votes.

## ECOLOGY

## Locations of Major Salinity Inputs from Runoff in Trout Run and Four Mile Creek

Ashley Ethridge and Beth Keopka (Pamela Silver), Penn State Behrend, School of Science - Ecology

Road salt used on highways and sidewalks for safety during winter months can cause environmental problems when it reaches streams. The objective of this research was to determine the major inputs of salt to Trout Run and to compare inputs from the Behrend Campus and the Bayfront Connector. Data loggers were placed near known input sites and salinity was measured every fifteen minutes from 26 January to 10 April 2007. Salinity also was measured with handheld meters at 26 locations in Trout Run, Four Mile Creek, and a cross-campus tributary on days when runoff occurred. Salinity of input from the detention pond reached levels >10 ppt when runoff was very high. Salinity of input from the cross-campus tributary reached levels >10 ppt and was high during all runoff events. Salinity decreased exponentially downstream of input sites. Signals from Trout Run inputs were detected in Four Mile Creek. The primary source of the salinity increase in Trout Run was sidewalks and roadways on the Behrend Campus.

## ELECTRICAL ENGINEERING

**3-D Reconstruction from Computerized Tomographic Images**

Daniel Kubacki (Thomas Hemminger), Penn State Behrend, School of Engineering - Electrical Engineering

The purpose of this senior thesis project was to advance Penn State Behrend’s knowledge of MATLAB’s 3-D capabilities for the improvement of Dr. Hemminger’s Signal and Image Processing course. MATLAB is a powerful matrix based engineering program that has wide spread use among engineering disciplines. The project researched MATLAB’s 3-D visualization capabilities in order to reconstruct a 3-D image of a male abdomen using multiple 2-D computerized tomographic images. The organ search algorithm utilized image thresholding techniques as well as object selection from binary images. The results produced an algorithm for extracting organ data from a volume matrix and visualizing it using isosurface patches. The knowledge gained through this thesis project will allow Dr. Hemminger to introduce students to MATLAB’s capabilities to store and visualize 3-D data.

## ELECTRICAL ENGINEERING TECHNOLOGY

**Validation via Case Study Analysis of a Protocol for Determining the Economic Feasibility of Installing Dedicated Wind Energy in Rural Areas of Pennsylvania**

Alexander Winter (Robert Weissbach and James Sonnenmeier), Penn State Behrend, School of Engineering - Electrical Engineering Technology

The purpose of this research was to run evaluative case studies in order to validate a protocol to be used by homeowners for determining the economic feasibility of installing wind energy. Validation of the protocol involved researching various wind energy projects which included either estimated or actual economic data for the lifetime of the project. The economic data from the sample project were then entered into the protocol and the financial results were compared to those given in the sample project. Specific economic data that were compared includes pre- and after-tax IRR (Internal Rate of Return). If the IRR results from the sample project and the protocol differed by more than 10percent, the data from the sample project was entered into RETScreen. RETScreen is a spreadsheet based software package which can be used to perform a very comprehensive analysis of wind energy projects. The RETScreen software was used to filter possible errors that may have occurred while entering the sample project data into the protocol, as well as validate the economic data from the sample project. However, the financial results from the protocol and sample project were generally within the 10 percent limit. The researchers plan to have 10 case study analysis completed by May 2007.

## Characterizing and Estimating the Electricity Consumption of a Household

Alexander Winter (Robert Weissbach and James Sonnenmeier), Penn State Behrend, School of Engineering - Electrical Engineering Technology

The purpose of this research was to characterize the electricity consumption of a household and then to develop a spreadsheet calculator that could be used to estimate the household’s electricity consumption based on its characterization. The household electricity estimation sheet was developed in conjunction with a protocol that is currently being developed for determining the economic feasibility of installing dedicated wind energy in rural areas of Pennsylvania. Characterizing a household’s electricity consumption involved creating a list of typical appliances found in a household and the appliance’s corresponding energy consumption. To formulate an estimation of the energy consumption of a household, a homeowner can use the spreadsheet calculator by indicating how many hours per day each appliance is operated. Once the spreadsheet version of the calculator was tested and approved, the calculator was then created using Visual Basic.net. The Visual Basic version of the calculator will be incorporated into the wind energy protocol and made downloadable from a Web site for homeowner use.

