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# PENN STATE BEHREND - SIGMA XI 2005 FOURTEENTH ANNUAL UNDERGRADUATE STUDENT RESEARCH AND CREATIVE ACCOMPLISHMENT CONFERENCE ABSTRACT BOOK

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## ORAL PRESENTATIONS ABSTRACTS

### ART

#### Mt. Jewett Heritage Mural and Its Effect on the Community and Social Structure

Jill Alane Moore (Kong Ho), University of Pittsburgh at Bradford, Humanities Division – Art

The mural has been a social focal point dating back to cave paintings. They have been used to communicate stories and history about society. From paintings in Egyptian tombs, Greek and Roman stone carvings, Medieval and Renaissance art, to civil unrest in Mexico in the 1930s and present day graffiti art.

In this Case Study of the Mt. Jewett Heritage Mural, a mural depicting the rich cultural heritage of this small northwestern Pennsylvania town, I will look at the social structure of the community and discover what effect living with art has had on the citizens of Mt. Jewett.

### BIOLOGY

#### Gene Expression Changes Associated with Dormancy Breakage by Bromoethane in Potato

Lee Beers1 and Charlotte Boni1 (Michael Campbell1 and Jeff Suttle2), 1Penn State Behrend, School of Science and 2USDA Northern Crop Science Lab, Fargo, ND – Biology

Dormancy in plants is a poorly understood process controlled by endogenous and exogenous factors. In order to elucidate the endogenous processes of plant dormancy we have established a procedure to examine global gene expression changes in potato meristems induced to break dormancy. Dormant potato tubers were harvested in the fall of 2002 and stored until they exhibited a sprouting response after treatment with bromoethane (BE). Following BE exposure tuber meristems exhibited a 3.8-fold increase in H3-Thymidine over a nine-day period. In comparison to non-treated controls which showed increases in day 5 and day 6 only. Microarray analysis showed numerous genes with a two-fold increase in expression levels as dormancy breaks. Among the genes that showed a two-fold decrease in expression level were the BURP genes, (BNM2 clone derived from *Braccus napus*; USPs and USP like proteins; RD22 from *A. thaliana*; and PG1beta from *Lycopersicon esculentum*). The expression levels of these BURP genes dropped with a two-fold decrease from day 1 to day 4 and from day 4 to day 8.

#### Isolation and Characterization of the NDP Gene from Arabidopsis thaliana and Solanum tuberosum

Charlotte Boni (Michael Campbell), Penn State Behrend, School of Science – Biology

A random clone (*NDP1*) was isolated from a cDNA library produced from dormant *Solanum tuberosum* (potato) meristems. Further analysis on *NDP1* was conducted in *Arabidopsis thaliana* because a single copy homologue exists at At5g02130. The *A. thaliana* and potato *NDP1* homologues share greater than 50% identical and 73% conserved amino acids. Examination of an *A. thaliana* T-DNA knockout mutant of the *NDP1* locus results in a 93% reduction in both growth rate and chloroplast movement rate. Complementation experiments of the *ndp1* mutant have not been accomplished due to the reduced growth rate and dwarf phenotype. An alternative is to create a new *ndp1* mutant using antisense RNA technology. This mutant is under development. Our goal is to show the observed phenotype matches that of the *ndp1* T-DNA knockout mutant, thus allowing determination of function by analysis of the mutant. In addition to complementation, we have cloned the *NDP1* gene into the pETa vector. This has resulted in purification of the NDP protein. The Immunology class at Penn State Behrend is using the purified protein to generate anti-NDP antibodies in a rabbit. Our goal is to utilize this antibody to determine the subcellular location of the NDP protein. Analysis of the promoter region is also being done.

#### A Genetic Comparison of Parthenocissus heptaphylla, a Texas Endemic, to Parthenocissus quinquefolia

Maggie J. Campbell (Marlene Cross), Mercyhurst College, Department of Biology – Biology

Little is known about the time frame and context of speciation events producing the high degree of plant community endemism on the Edwards Plateau of Texas. Molecular genetic comparisons of endemic species and closely related plants within the same genus can be used to investigate the speciation process. A genetic comparison was undertaken of *Parthenocissus heptaphylla* (an Edwards Plateau endemic) and *Parthenocissus quinquefolia* (its more widespread eastern relative). Samples of both *Parthenocissus* species were collected from sites within Fort Hood on the northeastern edge of the Edwards Plateau. Comparative material of *Parthenocissus quinquefolia* was also obtained from several locations in Erie County, Pennsylvania. The leaves of each sample were dried with silica gel, and bagged for further laboratory assessment in which DNA was isolated using a CTAB-based extraction method. After the priming and sequencing of the *rbc*L gene from the chloroplasts, further conclusions regarding the evolutionary relationships within the *Parthenocissus* genus will be made by examining the nucleotide differences between two separate members of *Parthenocissus quinquefolia* compared to those found between *Parthonocissus quinquefolia* and *Parthenocissus heptaphylla*.

Using Molecular Markers to Discriminate Potential Pollen Donors in a Plot of *Symphyotrichum pilosum*

Claire Cardone and Erin Ridley (Jeffrey Taylor and Jerry Chmielewski), Slippery Rock University, College of Health, Environment, and Science – Biology

The purpose of this study is to identify molecular markers that are capable of discriminating the individual members of a natural plot of *Symphyotrichum pilosum* (the pilose aster). Molecular markers, while generally not genes, indicate much about the organisms they are found in. As the genetic makeup of each plant is different, it should be possible to use molecular markers to discriminate the individuals in this localized population. DNA was obtained from the plants using E.Z.N.A. Miniprep kits. Molecular markers were then produced by the polymerase chain reaction, or PCR, via the RAPD (random amplified polymorphic DNA) protocol. RAPD primers, though less robust than traditional PCR primers, are advantageous in that they can potentially produce many bands and require no previous sequence knowledge. Following PCR, the products were analyzed by electrophoresis and band sizes produced by each RAPD primer were recorded. The PCR products are being analyzed to ascertain which primers produce the polymorphisms capable of discriminating each member of the population. Ultimately, these primers will be used to identify those plants that contributed pollen to a particular ovary in the plot.

#### Antibody Production of 3 Zebrafish Fragile X Related Proteins

Jason Creps (James Warren Jr.), Penn State Behrend, School of Science – Biology

Fragile X syndrome is a leading cause of inherited mental retardation, and is caused by the absence of Fragile X mental retardation protein (FRMP). This X linked gene has two autosomal homologs, Fragile X related proteins 1 and 2 (Fxr1p, Fxr2p) to make a family of genes involved in RNA binding. Isolated Fragile X genes from (*Danio rerio)* have been subcloned into bacterial expression vectors in order to generate purified protein for antibody production. Three DNA clones for the Fragile X related genes have been isolated, and studies have begun which show which cells are expressing the genes through early development using mRNA *in situ* hybridizations. By subcloning the Fragile X genes into bacterial expression vectors, pure Fragile X proteins will be isolated. These isolated proteins will be then injected into rabbits to create antibodies specific for the proteins. These Fragile X related antibodies can be used to determine the subcellular localization of these gene products. This study should give us insight into the normal role of the Fragile X gene family in vertebrate development. This presentation describes the methods used to generate antibodies against the zebrafish Fragile X gene family, and the results obtained thus far.

#### Identification of the Culturable Species of Microorganisms in Compost Tea

Joana Feliciano (David Hunnicutt), Penn State Behrend, School of Science – Biology

Plant disease is an area of continued research with many methods of pathogen inhibition being tested. One method developed is the use of compost tea as an antagonist to plant pathogens. The tea, created by an aerobic brewing process, is composed of compost and water, and is sprayed onto the plant. The use of compost tea requires information regarding the microorganisms present in it. Previously, 30 culturable bacteria were isolated from the tea and stored in glycerol at -80oC. The purpose of the present research was to identify each isolate in order to characterize the microbial composition of the tea. DNA of each isolate was amplified by PCR then sequenced with universal eubacterial primers. BLAST searches were performed on the resulting sequence data to identify the species and ClustalW multiple sequence alignments were used to compare sequences. To date the following species have been identified: three Pseudomonas, one Sphingomonas, two Rhizobium, four Bacillus, two Streptomyces, and one Frigoribacterium.

#### A Bioindicative Relationship among Freshwater Periphyton, Benthic Macroinvertebrates, and Unionids

Lillian Gehres (J. Michael Campbell), Mercyhurst College, Department of Biology – Biology/Environmental Science

There is a general lack of research regarding the interactions among traditional periphyton, macroinvertebrate, and native mussel communities in running water habitats. Current published research tends to a focus on how one of the previously mentioned communities relate to variations in habitat quality. Few, if any studies, simultaneously investigate two or more of these communities to assess their combined indications of ecosystem health. The purpose of this research was to explore, on a descriptive level, the possible bioindicative relationship among freshwater stream periphyton community composition and stream invertebrate communities including both benthic macroinvertebrates and freshwater unionids. This study involved sampling and identification of periphyton, benthic macroinvertebrates and unionids from several sites on Conneaut Creek in northwestern Pennsylvania and northeastern Ohio along a gradient of varying favorability for unionids and macroinvertebrates. Various measures of periphyton and macroinvertebrate community structure will be compared among the Conneaut Creek sites and a reference site near the mouth of Elk Creek (western Erie County) where no freshwater mussels occur.

#### Evaluation of the Relative Activity of Two Naturally Occurring Allelic Forms of the Promoter Controlling the Human Mitochondrial DNA Single-Stranded Binding Protein (mtSSBP) Gene

Erin Kristobak (Durwood Ray), Grove City College, Department of Biology – Molecular Biology

The mechanism by which mitochondrial DNA copy number is regulated in eukaryotic cells has not been characterized. Our lab has found evidence suggesting that an increased amount of mitochondrial DNA (mtDNA) may be present in human breast cancer cell populations. One protein which may regulate the amount of mtDNA is the mitochondrial DNA single stranded binding protein (mtSSBP), which keeps the strands of mtDNA separate during replication. We have discovered a 16 base pair insert in the sequence of the promoter region of the gene with respect to the previously published sequence, indicating the presence of two alleles for the gene in the population. The goal of this study is to explore the promotion of transcription by each allele of mtSSBP by using expression vectors. A section of the promoter region of the mtSSBP was chosen for PCR amplification, restriction enzyme digestion, and ligation into a promoterless expression vector ahead of the coding region for Green Fluorescent Protein (GFP). After transfecting human cells with the expression vectors containing each of the promoters, we will assess the amount of GFP expression in order to characterize the level of transcription initiated by each of the two alleles of the mtSSBP.