## GEOLOGY

## Paleolimnology of Edinboro Lake

Maggie Coon (Brian Zimmerman and John Ashley), Edinboro University of Pennsylvania - Geology

Cultural eutrophication has been blamed for the degradation of Edinboro Lake resulting in lack of water clarity due to excessive algae growth. An 80 cm sediment core obtained from Edinboro Lake provides a multiple proxy record of the lake’s trophic state over the past 200 years. Lead-210 radiometric dating constrains the age of the core and indicates an average sedimentation rate of 212 mg/cm2/yr. Sediment size analysis indicates a range of compositions from 33- 48 percent clay, 42- 62 percent silt, and 0 percent - 20 percent sand by volume. A sudden increase in sand content at 69 cm depth may indicate that a significant land disturbance occurred within the watershed in approximately 1911. Organic matter (25.6- 14.1 wt percent) increases after 1980 and carbonate content (2.05- 3.86 wt percent) decreases after 1990. Biogenic silica, a proxy for diatom abundance, increases steadily after 1900 with a significant increase occurring in the early 1950s. Analysis of sub-fossil chironomid head capsules and diatoms contained within the core indicate that eutrophic conditions have existed in the lake for at least 200 years and reveal a gradual increase in productivity with time.

## MARKETING

## The Current Status of Corporate Social Responsibility in the Food Industry’s Supply Chain

Liz Stablein (Michael Maloni and Michael Brown), Penn State Behrend, Sam and Irene Black School of Business - Marketing

The purpose of this study was to look at implementation of Corporate Social Responsibility in the food industry’s supply chain. I looked at 20 U.S. based food chain companies, eight agribusiness companies, five agribusiness/manufacturer companies, ten grocer companies, ten manufacturers and five food service companies. I categorized these 58 companies into a nine defined areas of corporate social responsibility that came from Dr. Maloni and Dr. Brown. These nine areas consisted of animal welfare, biotechnology, community, environment, finance, health and safety, labor, procurement ethics, and monitoring and enforcement. The rudimentary search began by determining if companies mentioned CSR on their Web pages. Then I looked into whether they had a corporate social responsibility report or supplier code of conduct on their Web page. After in-depth research, I examined the annual reports for evidence of corporate social responsibility to further explore the nine areas of CSR. The results of the study verified that only a small percentage of companies addressed most of the nine areas of corporate social responsibility. The results also confirmed that companies that did address corporate social responsibility were previously publicly cited for poor business practices.

## MECHANICAL ENGINEERING

**Analyzing Temperature and Electrical Current Flow Fields through a Variety of Dome Height Test Specimens**

Marc Hoffman (John Roth), Penn State Behrend, School of Engineering - Mechanical Engineering

Prior research has shown that passing electric current through metal can drastically change its material properties. The effect being that it temporarily changes the materials properties and can lead to new methods of manufacturing. The purpose of this study was to analyze the flow of electricity and heat generation in a dome height test specimen while carrying a large amount of electric current. The goal was to be able to accurately predict the flow path of the electricity and the temperature profiles. Many tests were run under a number of conditions. Changes in the test specimen geometry and orientation were examined as well as varying the current density, clamping locations, and length of time the tests were run. It is now better understood how the different parameters affect the current flow and heat generation.

**Using Finite Element Analysis to Analyze the Effects of Temperature and Electrode Placement on Plastic Deformation**

Daniel Jageman (Amir Khalilollahi and John Roth), Penn State Behrend, School of Engineering - Mechanical Engineering

When forging sheet metal into complicated shapes, there is the issue of the sheet metal workpiece undesirably necking and/or tearing during forming. There are many ways to improve the manufacturability of workpieces forged out of sheet metal. One way to improve the manufacturability involves applying an electric current to the workpiece during deformation. This results in higher ductility of the workpiece, which can significantly delay necking and/or tearing of the workpiece. Previously, this effect of applying electricity has been proven under uniaxial conditions both experimentally and through the use of a finite element analysis (FEA) model. In this research, however, the effect is investigated under three-dimensional conditions. A working FEA model has been developed for these more complicated three-dimensional flow fields and will be presented as a part of this research. To demonstrate the capabilities of the FEA model, two dome shapes forged from aluminum plates were separately modeled in ANSYS and subjected to a large electric current. The temperature and current density distributions were determined by solving the model and compared to experimental data to determine the effect of electrode placement and amount of applied current on the temperature and current density distributions.