#### Sequencing the Mitochondrial Genome of the Branta canadensis and Comparison to Anser albifrons

Craig Andrew Mackaness, Megan Sopher, and Jonathan Huber (Frederic Brenner and Durwood Ray), Grove City College, Department of Biology – Molecular Biology

The *Branta canadensis* (Canada goose) has several classical morphologically defined subspecies within the common North American waterfowl. By defining the genetic sequence of their mitochondrial DNA, wildlife biologists will be able to genetically define and monitor migration, breeding, and feeding patterns of these geese. We have sequenced the entire mitochondrial genome of the Canada goose and have found regions of significant variation in the coding regions and non-coding regions of the mitochondrial genomes of the *Branta canadensis* and the related *Anser albifrons* (white-fronted goose). DNA sequencing employed our designing primers from the known sequences of *Anser albifrons* to carry out polymerase chain reaction (PCR) based sequencing in our Perkin Elmer 310 DNA sequencer. We used dye terminator DNA sequencing chemistry with PCR amplicons to sequence both strands, and we constructed a contiguous sequence with SeqMan II software from Lasergene. The complete mitochondrial DNA sequence of the *Branta canadensis* will be submitted to the NCBI. By providing the mitochondrial genome, we and other researchers will be able to monitor these birds genetically. The advantages of DNA analysis over morphology in monitoring a species is its specificity and convenience.

#### Analysis of Benthic Macroinvertebrate Communities as Indicators of Water Quality in Conneaut Creek, Erie County, Pennsylvania

Randi Marmalich, Joseph Slepko, and Amy Stewart (J. Michael Campbell), Mercyhurst College, Department of Biology – Limnology

The objective of this study was to evaluate the effects of nonpoint source pollution on benthic marcoinvertebrate communities at several different sites on Conneaut Creek (Pennsylvania and Ohio) and a single site on Elk Creek (Pennsylvania) used as a reference site. A reach approximately 100 m in length was sampled at each site. In each reach five kick samples were taken using a D-frame dip net. Organisms in the samples were identified and enumerated, and were then converted to metrics using an analysis outlined in *U.S. EPA Rapid Bioassessment Protocols*. Our analysis indicated that benthic macroinvertebrate communities of most of the sites sampled on Conneaut Creek indicated high water quality compared to the Elk Creek site and other large streams in Erie County. The favorable indications of water quality we found in Conneaut Creek correspond with other studies indicating that a diverse community of native freshwater mussels is supported by this system.

#### The Effects of Noise Disturbance on Relative Fitness of Black-Capped Chickadees (Poecile atricapillus) on Penn State Erie’s Campus

Sam Marvit (Margaret Voss), Penn State Behrend, School of Science – Biology

In past studies of chickens and pied flycatchers (*Ficedule hypoleuca*), differential blood counts revealed an increased heterophil/lymphocyte ratio in response to stressors. Black-capped chickadees (*Poecile atricapillus*) may exhibit a similar type of immune response to traffic noise. To test this response, background noise levels were measured regularly at three sites on the Behrend campus, two intermediate (~50 dBA) and one high noise area (~60 dBA). Blood was drawn from chickadees, but because of interspecific nestbox competition with house wrens (*Troglodytes aedon*), blood was drawn from wrens as well. Collected blood was smeared onto microscope slides in the field in addition to being preserved. Differential blood counts were conducted on blood slides and preserved blood was frozen upon returning to the laboratory for microsatellite analysis, which is currently being conducted. If there is a difference in lymphocyte/heterophil ratio, further analysis will be conducted to determine the significance of noise disturbance to the fitness of local house wren and/or black-capped chickadee populations.

#### Microsatellite Diversity Study of Local Ambystoma maculatum Populations Using Fluorescent Microsatellite Tagging

Floyd Mattie (Michael Campbell), Penn State Behrend, School of Science – Biology

The spotted salamander (*Ambystoma maculatum*) is a yellow-spotted amphibian which has localized populations over a widespread geographic area of the eastern United States. In early spring, adultstravel relatively long distances to return to their native breeding pond to mate. Penn State Behrend is located in northwestern Pennsylvania, and contains two such *A. maculatum* breeding sites. The habit of returning to their native pond combined with the fact that the breeding ponds are separated by a relatively large tract of developed land creates isolated populations. Our goal in this study is to determine if significant genetic diversity exists between these two isolated populations of *A. maculatum*. Genetic population analysis was accomplished through the use of co-dominant microsatellite markers. Four microsatellite markers previously established for *A. maculatum* were used to investigate the genetic population structures. The microsatellite markers elucidate 8-12 alleles each. Using DNA isolated from toe clippings of 96 individuals, the microsatellites were fluorescently tagged, isolated, and amplified. The allele lengths were measured on a capillary electrophoresis instrument. Currently the results from capillary electrophoresis are being scored for the allelic variation present in the sampled individuals. This information will be organized according to the spatial and temporal attributes of the samples, and analyzed using specific microsatellite analysis software.

#### Virulence of Flavobacteria in Zebrafish (Danio rerio)

Thomas R. Moyer (David Hunnicutt and James Warren Jr.), Penn State Behrend, School of Science – Biology

Zebrafish have potential to be an excellent model system for the study of infectious disease due to their ease of care, quick reproductive cycle, and an immune system analogous to that of humans. *Flavobacterium johnsoniae* is a gram negative bacterium and opportunistic fish pathogen that is closely related to *Flavobacterium columnaris*, which causes columnaris disease, a serious infection in fish. Both bacteria display an interesting type of movement known as gliding motility. In order to study their pathogenic properties, adult zebrafish were infected through a bath procedure involving incubation in varying concentrations of *F. johnsoniae* or *F. columnaris* strains. External observation of infected fish revealed that infection with *F. columnaris* has produced a specific type of lesion known as a saddleback; *F. johnsoniae* infection has not produced these lesions. By performing multiple replicates of zebrafish infections and monitoring the zebrafish populations until the time of their death, the 50% lethal dose (LD50) of *F. johnsoniae* and *F. columnaris* in zebrafish can be determined. These data are being compared to LD50s determined through a direct injection technique of the bacteria into anesthetized zebrafish. Preliminary calculations suggest the LD50 of *F. columnaris* is much lower then that of *F. johnsoniae*. These experiments will be helpful in furthering our knowledge about *Flavobacteria-*related diseases within fish populations, specifically columnaris disease.

#### Murine Immune System Responses to Staphylococcus aureus Strains Varying in Clumping Factor Expressions

Pamela S. Ogurchock and Christopher Knecht (Mary Dominiecki), Slippery Rock University, College of Health, Environment, and Science – Biology

*Staphylococcus aureus* is a Gram-positive, infectious bacterium of particular research interest because many strains are resistant to multiple antibiotic treatments. Our goals include the study of: a) the role of virulence factors of *S. aureus* in septicemia development, b) the roles of innate and acquired immunity in resistance to staphylococcal infections, and c) the interplay of host immune system components and *S. aureus* in a murine model of septicemia. Laboratory and clinical strains of *S. aureus* were intraperitoneally injected into mice. We used four different strains varying in clumping factor expression (Newman, Newman *Clf A-*, Newman *Clf B-*, and Newman *Clf A-B-*). Clumping factor expression increases resistance of *S. aureus* to host defenses including phagocytosis by host immune cells. A time course using a sublethal dose of bacteria (0.1 LD50) was conducted in an effort to ascertain the appropriate timepoint for future studies. At each timepoint (18 hours, 3, 5, 7, and 10 days), spleens, kidneys, livers, and blood were harvested. Tissues from all time points were sectioned and stained for histological studies. We found different rates of bacterial clearance among the four bacterial strains and changes in the architecture of some organs after infection.

#### The Impact of Noise Disturbance on Reproductive Fitness in Black-Capped Chickadees

Melissa Peters (Margaret Voss), Penn State Behrend, School of Science – Biology

Limited evidence suggests sound disturbance alters the breeding behavior and nest distribution of songbirds. Females on disturbed sites should be less attentive during incubation. Incubation patterns can be recorded through temperature fluctuations of thermocouple implanted eggs. If trade-offs between incubation and increased vigilance exist, nests on disturbed sites should have decreased average egg temperature and increased thermal variation. Lower average egg temperatures should in turn increase the time required for embryonic development. I have been exploring this effect in black-capped chickadees (*Poecile atricapillus*) that nest in different levels of traffic noise. Environmental sound levels, egg temperature fluctuations, and physical measurements of nesting birds and offspring were taken every third day of the nesting season between May and August of 2003 and 2004. Females appeared to prefer nest sites with intermediate noise levels and spent less time away from eggs on these sites (p ≤ 0.001, ANOVA). Female behavior patterns may reflect trends in offspring growth, but tests for differences in growth rates were not significant and showed much variation. Additional data are required to adequately test this hypothesis. The results of this work will be combined with results from several other student projects and my research on paternity patterns to comprise a single paper on the effects of noise disturbance on reproductive behavior in songbirds.

#### The Importance of the lolA Gene for Flavobacterium johnsoniae Motility

Matthew S. Sack (David Hunnicutt), Penn State Behrend, School of Science – Biology

*Flavobacterium johnsoniae* is a gram-negative bacterium which relies on gliding motility for its movement. Gliding motility is a poorly understood method of movement. Transposon mutagenesis generated a number of not-motile *F. johnsoniae* mutants. Two of these mutations are in a gene called *lolA*. The *lolA* gene codes for a protein thought to be involved in lipoprotein synthesis. To study the effects of the mutation we are attempting to complement the mutant with intact *lolA* on a plasmid vector. The *lolA* gene alone was successfully conjugated, but motility deficient *F. johnsoniae* did not gain mobility. We are currently cloning additional genes downstream of *lolA* to determine whether they are required to correct the defect. Successful complementation will prove that *lolA* and the surrounding genes are required for motility. Knowing the role of *lolA* and the surrounding genes will further the understanding of *F. johnsoniae* motility.

#### Differential RNA Expression Studies Using Microarray Analysis in Three Mouse Cell Lines Representing Different Stages of Cancer Progression, and the Comparison after Treatment with the Natural Tumor-Suppressing Agent Matrine

Rebecca Sauerwein and Erin Henninger (Durwood Ray and David Jones), Grove City College, Department of Biology – Molecular Biology

Matrine is a Chinese medicine derived from a Japanese herb. It has been used to treat various ailments including hepatitis B, tumor suppression in liver cancer, and reperfusion injury. The purpose of our experiment is to study how matrine affects RNA expression in three different cell lines. The three cell lines are derived from the NIH Swiss mouse, specific characteristics being the following: NIH/3T3 cells are immortalized, non-tumorigenic, non-contact inhibited, and precancerous. The T2A cells are highly aggressive, non-metastatic cancer cells derived from transfection of the NIH/3T3 cells with h-ras oncogene. The T4PA cells are highly aggressive, tumorigenic, and metastatic cancer cells derived from metastatic tumors generated in the nude mice. Microarray analysis was used to detect RNA expression of 17,500 genes in each of the three cell lines. Upon comparing results of the cell lines, significant differences in expression levels were found in parallel gene transcripts. In continuation, the three cell lines will be treated with the compound matrine, and the RNA expression subsequently analyzed and compared with the results from the previous untreated microarray studies. If significant differences are evident, as time permits, quantification experiments may be performed utilizing RT-PCR for the more interesting RNA transcripts.