**A Study of the Fluid Flow Over Single and Multiple Square Sails**

Kent McKee (William Lasher), Penn State Behrend, School of Engineering - Mechanical Engineering

Recent research has shown that the fluid flow behavior of square sails is somewhat contradictory to what was previously believed. The purpose of this research was to accomplish two objectives: 1) to model the fluid flow of a single square sail with CFD (Computational Fluid Dynamics) software, and 2) then compare those results with those obtained from a similar wind tunnel test. After achieving those results and verifying that the CFD software could accurately predict the fluid flow for the sail, the software was then used to calculate the maximum lift and drag forces and heeling moments seen by the sail in different positions in the wind. The desire is to find the sail configuration that provides the most lift or driving force with the least amount of drag force which causes the ship to tilt or heel. This process of finding the optimal configuration was repeated for multiple sails of two and five. The results show that for a range of apparent wind angles between 80 and 160 degrees, the angle of the sail should be at 40 degrees compared to the previously believed 45. The results for the multiple-sail configurations were similar in findings to the single-sail results.

### Using Direct Electric Current to Investigate the Effects on Glass

Jason Papucci (John Roth), Penn State Behrend, School of Engineering - Mechanical Engineering

The deformation of glass is limited by the ductility and the strength of the material. This process is currently done by heating the material in a furnace or utilizing some other heating method. Unfortunately, the current techniques are costly and cannot easily produce parts in the wide range of physical shapes that metal can be formed. One proposed method to deform a material is to pass direct electric current through the material during the deformation process. This method would be significantly cheaper since it does not require the use of expensive furnaces and extra time. Passing direct electric current through the material can be done while deforming the material. Passing electric current through the material improves the manufacturability of the work piece and ultimately the production cost to work the material. The objective of this research was to extend the electrical effects seen in metal by passing a direct electric current through glass.

**Vibration Analysis of Electrostatically Driven Micro-Beams**

Kevin Sunealitis (Oladipo Onipede), Penn State Behrend, School of Engineering - Mechanical Engineering

Several high frequency microelectromechanical (MEMS) devices such as electronic signal resonators and filters can be modeled as electrostatically driven micro-beams and micro-plates. While their static structural response depends solely on the magnitude of the applied voltage and their elastic stiffness, their dynamic response also depends on their mass, damping properties, and the applied voltage frequency. In designing these devices, critical parameters include the maximum voltage, voltage frequency, and the natural frequency of the system. Even though the electrostatic force developed by the voltage is non-linear, the system can be modeled as a harmonic system due to the periodic nature of the response. ANSYS, a commercial finite element analysis computer software, was used to model and analyze micro beams and micro-plates in electrostatic fields. The deflection and maximum voltage results from ANSYS were compared with results from finite difference models. Results from beams and plates with various boundary conditions and loading conditions were obtained. Results from harmonic analysis using ANSYS show the influence of the applied voltage on the natural frequency of the beam. The effect of various mechanical properties on the natural frequency will also be presented.

Using DC Electrical Current to Investigate the Enhanced Ductility of Various Aluminum Alloys

Matthew Warner (John Roth), Penn State Behrend - Mechanical Engineering

Current manufacturing processes increase the formability of workpieces by working them at elevated temperatures. However, heating the workpiece to manufacture it has many downsides, including cracks and reduced surface finish. The purpose of this investigation is to perform an in-depth analysis of various aluminum alloys subjected to a pulsed DC electric current during loading. It has been observed that, in tension, the use of constant DC electric current during deformation processes decreases the overall strain and stress within a given workpiece. However, it has been shown that a pulsed application of the electricity can increase the overall deformation achieved. Previous research has investigated varying different test parameters such as period and frequency, as well as magnitude. This research has further investigated the effects of varying the aforementioned test parameters, as well as altering other test parameters. Additionally, changing the direction that the current passes through the specimen was considered.

## NEUROSCIENCE

**The Effects of Prenatal Exposure to Fluoxetine (Prozac) on Rats: Implications for Autism**

### Molly McCoy (Jeff Hollerman and Alec Dale), Allegheny College - Neuroscience

Recently the CDC reported a continuing increase in the prevalence of autism, which has also been the trend seen in research over the last decade. Factors contributing to this increase could include one or more of the following: 1) increased public awareness of autism, 2) broadening criteria for diagnosis, and 3) environmental influences to which we were not previously exposed. Studies have shown increased levels of serotonin in autistics. Research also shows that women of child-baring age have the highest rate of depression of any demographic. Exposure to SSRI's in utero could result in increased levels of serotonin at a critical time in development. The goal of the current study was to investigate the behavioral effects of prenatal exposure to Fluoxetine (prozac) and to assess its validity as an animal model of autism. Pregnant dams were given 10 mg/kg equivalent injections on gestational days 13-19. Thirty-six treated and 11 untreated juveniles then completed behavioral testing for social recognition and object preference. The hypothesis was that the prenatally treated group would display a deficit in social recognition and a preference for a familiar stimulus. Conversely, the untreated group should show intact social recognition abilities and a preference for a novel stimulus.

## PHYSICS

**Orbital Stability of the Galilean Satellite System around Jupiter**L. Blake Autin (Darren Williams), Penn State Behrend, School of Science - Physics

The Galilean satellites of Jupiter include the planet-sized objects Io, Europa, Ganymede, and Calliso. All of these moons, in close proximity to Jupiter and one another, move in approximately circular orbits. Here we use orbital integration software to study the evolution of this ultra-stable satellite system subjected to a hypothetical external perturbation from a rogue interplanetary intruder into the Jupiter region. We also examine what would happen to the system if one of the moons were placed in an orbit slightly different from the current one. This work will help us understand how multi-satellite systems such as this one might form in the first place.

### Animations to Study Planetary Dynamics and Orbital Mechanics

Charles Moore (Darren Williams), Penn State Behrend, School of Science - Physics

Complex planetary systems can rarely be fully explained without visual aid. Animation is used in planetary study due to the fact that large body analysis takes an enormous amount of *real* time to complete. With the help of a “galaxy simulator” known as *Celestia* (a free software package from Cornell University), it is possible to set up an infinite number of planetary experiments using actual or fictitious ephemeris. By editing the software with a simple text editor, the user is given total control of time, distance, camera angle, and even the size, shape and physical appearance of the bodies. The entire experiment can be recorded as an animation file and used as a pedagogical application.

## PSYCHOLOGY

**An Interdisciplinary Project for the Development and Evaluation of Spatial Training**

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Many careers such as engineering and architecture involve the need for high spatial skills, however many people lack this ability to manipulate situations and shapes in their minds. Research has demonstrated that practice in these areas can improve spatial ability. This project was designed to create hands-on games that could strengthen spatial skills, focusing on mental rotation, spatial perception and spatial visualization. The first game, “Time Bomb,” focuses on mental rotation and spatial perception. In this game players are asked to take the perspective of another person sitting at the game board in order to work as a team to diffuse a bomb. The second game, “Pizza Party,” is used to promote way finding in order to enhance spatial visualization. The objective in this game is to communicate with a teammate in order to find a specific location using a map. The games were evaluated for usability, enjoyment, and enhancement of spatial abilities. Participants completed a mental rotation task before and after playing the games to determine if they were a valid tool for enhancing spatial skills.

### Gender Stereotypes in Animated Media

Steven Buesink and Sara Nielsen (Victoria Kazmerski), Penn State Behrend, School of Humanities and Social Sciences - Psychology

Students watched video clips from different animated movies and television shows. Each participant viewed one of three clip sets: an extreme gender stereotype set, a neutral set, or a reversed gender stereotypes set. After viewing the assigned clip set, each participant completed the IAT (Implicit Association Test). We hypothesized that participants viewing the extreme stereotype set would have a greater implicit gender stereotype based on the IAT. The IAT data will be analyzed using a between-subjects one-way ANOVA test. This allowed us to measure implicit gender stereotypes primed by the video clips. Our research will show how the media influences the way people view others. Animated media may facilitate and encourage gender stereotyping and traditional gender roles.