#### Impact of Vesicular Arbuscular Mycorrhizae on Plant Ion Uptake Potential

Michelle Shields (Jeffrey Taylor), Slippery Rock University, College of Health, Environment, and Science – Biology

In a mycorrhizal association, the fungal partner is capable of absorbing mineral nutrients from the soil and passing them to the plant partner. While ectomycorrhizae have been established as decreasing the root surface area available for ion uptake, the impact of vesicular arbuscular mycorrizae (VAM) is not known. In the research presented here, the impact of VAM on the plant ion uptake potential of maize (*Zea mays*) roots was ascertained. First, corn plants were established in heat sterilized soil and soil that had been laced with a VAM Cocktail Mix provided by Plant Health Care, Inc (Pittsburgh, Pennsylvania). The root systems were isolated, and macroscopic measures were made. Second, it was necessary to determine the total plasmalemma surface area and number of those cells capable of absorbing mineral nutrients from the soil solution for plants from both growth media. Third, Trypan blue staining was used to assess the degree of VAM colonization between the sterile and inoculated soil. These findings allowed the relationship between VAM association and independent ion uptake potential in corn to be ascertained.

#### The Effects of Nonpoint Source Pollution (NPSP) on the Macroinvertebrates and Periphyton Communities of Trout Run, Erie County, Pennsylvania

Rebecca Turner (J. Michael Campbell), Mercyhurst College, Department of Biology – Biology

Macroinvertebrates and periphyton can both be used as biological indicators of aquatic habitat quality. Certain taxa of macroinvertebrates are more sensitive to pollution arising from both indirect and direct sources. Because of this, pollution sensitive taxa are indicators of a healthier stream environment whereas pollution tolerant taxa may indicate unhealthy or polluted waters. In the same way, certain species of periphyton are more sensitive to organic pollution while other more motile periphyton are indicators of increased silt in a stream. In this study, both macroinvertebrates and periphyton were sampled at seven sites along the main channel of Trout Run, above and below presumed sources of NPSP originating from the town of Fairview. The study indicated that the macroinvertebrates seemed to correspond to the areas of the stream affected by NPSP; those sites closer to the main area of NPSP showed more pollution tolerate species whereas sites further away indicated the presence of more pollution intolerant species. The degree of correspondence found between macroinvertebrate and periphyton community indicators of habit quality will be described.

#### Examination of the Effect of Mycorrhizae on Root Anatomy as It Impacts Nutrient Ion Acquisition in Tomato

Adriann Waltenbaugh (Jeffrey Taylor), Slippery Rock University, College of Health, Environment, and Science – Biology

Mycorrhizae are a symbiotic association between plant roots and fungi in which the plant gives sugars to the fungus, and the fungus supplies mineral nutrients to the plant. In the case of most herbaceous species, the type of association that forms is called a vesicular arbuscular mycorrhizae (VAM). It has been previously established that other forms of mycorrhizal associations act to reduce the capabilities of the root system to obtain mineral nutrients independent of the fungal partner. In the present study, we investigated how a VAM association impacts the potential absorbing plasmalemma surface area of tomato (*Lycopersicon esculentum*) roots. To begin, tomato plants were established in both sterile soil and soil that had been purposely inoculated with mycorrhizal spores. The root systems were isolated, and macroscopic measures were made. Next, Trypan blue staining procedures were undertaken to establish that the plants grown in sterile soil were absent of, or extremely deficient in, mycorrhizal associations. Lastly, it was necessary to determine the total plasmalemma surface area and number of those cells capable of absorbing mineral nutrients from the soil solution. With these results, the impact of VAM associations on the ability of tomato roots to absorb mineral nutrients independently was ascertained.

#### A Survey of the Freshwater Mussels (Bivalvia:Unionidae) of Fort Hood, Texas

Erik A. Weber and Maggie J. Campbell (J. Michael Campbell), Mercyhurst College, Department of Biology – Biology

Shells of freshwater mussels are commonly found at archeological sites on Fort Hood, Texas. Native Americans apparently used mussels as food, ornaments, and tools; species found at some sites can also be used as indicators of past conditions of aquatic habitats on the fort. This survey of the modern and prehistoric mussel fauna of Fort Hood was undertaken to support interpretive analysis of mussel shells recovered at archeological sites. Gravel bar features of the two largest streams in and near Fort Hood – Leon River and Cowhouse Creek were inspected in November 2003, and April, June, and August 2004. Modern collection records were also reviewed.

A total of 11 species were identified at one site surveyed on the Leon River. Large numbers of the invasive sphaerid clam *Corbicula fluminea* were also observed. The only indications of mussel populations found along Cowhouse Creek were fragments of shells recovered from the exposed alluvial deposits on the banks of the creek. Mussel species found in previous archeological studies of prehistoric sites along Cowhouse Creek suggest that this stream supported a diverse freshwater mussel community. Prehistoric and historic changes in substrate and hydrology may have contributed to the decline of freshwater mussels in Cowhouse Creek.

### CHEMISTRY

#### Analysis of Arson Accelerants Using Gas Chromatography

Rebecca Davis and Diana Hoover (Naod Kebede), Edinboro University of Pennsylvania, School of Science, Management, and Technology – Chemistry/Forensic Sciences

The Uniform Crime Reporting (UCR) Program defines arson as “any willful or malicious burning or attempt to burn, with or without intent to defraud, a dwelling house, public building, motor vehicle or aircraft, personal property of another, etc.” There were approximately 71,000 reported cases of arson in the United States in 2003 ([www.fbi.gov](http://www.fbi.gov/)). The main objective of this study was to create a database of information that can aid in the identification of commonly used accelerants in arson. Gas chromatograms of liquid accelerant samples, as well as the headspace samples were obtained for comparison purposes using a Hewlett Packard Series 5890 II gas chromatograph with flame ionization detection. Wood samples soaked in accelerant for approximately 48 hours were burnt, and headspace gas chromatograms of each were analyzed. All chromatograms were scanned and digitized using Digitize It shareware in order to produce the database.

### ECONOMICS

#### Estimating Spatial Cost of Living Differences with Housing Costs

Michael L. Hammill (James Kurre), Penn State Behrend, Sam and Irene Black School of Business – Economics

It is commonly known among economists and other social scientists that the cost of living (COL) can vary quite substantially within a nation’s borders. Much of this evidence can be seen in a few good spatial cost of living indexes (COLI) such as the ACCRA COLI. While ACCRA and other COLIs cover many urban and metropolitan areas and cost of living comparisons can be made across these areas, they typically do not include small, rural places. Consequently, it is difficult for smaller areas to get a good understanding of their relative cost of living. This paper investigates one way in which the COL can be estimated across all areas within the United States, urban and rural. Specifically, data from three COL sources are regressed on housing costs from the decennial Census to determine the appropriateness of using an area’s average cost of housing as a proxy for that area’s COL. The results from the analysis indicate that, while imperfect, housing costs are a reasonable estimate of an area’s COL and explain anywhere from about ½ to ¾ of the variation in the three cost of living sources used.

#### Follow the Leader: Creating a Leading Index for the Erie Economy

Jeremiah J. Riethmiller (James Kurre), Penn State Behrend, Sam and Irene Black School of Business – Economics

A good leading index can provide a glimpse into the future of an economy. The U.S. leading index has accurately predicted the last seven recessions in the United States. While the U. S. leading index can be helpful in forecasting what is going to happen with the Erie economy, the index uses factors such as the money supply (M2) which may not be a leading indicator of the Erie economy. Other factors, such as average weekly hours worked in manufacturing, may need to be weighted more heavily because Erie has a greater then average share of manufacturing activity. A leading index for the Erie area would make local businesses more competitive because they would be able to plan better for fluctuations in economic conditions. This project attempts to find leading indicators that are relevant to the Erie economy. These indicators will then be used to create a leading index. To ensure that the leading index performs accurately, it will be tested against historical data before it is branded as a useful predictor of economic expansions and contractions.

#### Economic Bankruptcy in Erie as Compared to the State and Nation

Ross Michael Zambanini (James Kurre), Penn State Behrend, Sam and Irene Black School of Business – Economics

As much as we know about the life cycle of a business, from the conception of a company and what affects the decisions it makes throughout its lifespan, relatively little is known about a firm when it dies. Bankruptcy is just as much a part of a firm’s business cycle as is start-up; they just happen to be polar opposites. This paper will define: what bankruptcy is, what role bankruptcy plays in our own economy, and how bankruptcy laws work. Another focus of this study will be to compile a database of the Erie, Pennsylvania, and U.S. economies for statistical analysis. The final portion of this paper will define Chapter 7, Chapter 11, and Chapter 13 Bankruptcy in reference to the Erie, Pennsylvania, and U.S. economies.

### ENGINEERING

#### Stability and Vibration of Electrostatically Driven Actuators

Lisa Buziewicz (Oladipo Onipede Jr.), Penn State Behrend, School of Engineering and Engineering Technology – Mechanical Engineering

Combdrives are microelectromechanical (MEMS) machines that are used as actuators and switches in many electronic devices. They work by oppositely charging the fingers of a pair of combs with one set of fingers fixed. This allows for a lateral motion that can be used to rotate micro-mirrors, drive micro-motors, or control MEMS switches. The fingers of the combdrives are long and slender and as such they can be modeled as cantilevered beams and the electrostatic force can be modeled as a distributed load on the beam whose magnitude is proportional to the deflection of the beam. Other studies of combdrives have assumed these fingers to be rigid and as such have not accounted for their deformation. A finite difference model of the combdrive fingers is used to study critical factors that affect the combdrives functionality and performance. This includes the critical voltage as the comb fingers move in and out of one another and the effect of a slight misalignment. It is expected that theses results will lead to further studies on the performance of combdrives and also assist MEMS designers and fabricators to develop more accurate and reliable designs of MEMS actuators.