**The Effects of Service Learning on Awareness Development**

Mandy Canzano, Jessie Westrick, and Erica Zinsser (Jennifer Trich Kremer and Dawn Blasko), Penn State Behrend, School of Humanities and Social Sciences - Psychology

Service learning in combination with classroom education provides pedagogical strategies that help to enhance student involvement, personal reflection, increase self-confidence, and promote moral development. This study examined the relationship between service learning and awareness development through the constructs of empathy and moral development (Wells and Grabert, 2004). Participants were students at Penn State Behrend (N = 36), ages 17 to 26. The experimental group completed a pre- and post-test packet as well as reflection sheets on their service-learning experiences. The control group completed one packet and had no experience with service learning. Service learning primarily consisted of tutoring ESL students and members of the Hispanic-American Council (direct service), as well as viewing cultural films and documentaries (indirect service). Qualitative findings of this study supported the current research and the hypothesis that direct service is more effective than indirect service. Specifically, direct service had a greater impact on participants, “It opened my eyes to a lot of the things most people of our country turn away from.” A significant increase in empathy on the Perspective-Taking subscale was found.

### Personality and Coping with Distractions

Lindsay Chatmon and Christy Miller (Victoria Kazmerski), Penn State Behrend, School of Humanities and Social Sciences - Psychology

Recent research has shown semantic changes, differences between words or meanings, are better detected when processing is more extensive, yielding better memory trace and recall. The purpose of this research was to explore whether and to what extent gender and personality have on the academic achievement of college students at the undergraduate level. In this study academic achievement was measured by the Dr. Seuss word tasks that participants were given after reading the paragraphs that were associated with them. Given the general finding that extraversion is positively correlated with academic achievement, we varied our study to focus on introversion. The design of this study used an Analysis of Variance, ANOVA, for repeated measures between several variables. Variables that were measured using the ANOVA were gender and personality; introversion and academic achievement; and distractions and no distractions while participants were completing two different word-recognition tasks. We varied the types of distractions that occurred while the participants were reading the second word-recognition paragraph. We hypothesized that gender would have no affect on academic achievement and although we hypothesized introverted individuals would have a higher percentage correct for recalling words that appeared in the paragraphs, extraverted individuals would achieve more academic success. This study is useful to know whether introverted or extroverted students do better in school.

**Individual Judgments of Line Length in Visual Forms**Alicia Dunbar (Clare Porac), Penn State Behrend, School of Humanities and Social Sciences - Psychology

The Mueller-Lyer (ML) illusion is a classic visual-geometric illusion where the length of a horizontal line is perceived to be longer or shorter when interrupted by inward or outward facing wings. Centroid theory argues that perceived length is controlled by all visual stimuli that lie in the vicinity of the target to be judged; in the case of the ML figure, the target is the endpoint of the horizontal line. The judgment of the line length is decided on using centroid extraction where the visual system calculates the center point of all stimuli lying in the vicinity of the target endpoints and compares the two halves. In the ML figure, the inward or outward facing wings affect the centroid extraction process and consequently change the perceived length of the horizontal line. This research used 10 standard and 10 distracter stimuli all consisting of outward facing wings. Non-target stimuli varied in form (dots/lines) and color (red/black) and were placed on the classic form of the ML illusion to either maximize or minimize the illusory effect. Preliminary analyses show a trend for both dot and line stimuli to produce a maximizing illusion for all figures with no consistent difference of color.

**The Effect of Time Perspective and Mortality Salience on Leadership Selections**

Christopher Engelhardt (Dawn Blasko), Penn State Behrend, School of Humanities and Social Sciences - Psychology

Previous research has demonstrated how time perspective (attitudes toward the past, future, and present) and mortality salience (MS - thinking about one’s death) affect behavior. In Experiment 1, all participants filled out a time perspective survey and were randomly assigned to a mortality salience or dental control condition (thinking about an upcoming dental exam). Afterwards, all participants evaluated hypothetical business leaders. Contrary to hypotheses, participants in the MS condition did not show preference for the charismatic leader. However, the results showed that those in the control condition with a more negative view of the past tended to prefer the relationship-oriented leaders. In Experiment 2 participants were again asked to choose the leader of a company. However, in this experiment the health of the company was also manipulated. The company was either in good or poor financial condition (bankruptcy). Interestingly, the results indicated that charismatic leaders garnered more votes to lead the company than both a task-oriented or relationship-oriented leader, but only when the company was in danger of bankruptcy. Results suggest corporate mortality may impact leadership judgments.