#### The Low Level Vibrations Sensing Unit

Rick Hinman, Stephanie Muchow, and Cody Schultz (Thomas Hemminger), Penn State Behrend, School of Engineering and Engineering Technology – Electrical and Computer Engineering

The Low Level Vibrations Sensing Unit (LLVSU) is a system designed for a defense contractor that monitors vibrations caused by fans in electronic rack systems onboard submarines. The purpose of monitoring the vibrations is to eliminate the noise caused by both airborne and shipborne vibrations. Shipborne vibrations are of a mechanical nature created in the rack structure, which can be transmitted through the body of the submarine. This is a problem as it may allow enemy vessels to identify the location of the vehicle. Airborne vibrations cause audible noise, which is a nuisance to the sailors and can still be converted to physical impulses through water.

In developing the LLVSU, a significant amount of research was needed. First, the optimal sensor for this application had to be selected and tested. After selecting this sensor, a model was created to simulate a computer rack system. This model was used to acquire data and characterize the noise. Using this information, the LLSVU was programmed to compare input noise levels against allowable thresholds. When noise exceeds these thresholds, the LLVSU takes corrective actions, which may include providing a warning to the user interface as well as adjusting the speed of defective fans.

#### Reducing Cutting Forces by Use of Electricity

Joseph Piazza and Paul S. Podbielski (John Roth), Penn State Behrend, School of Engineering and Engineering Technology – Mechanical Engineering

One of the items consumed more in our society than any other is energy. Concerns lie in the details of how much is used and the current and rising cost of energy. This concept is directly related to manufacturing and trying to reduce energy consumption. Reduction of energy consumed by the machines would reduce energy intake and also expenses. One way to do this is to reduce the energy required to machine our steels. The purpose of this research is to justify the existing theory that electricity can predictably reduce the cutting forces on a work piece. One very interesting characteristic is the current density, which will be compared to tensile specimens with similar running conditions that have showed favorable results. Analytical procedures will also be used in the examination in microstructures and comparison to tensile specimens. This project focuses on the investigation of electricity used in machining processes and concluding what effects it has on cutting forces.

### GEOSCIENCE

#### Behrend Atmospheric and Climate Observation Network

Timothy Reed, Thaddeus Ruefthaler, Matthew Stanton, and Joshua Walker (Ronald McCarty, Kevin Norton, and Gary Walker), Penn State Behrend, School of Science – Geoscience

The BACON Project was developed by our student team to provide a geoscience research resource for Erie-centric GOES and NOAA satellite images as well as seismic data. We are installing a ground receiving station to retrieve data from NOAA satellites that are in polar orbit. These satellites will broadcast images of the atmosphere and ground surface of the Erie area. With the current satellites in orbit, we will receive approximately 10-12 images per day. Images from the geosynchronous GOES satellites will be retrieved from a NASA data source and stored in our system. These images will show atmosphere and ground surface of the eastern portion of the United States. The data from both sources will be stored in a database and accessed through a Web site. Data from the Behrend campus seismometer is being retrieved from the Incorporated Research Institutions for Seismology to convert the seismic data into a readable graph and accessed by the site.

### HISTORY

#### Warren State Hospital: 125 Years of Transition

James Davis (John Rossi), Penn State Behrend, School of Humanities and Social Sciences – History

For generations society has pondered over the issue of caring for the mentally ill, primarily which form of care is the best. Using the Warren State Hospital as a case study, research uncovered how a mental institution created at the end of the nineteenth century has had to adapt and change to remain relevant for public needs. Changes in medicine, public attitudes, and the growth of the fields of psychology and psychiatry illustrate different stages the Warren State Hospital has gone through.

#### The Disparate Effect of the French Revolution on Equal Rights for Women

Thomas R. Pietro (Michael Christofferson), Penn State Behrend, School of Humanities and Social Sciences – History

My research has involved examining primary and secondary sources to track the advancement of equal rights during the French Revolution. Many groups which had traditionally been denied rights in Old Regime France (Jews, blacks, and slaves) eventually gained a great deal of the political and personal freedoms espoused in the Declaration of the Rights of Man and Citizen. The advancement of these groups suggests that the Revolution had a certain commitment to equalizing rights before the law. This assumption is challenged by the study of the women’s rights movement. Women did not make nearly the progress during the Revolution that these other groups enjoyed. So, even while many men in minority groups were gaining political rights, half of the population was still restricted from participation. There were areas, outside of politics, in which women did gain more equal treatment. In the family, the absolute power of husband and father would be challenged during the Revolution, and women would begin to gain equality in civil matters rivaling the success of other groups in politics. Through my research, I have learned more about the Revolutionary commitment to equal rights and its unique approach to addressing women’s issues.

#### The Problem of Universal Suffrage and the French Revolution of 1848

Erik L. Regis (John Rossi), Penn State Behrend, School of Humanities and Social Sciences – History

The French Revolution of 1848 began France’s first extended experiment with universal suffrage. This democratic reform was implemented in a country that was in many ways unprepared for such a privilege. The politically radical revolutionaries who were part of the Provisional Government, set up in the aftermath of the revolution, hoped that suffrage would bring about great social reforms. Much to their dismay they did exactly the opposite. A conservative peasantry, by far the most numerous demographic in France, elected a constituent assembly that was dominated by the political right. The result of the assembly’s ensuing policies caused an uprising by radical Parisians. The political turmoil created by the elections allowed Louis Napoleon Bonaparte to capitalize on the growing fear of radicalism in France. The nephew of Napoleon appealed to the ignorant peasantry with his name and his promises of returning France to the glory his uncle had achieved fifty years before. Bonaparte used suffrage to his advantage and easily won the presidency of the newly created French Republic. He was, however, not a friend of republicanism, and soon he would destroy the government and establish a dictatorship. Suffrage, in summary, destabilized the government and allowed Bonaparte the chance to destroy it. Suffrage is a fundamental right many Americans take for granted, but it is important to note the danger that it can bring to a society that is not properly prepared to participate in a democratic society.

### MANAGEMENT

#### Project Management: A Comparison of Business vs. Engineering Students' Personality Factors and Expectations

Timothy J. Schultheis II1 and Michael A. Wiseman1 (Diane Parente2), Penn State Behrend, 1School of Engineering and Engineering Technology and 2Sam and Irene Black School of Business – Management

Today, it is difficult to differentiate between where the engineering realm ends and the business world begins. Business management and engineering technologies are becoming increasingly integrated in our present society. Well-developed management techniques are absolutely vital for the survival of any engineering corporation or facility. As a result of this global integration comes the need for engineering students to be more skilled in managerial practices when exiting college. The main objective of this study is to examine and identify the differences between business management students and engineering students in the field of project management. Personality traits will be identified using the *Big Five Personality Dimensions* which will provide similarities and differences with regards to team development, goals, and expected skill acquisition.

#### The Impact of a Project Management Class on an Undergraduate Engineer in Senior Design

James S. Wyble III1 (Diane Parente2, Eric Jackson2, and Kenneth Fisher1), Penn State Behrend, 1School of Engineering and Engineering Technology and 2Sam and Irene Black School of Business – Electrical Engineering and Management

The purpose of this study is to help determine the impact that a project management course has on an undergraduate engineer in the senior design project. Senior design classes revolve around a group project atmosphere that would be similar to those found in the real world. Students taking this class would benefit from the knowledge and tools that project managers possess. This study investigates which project management skills are used by the undergraduate engineers and how they affect the success of the student and the group project. The design of this study first involves research through literature reviews and focus groups to identify the definition of success for a student and project in the senior design class. Then, focus groups that are distinguished by students who have or have not taken a project management class are used to identify skills that are most commonly used by the students, as well as skills that should be used by the students. Ultimately, a survey will be created that can be used in the future to track the characteristics of successful groups in senior design, as well as the skills they use that are different from other less successful groups.

### MARKETING

#### What Explains Customer Satisfaction in Bruno’s?

Amy Caskey, Bretten Folga, Eve Savelli, and Jill Vroman (Syed Andaleeb), Penn State Behrend, Sam and Irene Black School of Business – Marketing

With the increasing number of students now attending college, the topic of how well the campus cafeteria is meeting their needs has become increasingly popular. Student complaints about the lack of food variety and the long waits in lines sparked the idea of conducting research at Bruno’s. The purpose of the research was to find areas in which students were unsatisfied and to gain insight into what could raise their satisfaction level. A questionnaire was developed and distributed to a random sample of people frequenting Bruno’s. Questions included those focusing on cleanliness, food variety, employees, hours of operation, prices, waiting time, and size of the café. The questionnaire also included basic screening and demographic questions in order to gain a better understanding of those participating in the research. Results showed that students were extremely unhappy with the food variety. They wanted to see a healthier, more diverse selection. Other areas that could be improved were those involving employees and atmosphere.

#### Resistance and Customer Satisfaction during the Computer Purchase Process

Shannon Farley, Cayla Javor, Jenny Kaleta, and Courtney Kaplin (Syed Andaleeb), Penn State Behrend, Sam and Irene Black School of Business – Marketing

Research was conducted to achieve an understanding of the resistance felt among college students when purchasing computers. Knowledge about computers was the primary factor influencing resistance. There were a number of aspects considered to be possible causes of resistance, most proving to have minimal effect on the resistance felt from students during the actual purchase process. However, the model explained satisfaction much better. The survey questions were designed to generate reliable responses. The survey contained a combination of nominal, ordinal, and interval questions. The interval questions were used to determine the customers’ feelings throughout the purchase process. These questions were mainly directed to determine sources of anxiety and causes of resistance. Data were obtained using random sampling of students. Data analysis was completed using the SPSS software program. The current generation of students is surrounded and influenced by technology. Students’ low resistance during the purchase process of computers can be attributed to their dependency on computers and computer technology.

### MATHEMATICS

#### Analysis of the Game of Snort

Matthew Futterman (Paul Olson), Penn State Behrend, School of Science – Mathematics

The Game of Snort is a map-coloring game, created and named after Simon Norton. The purpose of this research was to explore properties of Snort fields by examining and determining strategies for the game of Snort, and to apply these findings to further the knowledge of Snort. The analysis of the game was accomplished using combinatorial game theory, and strategies were developed by “playing” games on simple Snort fields, and determining consistent patterns and strategies for making a “good” move. These strategies were then applied to more complicated Snort fields, for verification. The most important strategies are: 1) Choose a region which is adjacent to as many other regions as possible, 2) “Isolate” as many regions as possible (make regions unavailable to the opposing player, but still available for you), 3) Isolating a region available to *both* players *may* or *may not* be advantageous.