### Background Music and its Effects on Memory Recall

Chelsea Fenush and Shelby Deutsch (Victoria Kazmerski), Penn State Behrend, School of Humanities and Social Sciences - Psychology

There is conflicting research surrounding background music and its effects on cognitive functions such as short-term memory and visual-spatial tasks. This study builds on previous research and attempts to unravel some of the current debates amidst cognitive psychologists today by examining how vocal and instrumental music, and genre (classical, country, and pop) affect short-term memory in college students. During the study participants listened to vocal or instrumental music of three different genres while reading different passages. Between the readings and the reading comprehension tests delays were given. Along with reading comprehension scores, musical experience, introversion/extraversion, and working memory capacity were also assessed. It was expected that because of the irrelevant-speech effect that vocal music would inhibit memory recall, while non-vocal music would not. Although there is controversy surrounding the Mozart Effect, we proposed that classical music would boost reading comprehension. Finally, due to the differences in personality and tolerance of stimulation, we expected that extraverts would benefit from vocal music, whereas introverts would not. We hope that the results from this study will help college students realize which background stimuli are most beneficial for retaining and recalling previously learned information.

**The Relationship between Thought Suppression and Emotional Intelligence**

Lauren Gilmore, Melissa Shrout, and Sandra Grgic (Jennifer Trich Kremer), Penn State Behrend, School of Humanities and Social Sciences - Psychology

The focus of this study was to investigate the relationship between thought suppression, fluid intelligence, emotional intelligence, and working memory capacity. Previous research has identified correlations among thought suppression, working memory, and fluid intelligence (Brewin and Beaton, 2002) as well as emotional intelligence and fluid intelligence (Bastian, Burns, and Nettlebeck, 2005). Since thought suppression and emotional intelligence were both correlated with fluid intelligence, this study expected thought suppression and emotional intelligence to correlate with each other. However, the statistical analysis did not support this hypothesis. Additionally, there was no support for the relationships found by previous research. This could be due to an insufficient number of participants which resulted in a low statistical power.

**Looking Beyond the Stereotype: Defining Sexual Harassment in a College Setting**

Jenay Guardiani, Angela Speck, and Lori Szymanik (Jennifer Trich Kremer), Penn State Behrend, School of Humanities and Social Sciences - Psychology

Sexual harassment is a serious issue that society as a whole tends to ignore or downplay. Distinguishing acts of sexual harassment is difficult due to the ambiguity of definitions and existing cultural stereotypes. Participants included 70 students from Penn State Behrend who evaluated sexual harassment situations. It was hypothesized that presenting a legal definition of sexual harassment would lead to the most accurate interpretations of sexual harassment situations. Situations manipulated harasser and victim gender, along with power of the harasser over the victim. It was expected that an unequal power dynamic would increase sexual harassment ratings; i.e., females would rate situations as harassment more than males and males would label situations as harassment with a male victim and harasser. No difference was found for definition; however, the combination of participant, harasser, and victim gender impacted the ratings. There was a main effect for participant gender, which shows that the gender of participants had an effect on how they rated the situations. There was a significant main effect for harasser gender. Situations involving males as the harasser were rated as showing more sexual harassment than situations involving females as the harasser.

**Effects of 5-HT Uptake Blocker Fluoxetine and Naloxone on Alcohol Self-Administration in Rats**

Heather Hahn (Rodney Clark), Allegheny College - Psychology

Six female Sprague-Dawley rats were trained to self administer ethanol (12 percent v/v) using a water deprivation fading procedure. Fluoxetine (1.0, 2.0, 3.0, and 5.0 mg/kg) and naloxone (1.0, 1.7, 3.0, and 5.6 mg/kg) were examined in separate trials for 10 consecutive self-administration sessions. Drug injections were given twice weekly, 30 minutes prior to self-administration sessions. Doses were administered randomly, so that each rat would receive each dose and drug once. On non-drug sessions rats either received a saline injection or no injection. Neither Fluoxetine nor naloxone substantially altered the rate of alcohol self-administration in rats at the doses tested.