#### Classification of Small Groups Which Admit Faithful Blockings

Robert A. Goins (Paul Becker), Penn State Behrend, School of Science – Mathematics

A group is a set together with a binary operation, which satisfies algebraic restrictions. Groups are widely studied, but they are frequently viewed as abstract constructions. Cayley’s theorem states that they may be viewed as a very concrete construction; any finite group is isomorphic to a multiplicative group of matrices A specific correlation of an abstract group G with a group of matrices is called a representation of G. A recent research paper shows that many finite groups are isomorphic to groups of simple blocked matrices. The corresponding representations are called faithful blockings. In this research we looked to broaden the class of groups which are known to admit faithful blockings. In particular we determine which groups of order 16 adit faithful blockings.

#### Modeling Human Fluid Dynamics

Brandon Hamschin (Scott Stevens), Penn State Behrend, School of Science – Mathematics

Recent research has shown that the application of a mathematical model known as the Lumped Parameter Model to the fluid dynamics of intracranial and cardiovascular circulation is capable of accurately predicting responses to many stimuli. As with many complex models such predictions are made and case by case validation is achieved by comparison of numerical results obtained under the model to clinical data. Though numerical analysis is often efficient and convenient, such results are considered fully valid only after a rigorous theoretical treatment. Therefore, the purpose of this research is to establish such a theoretical basis. Specifically, the intent of this research is to prove global stability of the resulting nonlinear model thereby giving firm theoretical support to the numerical results. The result achieved thus far is the development of a proof for a special case of the general conjecture, global stability. Currently, progress is being made toward the general conjecture and we hope to have a resolution soon.

#### The Mathematical Work of Artemas Martin

Kate Overmoyer (Antonella Cupillari), Penn State Behrend, School of Science – Mathematics

Artemas Martin was a self-taught mathematician from Erie, Pennsylvania. He published work in many areas of mathematics; the present research focuses on the work Martin did on probability and analysis. Martin founded two of the earliest mathematical journals, *The Mathematical Visitor* and *The Mathematical Magazine* in the nineteenth century*.* In these journals he published his findings. Martin received international recognition despite his lack of formal schooling. Martin’s work in probability involves problems of several different kinds, many of which are geometric problems. This research will examine in detail the problems and solutions that Martin published in *The Mathematical Visitor*, and work to make them more complete and understandable. An example of a probability problem that will be presented is:

From one corner of a square field a projectile is thrown at random with a given velocity which is such that the greatest range of the projectile is equal to the diagonal of the field; find the chance of its falling in the field.

Artemas Martin also did extensive work in the area of analysis. In this research some of Martin’s analysis proofs will be examined and discussed based on accuracy and completeness.

#### Image Compression Using Quadrant Decomposition with Variance Procedure

Christopher Suprock (Lawrence Downey), Penn State Behrend, School of Science – Mathematics

Current techniques in region-based image compression utilize fixed set area decomposition. The purpose of this study was to explore a method that compresses areas in a non-uniform but “smart” way. In particular, the method analyzes an image by identifying its uniformly colored regions and compressing accordingly. The identification of such regions is made flexible by allowing the user to specify a variance parameter, and thusly control output clarity. The application is designed to accept ASCII information in the form of an RGB matrix. Color data is processed for regions according to quadrant logic similar to that found in quad-tree algorithms. Although the application employs the use of quadrant logic, it only outputs the lowest fractional product within the constraint of acceptable color deviation. Preliminary results from the application demonstrate a capable compression of 15:1 for certain images. With current testing, this application seems more effective than several existing algorithms, warranting further investigation.

#### Chess and Combinatorial Game Theory

Kyle Szklenski (Paul Olson), Penn State Behrend, School of Science – Mathematics

Chess has been around for over a thousand years. It is a sport to many, a game to others. Chess is a game that everyone plays when they are young. Combinatorial game theory has applications in several different areas, including set theory, computer algorithm development, and computer applications. By analyzing chess with combinatorial game theory, we hope to develop better methods for the treatment of the various moves of chess. Furthermore, analysis of the Pawn Game on N x N size boards may lead to the development of new algorithms previously unknown. The application of this analysis could be applied best to computer science.

### MEDIA STUDIES

#### Mix’n and Match’n Identity: The Female Bratz Doll’s Affect on Femininity and Childhood

Jane Buseck (Ishita Sinha Roy), Allegheny College, Department of Communication Arts – Media Arts

The growing consumer power of Generation Y has created a new market segment – the ‘tweens.’ This phenomenon has produced what has been termed as ‘age compression’ or the pattern of ‘kids getting older young’ (K.G.O.Y). Consequently, young girls are showing an interest in lifestyle-dolls that correlate with teenage aspirations of *playing* at being adult. An example of this would be the Bratz dolls, produced by MGA Entertainment in 2001, which are a line of reality-based teenage fashion dolls. In this analysis of the female Bratz dolls, I adopt a cultural-studies approach to argue that as children have become economically ‘useful’ as consumers, they are being socialized to ‘buy’ into the idea that to be adult is to consume. The catch here is that female tweens are buying into a notion of commodified femininity that encourages young girls to pursue a narcissistic and sexualized lifestyle made possible through commodity consumption. More specifically, through the Bratz dolls, adolescents become aware of the ‘secrets’ of the adult world, which contributes to the loss of childhood. The significance of this argument is evidenced by relating it to other current trends within American popular culture.

#### Communicating through the Skin: Self-Injury as a Nonverbal Form of Communication

Shawna Little (Ishita Sinha Roy), Allegheny College, Department of Communication Arts – Media Studies

Our society is based on verbal communication, but we need to understand that there are certain experiences that cannot be expressed verbally. Self-injury, as a form of nonverbal communication, focuses public attention on the significance of body language. This project seeks to provide an understanding of how our bodies attempt to “speak” when our voices are silenced by pain. I argue that the self-injurer uses his or her body as a medium to communicate inner turmoil. Earlier misdiagnosis of self-cutting as a failed suicide attempt resulted in the dismissal of such behavior as being pathological. Recently however, the media has played a key role in creating new insights about self-injury. Both Johnny Depp and Princess Diana admitted to their experiences during nationally televised interviews, and television programs such as MTV’s “The Real World” and WB’s “7th Heaven” have contained episodes that address self-injury. Still, this means of coping with emotional stress carries the stigma of shame and embarrassment. This paper uses psychological and communication theories to argue that self-cutting needs to be re-interpreted more positively as a nonverbal means of communicating traumatic experiences when speech is inadequate.

### PSYCHOLOGY

#### Science Activity Learning and Spatial Abilities in Fourth Graders

Sarah Bretz and Marlena McNutt (Victoria Kazmerski), Penn State Behrend, School of Humanities and Social Sciences – Psychology

An understanding of scientific concepts at a level beyond the memorization of facts and definitions is crucial in modern technological society. One area of importance that extends beyond the science classroom to everyday life is spatial skills. Such skills play a role in a wide range of activities: finding our way across town and building bridges. There is some evidence to suggest that males perform better on such skills than females. There is controversy over whether such differences have developed through evolution or training. This study tested whether exposure to science activities requiring spatial processing improves students’ spatial performance. Twenty fourth-graders participated in a ten-week after-school science program. The students engaged in inquiry-based science activities that required spatial abilities. All students completed a spatial abilities test at the beginning and end of the sessions. We anticipated that students who participated in the after-school program would show improved spatial scores at the post-test. Furthermore, we hope to demonstrate that such programs can enhance students’ cognitive abilities and interests in the science curriculum. Early interests in science could lead to lifelong goals that include attending college for a science major.

#### When the Brass Said String: The Effects of Musical Experience on the Brain

Holly Drabik, Joshua Rowe, and Lyndsay Ferrara (Victoria Kazmerski and Dawn Blasko), Penn State Behrend, School of Humanities and Social Sciences – Psychology

The Stroop effect is a widely used measure of attentional interference. In one version of the task participants are given the word RED or BLUE written in either red or blue ink and asked to respond to the ink color. They are usually faster when the ink matches the word (congruent condition) in comparison to when the ink and word are different (incongruent condition). One question that remains is whether the attentional system is modality specific. The current experiment extends a prior study investigating attentional differences between musicians and non-musicians using musical stimuli (string and brass instruments). We used ERPs, event-related brain potentials that have been shown to be related to sensory, motor, and cognitive events within the brain. Our data showed the Stroop effect was evident across both tasks; congruent conditions were faster than incongruent conditions. In addition, musicians were faster and more accurate than non-musicians on the auditory task. Results from a SOURCE localization analysis of the brain recordings indicated different areas of activation for musicians and non-musicians. The results shed light on the workings of the attentional system and have begun to unravel the brain areas and neurological processes involved within the auditory stream.

## POSTER PRESENTATIONS ABSTRACTS

### BIOLOGY

#### Comparative Histology and Histochemistry of the Harderian Gland in Scincomorph and Iguanamorph Lizards

Jeremy J. Baker (Susan Rehorek), Slippery Rock University, College of Health, Environment, and Science – ­ Biology

The Harderian gland is a poorly understood orbital structure found in most tetrapod vertebrates.  This exocrine gland exhibits some anatomical, histochemical, and ultrastructural variation within Lepidosaurian reptiles.  Histochemically, a variety of secretions (mucous, serous, lipid) are observed in Class Reptilia.  Though there are comparative studies on Lepidosauromorph reptilian Harderian glands, the least studied are Scincomorphs and Iguanamorphs.  The purpose of this study is to examine the histology and histochemistry of a Scincomorph *(Tiliqua rugosa)* and compare it to two Iguanamorph *(Anolis carolinensis* and *Pogona vitticeps)* lizards.  The Harderian gland of *T. rugosa* is a compound tubuloacinar structure composed of simple columnar cells.  Serous, mucous, and mucoserous secretions were observed in the gland, but varied in location.  The gland has numerous ducts.  Additionally, blood vessels were observed as well as sporadic lymphatic aggregations.  The presence of mucous and serous secretions coincides with previous observations.  However, contrary to previous Scincomorph observations, mucoserous secretions were observed in the oral portion and body of the Harderian gland.  The Scincomorph Harderian gland has similar cell composition as the two Iguanamorphs, but differs in location/type of secretion and amount of blood vessels/lymph tissue present.

#### Amino Acid Profiling of Tomato Plants Generated by Activation Tagging and Insertional Mutagenesis

Leann Bartomioli, Andrew Collins-Hed, Jennifer Nimako, and Adam Rhodes (Yi-Hong Wang and Michael Campbell), Penn State Behrend, School of Science – Biology

The tomato (*Lycopersicon esculentum* L.) is a member of the Solanaceae family, which includes other important crop plants such as eggplant, potato, tobacco, petunia, and pepper. To understand functions of genes in the genome, transfer DNA (T-DNA) based activation tagging is being used to generate a library of activation tagging mutants. T-DNA acts as a mutagen when inserted into a coding region of a gene and may result in a knockout mutation. However, T-DNA containing an activating element can result in enhancement of gene activity if insertion occurs near a specific coding region. Thus, activation tagging can be a highly productive means of assigning function to genes in a plant, such as tomato, because more than half of the genes belong to gene families. In plants containing many gene families, increasing or activating a gene is an efficient method to identify gene function. In this project, we describe a procedure for developing a T-DNA activation tagged library for tomato. The overall goal is to create a series of activation-tagged mutants that exhibit aberrant amino acid profiles.

#### The Pineal Gland of Tinamu major

Richard K. Bierbower (Susan Rehorek), Slippery Rock University, College of Health, Environment, and Science – Biology   
  
The pineal gland, a dorsal evagination of the midbrain, is part of the circadian rhythm in several vertebrates.  It is connected to the epithalamus by a long pineal stalk.  Most research on the pineal gland has been carried out upon mammals, with scattered interest in Neognathae birds.  Little is known about Paleognathae birds.  In this study, the histology of the pineal gland in one species of Paleognathae (*Tinamu major*) was examined in prehatchlings using paraffin histology.  The pineal is a highly vascular structure possessing a simple cuboidal to columnar epithelium. It is a hollow structure with highly convoluted walls forming a series of follicle-like saccules.  The follicular walls are lined with pinalocytes with blood vessels and neuroglial cells interspersed between the central lumen and epithelium.  The pineal stalk, composed of primarily nervous tissue, possesses a central lumen that connects to the midbrain and to the central part of the pineal.  Pinealocytes, neuroglial cells, and corpora arenacea were seen in addition to connective tissue and epithelial cells.  The *Tinamu major* pineal gland is morphologically very similar to that of Neognathae birds.  It appears to possess the same cell types and a similar follicular organization.

#### Detecting Anthracycline Induced Intrachromosomal Recombination in Saccharomyces cerevisiae Using a Del Assay

Caitlin Feather, Erin Scully, and Jafa Armagost (William Mackay), Edinboro University, School of Science, Management, and Technology – Biology

For more than 30 years, anthracyclines (initially daunomycin and adriamycin and, more recently, idarubicin and epirubicin) have represented one of the most commonly used classes of anticancer drugs. It is known that anthracyclines interact with DNA in a very complex manner. Studies in our lab have shown that anthracyclines can induce base-substitution and frameshift mutations in the bacterium *Salmonella typhimurium.* The objective of this study is to accurately access the recombinogenic potential of anthracyclines in a unicellular eukaryotic organism. In the yeast deletion (DEL) assay, recombination is induced by the formation of DNA strand breaks, which are a substrate for initiation of genetic repair in this organism. Using the DEL assay our lab has examined the role of DNA recombination pathways in the recognition and removal of anthracycline-induced DNA adducts. Specifically, daunomycin (79-fold induction), adriamycin (490-fold induction), idarubicin (52-fold induction), epirubicin (280-fold induction) tested positive in this assay. These results indicate that anthracyclines can act as genotoxins in eukaryotes.

#### The Histomorphology of the Harderian Gland of Male Specimens of Three Species of Plethodontid Salamanders

Alix E. Grand-Pierre (Susan Rehorek), Slippery Rock University, College of Health, Environment, and Science – Biology

The Harderian gland is an exocrine orbital gland located in the anteromedial portion of the orbit of most terrestrial tetrapod vertebrates. It is the sole orbital gland in amphibians (especially frogs and caecilians) and is thought to play a role in orbital lubrication, but its function is less known in salamanders. In this study, the histology and histochemistry of the males of three species of plethodontid salamanders was examined. The histology and histochemistry of the Harderian gland in all three species of plethodontid salamanders is very similar. This gland is a relatively large compound tubuloacinar exocrine gland. It fills the ventral aspect of the orbit and appears to have a well-developed connective tissue capsule. The secretory cells produce a mucoserous secretion, and there is no histochemically distinct duct system. These secretions are released upon the corneal surface of the eye. Thus, the structure of the male plethodontid Harderian gland appears to be very similar to that of other amphibians. This is in contrast to published observations of several European salamanders whose Harderian glands have been described as nothing more than a series of glandular elements in the lower eyelid.

#### Differential RNA Expression Studies Using Microarray Analysis in Three Mouse Cell Lines

**Representing Different Stages of Cancer Progression, and the Comparison after Treatment with the Natural Tumor-Suppressing Agent Matrine**

Erin Henninger and Rebecca Sauerwein (Durwood Ray and David Jones), Grove City College, Department of Biology – Molecular Biology

Matrine is a Chinese medicine derived from a Japanese herb. It has been used to treat various ailments including hepatitis B, tumor suppression in liver cancer, and reperfusion injury. The purpose of our experiment is to study how matrine affects RNA expression in three different cell lines. The three cell lines are derived from the NIH Swiss mouse, specific characteristics being the following: NIH/3T3 cells are immortalized, non-tumorigenic, non-contact inhibited, and precancerous. The T2A cells are highly aggressive, non-metastatic cancer cells derived from transfection of the NIH/3T3 cells with h-ras oncogene. The T4PA cells are highly aggressive, tumorigenic, and metastatic cancer cells derived from metastatic tumors generated in the nude mice. Microarray analysis was used to detect RNA expression of 17,500 genes in each of the three cell lines. Upon comparing results of the cell lines, significant differences in expression levels were found in parallel gene transcripts. In continuation, the three cell lines will be treated with the compound matrine, and the RNA expression subsequently analyzed and compared with the results from the previous untreated microarray studies. If significant differences are evident, as time permits, quantification experiments may be performed utilizing RT-PCR for the more interesting RNA transcripts.

#### Sequencing and Characterization of Zebrafish Folate Metabolism Genes (BHMT and GCS H-Protein) Implicated in Neural Tube Defects

John D. Lapek Jr. (James Warren Jr.), Penn State Behrend, School of Science – Biology

Folate is a B-vitamin that has been linked to many different developmental abnormalities, such as neural tube defects (e.g. spina bifida). These defects can cause spontaneous abortion or severe lifelong handicaps if the child is born. In the case of neural tube defects (NTDs), it has been shown that periconceptual administration of folic acid can prevent up to 70% of NTDs. Using zebrafish (*Danio rerio)* as a model organism, two genes related to folate metabolism were obtained and sequenced in order to understand better the link between folate metabolism and embryonic development. Zebrafish are a good model organism because the genes related to folate metabolism are highly homologous to those in humans, and are a very tractable system in which to study the molecular genetics of folate metabolism. Betaine homocysteine methyltransferase (BHMT) and Glycine Cleavage System H-protein (GCS H-protein) genes were obtained, sequenced, and characterized using DNA analysis software. *In situ* hybridizations are currently being done with the GCS H-protein gene to understand better its link to folate metabolism and embryonic development. This will lay the groundwork for future research in the area of folate metabolism and its effect on different developmental defects.

#### Chironomid Response to Sediment in Presque Isle Bay as an Assessment of Bay Health

Timothy Lyon (Pamela Silver), Penn State Behrend, School of Science – Biology

The objective of this research was to investigate the responses of chironomid larvae to sediment samples of known contamination level obtained from Presque Isle Bay (PIB). The sediment samples were contaminated with variable levels of more than 20 known contaminants including heavy metals, organics, and polycyclic aromatic hydrocarbons (PAH). Sediments were collected from nine locations in PIB using a Ponar grab. Sediment samples were dried to a constant weight and percent organic content of the sediment samples was determined by combustion at 600oC for 1 h. The remaining sediment samples were frozen to kill any organisms without altering sediment chemistry. Samples from each site were divided among three replicate rearing chambers (n = 3 for each of 10 sites). One hundred 1-d-old *Chironomid riparius* larvae were added to each chamber and reared to adults (28 d). Life history responses (development time, percent emergence, and adult size) were used as indicators of the biological effects of sediment contamination. Male and female development times differed significantly among sites (ANOVA, p = 0.0121 and 0.0017, respectively). Male and female thorax lengths did not differ among sites (ANOVA, p = 0.16 and 0.07, respectively), nor did percent emergence (p = 0.21). Multiple regressions were used to determine the specific influences of percent organic content and sediment contaminants on male and female development times. Data for contaminant concentrations (metals, total PAHs, individual PAHs) at each site were obtained from Dr. Harry Diz (Gannon University). Collinear variables were removed from consideration. A 2-variable model consisting of lead and total PAH best explained male development time (R2 = 0.69), and a 4-variable model consisting of lead, copper, zinc, and total PAH best explained female development time (R2 = 0.91). Chironomid development time can be used as an indicator of contamination level.

#### Avian Population and Habitat Assessment of Presque Isle State Park

Jared McFarland (Lisa Mangel), Penn State Behrend, School of Science – Biology

Presque Isle State Park is a 3,200-acre peninsula located four miles west of downtown Erie operated and maintained by the Pennsylvania Department of Conservation and Natural Resources (DCNR). As a location on the Atlantic Flyway, Presque Isle provides excellent habitat for migrating bird species with over 300 different species of birds identified throughout history. Because of this abundance, Presque Isle has been designated an Important Birding Area (IBA) in Pennsylvania. The objective of this research was to construct a database documenting the use of Presque Isle by endangered species of wetland birds. This study allowed the combination of little known past history, current information, and the information collected during this survey. Preparations began in fall 2003 with data collection being completed between March 1 and July 4, 2004. Within Presque Isle State Park, 37 survey points were established with the requirement of being at least 250 m apart and within 100 m from a wetland boundary. At each site both auditory and visual identification methods were used in conjunction with playback recordings of targeted wetland bird species to identify the different species of birds in the area. Identifiable birds heard or seen during the survey were recorded into a database following all GIS standards. The 36 survey points were placed on a rotating schedule allowing each point to have three morning surveys and three night surveys for a total of 216 surveys. A habitat assessment for each point was also conducted focusing on type vegetation. Analysis of data provided an estimate of usage and correlations of habitat use by targeted wetland birds. With knowledge gained from this research more awareness of bird habitat usage will be available for future research and community awareness at Presque Isle State Park.

#### Sequencing and Characterization of Zebrafish Folate Metabolism Genes (MTHFD 1 and 2) Implicated in Neural Tube Defects

Stacy Mosier (James Warren Jr.), Penn State Behrend, School of Science – Biology

Folic acid is a B vitamin (B9) that has a profound effect on the prevention of neural tube defects (NTDs). These birth defects include spina bifida and anencephaly, two very severe birth defects leading to severe handicaps or death. Women who take folic acid before and during pregnancy reduce the risks of these NTDs. This link between folic acid and NTDs has been known for over 40 years, but we still don’t know precisely which biochemical reactions requiring folate are to blame. Folic acid has also recently been shown to alleviate a number of other human developmental abnormalities. Zebrafish (*Danio rerio*) are an ideal model to use in the research of the role of folic acid and normal vertebrate development. The purpose of this research is to perform dideoxy sequencing and primer walking to obtain DNA sequence information for the genes that encode the enzymes that are used in folate metabolism. The genes of interest are methylenetetrahydrofolate dehydrogenase (MTHFD) one and two, which are key regulatory enzymes in folate metabolism. Obtaining the normal DNA sequence of these genes will enable us to see if these genes are mutated in any of the more than 6,000 different mutant lines of zebrafish that currently exist. It will also lay groundwork for future bioinformatic studies that will analyze the link between folate metabolism and embryonic development.