### Social Recognition Testing in the VPA Rat Model

Lauren O’Keefe (Rodney Clark and Jeffrey Cross), Allegheny College - Psychology

The effects of prenatal exposure to valproic acid (VPA) on the behavior of Sprague-Dawley rats was accessed in the current study. Rats were exposed to VPA on day 12.5 of gestation. Two dams received intraperitoneal injections of VPA .1 mL/100g doses at a concentration of 367 mg/kg. These dams yielded two litters. Social recognition testing was completed twice. In the first test, controls and VPAs failed to show habituation. Controls were 34 days old. VPAs were 48 days old. Control and VPA rats decreased frequency of behaviors and increased in duration with each trial. The second test used controls that were 92 days old. Controls showed habituation. Frequency and duration decreased with each trial in controls. Frequency decreased but duration increased with each trial with the VPAs. VPAs did not habituate in this second test. This revealed that size and age of rats is a factor in social recognition testing. This test was repeated using a different set of controls that did exhibit habituation after each trial.VPA rats demonstrated significant social deficits. They were unable to discriminate between a novel and familiar stimuli.

**A Comparison of Pre-Sport Performance Anxiety in Male and Female Athletes**

Amanda Reinecke (Janet Satterlee), Penn State DuBois - Psychology

Current research shows that male and female athletes have different attitudes toward athletic competition. Competition is not limited to major athletic events. A survey of male and female athletes from several athletic disciplines (including a Kinesiology Indoor Sport class) showed that although males and females both experience pre-performance anxiety, the anxiety is manifested differently between the two genders. Additionally, females tend to have greater amounts of pre-performance anxiety regardless of the magnitude of the competition while males tend to have more pre-performance anxiety when faced with very important athletic events.

**Parent-Child Attachment in Divorced Families**

Jessica Roman, Erin Daquelente, and Mara Huber (Jennifer Trich Kremer), Penn State Behrend, School of Humanities and Social Sciences - Psychology

Research on divorce has primarily focused on adult relationships as opposed to parent-child relationships after divorce. This study assessed young adult’s perceived attachment and involvement with their mother and father from intact and divorced families. Participants were recruited from the Research Participation Pool at Penn State Behrend. This study used a quasi-experimental design. Quasi-independent variables incorporated into this research included the gender of the participant and the marital status of the participant’s parents. Dependent measures assessed interparental conflict, parent-child attachment, and parent-child bonding. We hypothesized that a high conflict environment would lead to lower parent-child attachment scores regardless of parent marital status. We also hypothesized that mothers would have better attachment with children than fathers due to their higher level of involvement. There were no significant differences on parent-child attachment in a high or low conflict environment. There was no difference in parental attachment for mothers and fathers. Two interesting findings focused on over-protectiveness and communication. Biological fathers from intact families tended to be more overprotective of their daughter than divorced fathers. When children talk to their mothers more often, the mothers were perceived as less over-protective, regardless of the parent marital status.

### Personality Types and Interview Style

Neil Rufenacht, Jessica Brown, and Carrie McNeal (Victoria Kazmerski), Penn State Behrend, School of Humanities and Social Sciences - Psychology

Any individual looking for a career faces an interviewing process. The study is based on social desirability variation in comparison of interview type, computer versus face-to-face, among the different personality types within the 5-factor model of personality. We hypothesize that participants who score higher on neuroticism and concientiousness would show higher scores on social desirability during the computer mode of the interview. We also hypothesize that those who score higher on extraversion, openess, and agreeableness would show higher levels of social desirability during the face-to-face portion rather than the computer version. Participants completed the Mini Marker survey, then completed half of the Paulhus Deception Scale (PDS) version 7 via the Web. A face-to-face interview was then conducted using the other half of the PDS. The results of the study help a person to determine their strengths and weaknesses in interviews based on their personality type. With that knowledge, they will be more prepared and able to compensate for their weaknesses and play up their strengths.

**Latent Savant Ability**

Mirja Tague (Rodney Clark and Jeffrey Cross), Allegheny College - Psychology

Recent research has examined the possibility of savant-like abilities being produced in average functioning people through use of repetitive transcranial magnetic stimulation (rTMS). Support for the theory of latent savant ability has been provided through historical references to victims suffering left brain damage who later exhibited savant-like abilities. Further support is provided through examination of fronto-temporal lobe dementia (FTD) in elderly citizens who suffer deterioration of the frontal lobes of the brain but exhibit an increase in savant-like skills. This has led to research examining the effect of rTMS on the functioning of the brain. By suppressing the activity of the left hemisphere there is potential for revealing or creating savant-like skills in the functioning right hemisphere. Studies have shown that there is a moderate increase in savant-like ability in some of the subjects undergoing rTMS immediately following the application and decreasing for one hour following. Future research includes in-depth examination of FTD patients, prodigies and geniuses, and their skill related connections to the savant. Future research will also examine the possibility of changes in duration and location of the application of rTMS in the subjects to create more pronounced suppression of the left lobe to produce savant-like skills.