#### Sequencing the Mitochondrial Genome of the Branta canadensis with Comparison to Anser albifrons and Parts of the Branta bernicla mtDNA

Megan R. Sopher, Jonathan P. Huber, and Craig A. Mackaness (Frederic Brenner and Durwood Ray), Grove City College, Department of Biology – Molecular Biology

The *Branta* *canadensis* (Canada goose) has several classical morphologically defined subspecies within the common North American waterfowl. However, monitoring a species by DNA analysis is more specific and convenient than morphological analysis. Current and former Grove City College students have sequenced the entire mitochondrial genome of the Canada goose and discovered variation in the coding regions and non-coding regions of the mitochondrial genomes of the *Branta canadensis* and the related *Anser albifrons* (white-fronted goose). Partial sequencing of *Branta bernicla* (brant) mtDNA is also underway to evaluate its genetic relationship to the other two species. DNA sequencing utilized primers we designed from the known sequences of *Anser albifrons* to carry out polymerase chain reaction (PCR) based sequencing in our Perkin Elmer 310 DNA sequencer. We used dye terminator DNA sequencing chemistry with PCR amplicons to sequence both strands and constructed a contiguous sequence with SeqMan II software from Lasergene. The completed mitochondrial DNA sequence of the *Branta canadensis* will be submitted to the NCBI. By providing the mitochondrial genome, we have provided wildlife biologists the ability to genetically define these birds in order to monitor their migration and breeding patterns.

#### The Effects of Average Egg Temperature on the Length of Incubation Periods in Tree Swallows

Kala R. Wolfe (Margaret Voss), Penn State Behrend, School of Science – Biology

The objective of this study is to test whether there is any correlation between egg temperature (Tegg) and the length of incubation period in a migratory passerine, the tree swallow (*Tachycineta bicolor*). It has been suggested that a trade-off should exist between a female’s energy expenditure to regulate Tegg and the length of the incubation period. Energetically, incubating females would do better by spending more time off the nest and allowing Tegg to decrease slightlyover the course of a day. This, however, should increase the length of the incubation period, which has been shown to increase egg mortality. Therefore, if a female reduces time on the nest, she may increase her own survival at the cost of reduced offspring survival. Forty-two tree swallow nests were studied to test the hypothesis that reduced Tegg results in a longer incubation period, and that increased Tegg reduces incubation periods. The results from this study support the hypothesis that increased egg temperature decreases the time required to complete embryonic development.

### CHEMISTRY

#### Characterization of Intermediates Related to Silicon Nitride Using Matrix-Isolation Spectroscopy

Jessica Collier (Jay Amicangelo), Penn State Behrend, School of Science – Chemistry

Matrix-isolation infrared spectroscopy is used to characterize short-lived reaction intermediates related to the chemical vapor deposition of silicon nitride thin films (Si3N4). Experiments were performed using a microwave discharge plasma source with mixtures of silane (SiH4) in nitrogen (N2) and with mixtures of silane and nitrogen in argon (Ar). Samples were introduced using three methods: introduction of the reagent mixtures directly into the plasma, introduction of the reagent mixture upstream from the plasma, and co-deposition of the reagent mixture with the output of the plasma. In all cases, the products of these reactions are trapped at 12 Kelvin and their infrared spectra obtained. The identification and characterization of the species generated is established by performing experiments with isotopic reagents (SiD4, 15N2), by matrix annealing experiments (warming to 30 K and refreezing to 12 K), by matrix photolysis experiments (mercury arc lamp), and by performing theoretical calculations (Gaussian 98).

#### The Prediction of the Ultraviolet-Visible Spectra of C-20 Retinal Stereoisomers Using Molecular Modeling

Jennifer Fishovitz (Timothy Laher and Michael Bucholtz), Gannon University, School of Sciences, Engineering, and Health Sciences – Chemistry

The prediction of the ultraviolet-visible spectra of C-20 retinal stereoisomers has been made using the density functional B3LYP method available in the Spartan molecular modeling software. After geometry optimization, the calculated HOMO-LUMO transition energy is correlated to the published absorbance maxima of a series of retinals. The correlation obtained can then be used to examine the spectra shifts obtained in the cis-trans isomerization.

#### Mass Spectral Fragmentation of Wood Volatiles

Mary Gelnett and Jessica Voich (Timothy Laher and Michael Bucholtz), Gannon University, School of Sciences, Engineering, and Health Sciences – Chemistry

The mass spectral fragmentation patterns of 11 wood volatiles, borneol, fencyl alcohol, phenethyl alcohol, alpha terpineol, bornyl acetate, menthyl acetate, menthol, terpinen-4-ol, diethyl fumarate, cinnamyl alcohol and cinnamyl acetate were examined. These alcohols and esters are found in wood along with other volatiles, cellulose, hemicellulose, and lignin. Combustion of wood involves a free radical mechanism and fragmentation. The EPA has been studying indoor air pollution due to combustion of wood in fireplaces and wood burning stoves, thus the interest in the fragmentation of these volatiles.

#### Analysis of Arson Accelerants Using Gas Chromatography

Diana Hoover and Rebecca Davis (Naod Kebede), Edinboro University of Pennsylvania, School of Science, Management, and Technology – Chemistry/Forensic Sciences

The Uniform Crime Reporting (UCR) Program defines arson as “any willful or malicious burning or attempt to burn, with or without intent to defraud, a dwelling house, public building, motor vehicle or aircraft, personal property of another, etc.” There were approximately 71,000 reported cases of arson in the United States in 2003 ([www.fbi.gov](http://www.fbi.gov/)). The main objective of this study was to create a database of information that can aid in the identification of commonly used accelerants in arson. Gas chromatograms of liquid accelerant samples, as well as the headspace samples were obtained for comparison purposes using a Hewlett Packard Series 5890 II gas chromatograph with flame ionization detection. Wood samples soaked in accelerant for approximately 48 hours were burnt, and headspace gas chromatograms of each were analyzed. All chromatograms were scanned and digitized using Digitize It shareware in order to produce the database.

#### The Effects of Pretreatment with S-Adenosyl-L-Methionine and Ascorbic Acid on p-Aminophenol Toxicity in Renal Slices from Fischer 344 (F344) Rats

Diana Hoover1 and Marcus Terneus2 (M.A. Valentovic2 and Thomas Guetzloff3), 1Edinboro University, School of Science, Management, and Technology, 2Marshall University, and 3West Virginia State University *–* Chemistry

The acetaminophen metabolite, PAP is a known nephrotoxicant. The purpose of this study was to investigate the effect of ascorbic acid and S-adenosyl-L-methionine (SAMe) on PAP *in vitro* nephrotoxicity. Renal cortical slices were isolated from F344 rats and washed at 25oC in Krebs buffer. Slices were then incubated with 0 – 0.5 mM PAP for up to 120 min at 37oC and constant oxygen. Renal slices exposed for 60 or 120 min PAP showed toxicity as measured by increased lactate dehydrogenase (LDH) leakage and decreased pyruvate-stimulated gluconeogenesis. Pretreatment for 30 or 60 min with SAMe did not alter the extent of LDH leakage mediated by PAP. Pre-incubation with 2 mM ascorbic acid did reduce PAP toxicity. The presence of ascorbic acid prevented a rise in LDH leakage by PAP. These data show that SAMe addition directly with renal cortical slices was unable to reduce PAP *in vitro* toxicity. Pretreatment with ascorbic acid for 15 min prior to the addition of PAP reduced PAP toxicity in renal slices.

#### Ab Initio Study of Hydrogen Chemisorption to Carbon Nanotube Models

Sara A. Houston and Jonathan Vadnal (Ron Brown), Mercyhurst College, Department of Chemistry – Biochemistry

To achieve the levels of hydrogen adsorption in carbon nanotubes necessary for use in fuel cells, chemisorption may be a significant factor. Chemisorption of hydrogen, the direct formation of C-H bonds, was studied using density functional theory (DFT) in order to understand better the possible adsorption mechanism. Small clusters containing from 9 to 45 carbon atoms were designed that model zigzag and armchair carbon nanotubes. The radii of the tubes were varied from 1.97Å to 3.54 Å representing (5,0)-(9,0) zigzag tubes and 2.05Å -4.10Å to model (3,3)-(6,6) armchair tubes. The relationship between geometry and chemisorption energetics was investigated using Gaussian03, at the B3LYP/6-31G\*\* level of theory. The chemisorption energy as a function of several geometrical parameters will be presented. These include the tube radius and the tube chirality (zigzag vs. armchair). In addition, the effects of different amounts and patterns of hydrogen coverage were investigated.

#### Synthesis and Investigation of the Photochromic Properties of a Platinum(II) Complex with a Tridentate Schiff-Base Condensate

Lymari H. Martinez (Alan Jircitano), Penn State Behrend, School of Science – Chemistry

Photochromic compounds are capable of reversible color changes which result from isomerizations or rearrangements in response to light. A photochromic platinum complex with an O, N, N ligand, [N-(2-aminobenzylidine)anthranilaldehydato-O,N,N]-chloroplatinum(II), has been previously studied in this group. This research deals with the synthesis of a new platinum(II) complex with an analogous O, N, O tridentate ligand. Schiff-base condensation of 2-aminobenzyl alcohol with salicylaldehyde, followed by oxidation with MnO2 and reaction with platinum(II) gives [N-(2-hydroxybenzylidine)-anthranilaldehydato-O,N,O’]chloroplatinum(II). The Pt-aldehyde bond is relatively weak and can be displaced by a coordinating solvent, such as acetonitrile, when in the dark. The displacement of the aldehyde can be seen by a color change of the solution. This rearrangement is reversible when exposed to light. The synthesis and characterization of this new complex and the study of its photochromic properties will be described.