**Perceptions of the Study of English as a Second Language among Native Brazilian-Portuguese Speakers**

Dawn Taylor (Missa Eaton), Penn State Shenango - Psychology

The purpose of this study was to determine how a number of factors affect the degree of perceived accent (DPA) in English (second language, L2) for native speakers of Brazilian-Portuguese and their level of motivation to speak English with the lowest DPA. Two groups of participants were recorded and interviewed while reading a group of words, sentences, a paragraph, and a description of an image similar to those in Munro and Mann (2005). Then, two coders rated the recordings on a scale based on speed, understandability, DPA, and origin (American to foreign). The participants also responded to a series of questions based on Piske, MacKay, and Flege (2001) to determine effects of age of L2 instruction, education level, L2 instruction, length of immersion, and L1 use on DPA in L2. As expected, results were significant. Results also supported the hypothesis that female participants would be more motivated to speak L2 with a lower DPA. Additionally, females spoke with higher speed, higher level of understandability, and sounded more American than did men. Socio-economic and psychological implications of motivation will also be discussed.

### Individual Differences in the Quality of Verbal Arguments

Lauren Wagner and Carrie McNeal (Dawn Blasko), Penn State Behrend, School of Humanities and Social Sciences - Psychology

We often judge people based on the quality of their speech. We view them to be more or less intelligent or maybe more open or extraverted people on this basis. Previous research shows a relationship between intelligence and working memory as well as working memory and speech quality. Two experiments examined the relationships between intelligence, working memory, personality characteristics, and verbal argument quality. Participants engaged in paper and pencil tasks to measure IQ, working memory, and personality. They were then asked to engage in a short debate to collect speech data. In Experiment 1 the participants were each given two minutes to present their side of the argument followed by one minute for each to rebut. In Experiment 2 one participant would present their two minute argument followed by one minute of rebuttal from the other participant. Results are consistent with those of previous research. Relationships were also found between intelligence, certain personality characteristics, and argument quality.

**The Effects of Relational Aggression and Social Understanding**

Andrew Walker and Zack Goncz (Victoria Kazmerski), Penn State Behrend, School of Humanities and Social Sciences - Psychology

Previous studies have demonstrated written text and auditory characteristics are valid means to represent the non-literal meaning. Individual characteristics, such as relational aggression (RA), have been shown to influence the processing and interpretation of the non-literal meaning in sarcasm. The purpose of this study was to explore verbal intonations, individual differences, and situation type that influence the understanding of the non-literal sarcastic meaning. It was predicted that reaction times for those with high RA were slower in understanding the situation, comprehension correctness, and using a sarcastic intonation when the literal counterpart is more appropriate. Females lower in RA had the fastest reaction times for the comprehension question and had more correct responses to utterance type and situation type in comparison to the other three groups, (sex by RA analysis). Those with low RA rated the sarcastic intonation more sarcastic and mean in comparison those with high RA. Low RA individuals rated the positive utterances more positive than those with high RA. Such results support the graded salience model of non-literal language processing.

## SOFTWARE ENGINEERING

**Studying Audio Protocols and Developing a Software System for Recording, Playback, and Signal Monitoring**

### Matthew Baker (Wen-Li Wang), Penn State Behrend, School of Engineering - Software Engineering

When a new file format is developed, the creators must define a specific and concrete protocol to get at the data stored in said files. The goal of this research was to develop a software system to follow the WAV protocol in order to playback and record WAV files. The Java API provides utilities that allow managed access to the resources needed to playback and record WAV files. These are used in the application. The signal-monitoring portion of the application normalizes the raw audio data and uses the Cartesian coordinate system to graph the values. One of the main problems to overcome in developing this application was achieving concurrency during execution. This was achieved using threads to separate the user interface from the audio portion of the application. In this system, all the features that require concurrency for WAV were implemented, but the MP3 encoder/decoder to handle compression is not yet available. The incorporation of MP3 will be a future project as the system is designed to be reusable and extendable for software evolution.