#### Synthesis of Beta-Ketonitriles from 3-Bromoisoxazoles

Elizabeth J. Marton and Nicholas G. Straub (Martin Kociolek), Penn State Behrend, School of Science – Chemistry

Isoxazoles have been found to be useful synthetic intermediates. The chemistry of these compounds, as well as their applications to the synthesis of natural products has been well documented. In the course of our research investigating 3-bromoisoxazoles, the reductive cleavage of these heterocycles was examined. If the nitrogen-oxygen bond is cleaved and bromine eliminated, it was expected that a beta-ketonitrile would result. Beta-ketonitriles have been found to be important synthetic intermediates, but they are very reactive. Since the isoxazole ring is considerably more stable, it may be useful as a synthetic equivalent for the beta-ketonitriles. A series of substituted 3-bromoisoxazoles were synthesized by the reaction of alkynes with dibromoformaldoxime, and characterized with 1H NMR and by elemental analysis. These compounds were then treated with either molybdenum hexacarbonyl or iron(II) chloride to transform the 3-bromoisoxazoles to the beta-ketonitriles. The molybdenum-mediated ring openings resulted in moderate to good yields of the beta-ketonitriles, while the iron-mediated reactions provided slightly better yields. The success of this transformation demonstrates the potential of 3-bromoisoxazoles as synthetic equivalents for beta-ketonitriles.

#### The Analysis of Snapping Turtles Collected from Erie County, Pennsylvania, for Mercury by Cold-Vapor Atomic Absorption Spectroscopy

Jessica L. Sarver1 and Katie A. Ortmann1 (Thomas Spudich2), 1Penn State Behrend, School of Science and 2Mercyhurst College, Department of Chemistry – Chemistry

Mercury has been widely accepted as a toxic pollutant for several decades. It was established long ago that mercury emissions to the environment could have serious effects on the health of humans and wildlife. Early studies demonstrated that various aquatic species commonly acquired high enough levels of mercury to cause concern as these contaminated species may be consumed. Snapping turtles *(Chelydra serpentina serpentina)* were obtained from Presque Isle Bay, Lake Pleasant, and Siegel Marsh in Erie County, Pennsylvania, and liver and muscle tissue samples were collected for analysis of mercury via cold-vapor atomic absorption spectroscopy. Emphasis was placed on obtaining a suitable digestion method without losing any mercury because of its high volatility. Initially, a microwave digestion method was attempted; however, all the mercury was driven out of the samples. As a result, this method could not be used. Therefore, the method selected was 303F from standard methods, which used acid digestion and heating samples for the tissue. The results of this analysis were used in correlation with diet, age, and location among the turtles to be used in a consumption advisory included in the fishing license booklets.

#### A Novel Photochromic Platinum(II) Compound Based on 2-Amino-4-Phenylbenzaldehyde

Julie A. Schreibeis (Alan Jircitano), Penn State Behrend, School of Science – Chemistry

In the presence of Pt2+, *o*-aminobenzaldehyde undergoes a Schiff-base self-condensation dimerization around the Pt2+ to form [N-(2-aminobenzylidine)anthranilaldehydato-O,N,N]-chloroplatinum(II) (Pt(AAA)Cl). The oxygen-platinum bond formed is relatively weak. When Pt(AAA)Cl is dissolved in acetonitrile, in the dark, the O-Pt bond breaks and acetonitrile coordinates to the Pt2+. The solution changes color from purple to red-orange. This color change is reversed upon photolysis. The compound is said to be photochromic. Using different derivatives of *o*-aminobenzaldehyde, various platinum complexes have previously been synthesized, including Pt(4-chloro-AAA)Cl, Pt(5-fluoro-AAA)Cl, and Pt(4-methyl-AAA)Cl, with the substituents located at the 4- and 5- positions. Each of these complexes is photochromic and undergoes the color change described, at a rate dependent on the substituent and its position. This research involves the synthesis of a new derivative, Pt(4-phenyl-AAA)Cl, with a phenyl group in the 4-position. The ligand synthesis in seven steps, starting with 4-aminobiphenyl, and the photochromic properties of the platinum(II) complex will be discussed.

#### Synthesis of Benzofused 6- and 7-Membered Rings From 3-Bromoisoxazoles

Jason W. Shaffer (Martin Kociolek), Penn State Behrend, School of Science – Chemistry

Isoxazoles are known to be important precursors to a variety of naturally occurring compounds, and their use as synthetic intermediates is well established. Ring opening methods for 3-bromoisoxazoles have already been developed, as well as methods for the tandem ring opening/cyclocondensation reaction of substituted bromoisoxazoles to give 2-cyanocycloalkenone rings. During the course of this research, the application of these tandem reactions to larger bicyclic molecules, such as benzofused 6- or 7- membered 2-cyanocycloalkenones has been under investigation. It has been our interest to observe whether or not the same chemistry is applicable to the synthesis of these more complex molecules. Discussed will be the attempted synthesis of several bromoisoxazole precursors, which will serve as the foundations to which the previous isoxazole chemistry can be applied. Successful application of the tandem ring opening/cycloaddition methodology can lead to the synthesis of benzofused 6- and 7-membered compounds, whose ring structures are found in a number of biologically active compounds.

#### Molecular Mechanics Study of Chemisorbed Hydrogen on Full Models of Carbon Nanotubes as a Function of Radii, Geometry, and Hydrogen Coverage

Nicole Vaccariello (Ron Brown), Mercyhurst College, Department of Chemistry – Biochemistry

Recent studies have shown that carbon nanotubes adsorb significant amounts of hydrogen. Some models have suggested that hydrogen chemisorption, the direct formation of C-H bonds, is necessary to explain the adsorption levels. The subject of this work is a Molecular Mechanics investigation into how the formation of C-H bonds to carbon nanotubes affects their geometry and overall stability. Full models, with capped ends, of zigzag and armchair tubes were constructed. The radii of the tubes ranged from 2.37 to 4.10 Å. The MacroModel software package was used to perform MM2 and MM3 energy minimization calculations. The lengths of the models were increased until the energy per carbon atom converged. Hydrogen atoms were then added to the tubes in a variety of patterns and the convergence process was repeated. Results include the effects of radii, hydrogen coverage amounts, and coverage pattern on the relative stability of the full nanotube structures.

#### The Electroscopy-Mass (ESI-MS-MS) Spectral Analysis of Coumarin Dyes

Julie Young (Michael Bucholtz), Gannon University, School of Sciences, Engineering, and Health Sciences – Chemistry

Coumarin dyes are a diverse family of dyes containing the coumarin group and primary, secondary, or tertiary amine. Most of these dyes are fluorescent. The analysis of dyes, especially in fabrics, is of forensic interest and the analysis method employed here is ESI-MS-MS. This study examines the (M+H+) peak from ESI-MS and that parent peak’s collision-induced dissociation (CID). Nine coumarins were studied for their fragmentation in the second mass detector. The coumarin dyes consistently lost C ≡ O and CO2.  Patterns of dissociation are proposed.

### COMPUTER SCIENCE

#### Tallow: A Calculus Software Program for Beginners

John May, Jason Jennings, Jamie Jones, and Lindsay Patton (Charles Burchard and Gregor Olsavsky), Penn State Behrend, School of Science – Computer Science

Our program, named Tallow, is an easy-to-use, discipline-support tool for beginning calculus students, as well as beginning calculus instructors. *Tallow* will enable students to perform differentiation and integration calculations, and find limits and relative extrema through the use of a set of user-friendly menus and buttons.

There are many calculus aids available today. Maple, Mathcad, MATLAB, and GAP are examples of such calculus software aids. These programs are particular with syntax and can be difficult to use and understand. Tallow will alleviate the syntax problem by having a user-friendly display that makes it easy to read and enter information. It is intended for beginning-level calculus students at the college or high school level, and has the ability to perform almost any operation from Calculus I. The user will be able to define the variable and enter the function. The user will be able to click buttons to display results of key operations. Tallow was written in Java by the team of four with guidance from the instructor and mentors. Tallow is platform independent and the software is available for installation on any computer.

### ECONOMICS

#### Remittances versus Brain Drain

Alexandra Andrianova (Gayle Morris), Edinboro University of Pennsylvania, School of Science, Management, and Technology – Economics of Growth and Development

The purpose of the present research is to compare the costs and benefits accruing to developing countries from emigration. The paper focuses on the trade-off between the remittances to households in developing countries sent by immigrants working overseas, and the brain drain caused by the emigration of skilled workers from developing nations to industrial countries. For example, in 2002 Foreign Direct Investment into South Asia was close to $5 billion, while remittances in the same year topped $16 billion. In some Central American nations remittances constitute more than 10 percent of national Gross Domestic Product. The positive effects of remittances are offset by the pernicious influence of brain drain, which hits the key sectors of economies (e.g. health care and education) of developing countries. Jamaica, for example, lost more than 500 of its 22,000 teachers to the United Kingdom in 2003. India loses $2 billion a year in resources because of the emigration of computer professionals to the United States. Due to the economic importance of remittances in fostering entrepreneurship and private sector development, developing nations should encourage remittances by streamlining bank transfer procedures. Government programs should also improve working conditions in developing countries, which would encourage the return of educated workers.

### ENGINEERING

#### The Effects of DC Current on the Compressive Properties of Various Materials for Use in Bulk Deformation Processes

Jacob R. Clarke and Carl D. Ross (John Roth), Penn State Behrend, School of Engineering and Engineering Technology – Mechanical Engineering

In bulk deformation manufacturing processes such as forging, rolling, and extruding, the cost of production is largely influenced by the force that is necessary to process the workpiece. By running electricity through the workpiece, the force required to achieve a certain amount of deformation can be reduced. Reducing this force has a number of benefits such as reducing the energy used, ability to use smaller equipment, and less tool and die wear. The amount of deformation that can occur before cracking starts can also be increased. Compression tests are preformed to determine the mechanical properties of several materials under various conditions. Steel, titanium, copper, brass, and aluminum are chosen to be tested because of their popularity as structural metals. Tests are run at various current levels (appropriate for each material) to determine the effects on the mechanical properties. Electrically pretreated samples and annealed samples are tested as well. The stress-strain properties, micro-structure, and alloying characteristics of each material were all compared with respect to the changes in current.

#### Twisting of Airfoil Sections Using Shape Memory Alloy Wire

Andrew Detar (Oladipo Onipede Jr.), Penn State Behrend, School of Engineering and Engineering Technology – Mechanical Engineering

An innovative way to twist slender structural members is through the use of shape memory alloy (SMA) wires. Twisting is achieved by wrapping SMA wires around a wing in a helical pattern and then heating the wires. The heating causes the wire to change from its martensite state to its austenite state, making the wire contract. Since the wire is attached to the airfoil, the contraction applies a torque and consequently twists the wing. Research was conducted to apply this method to actively twist airfoil sections. Measurements of lift and drag were taken to determine the effect of twisting under different flow conditions. FEA modeling was then conducted of the twisted airfoil using ANSYS to determine the forces applied by the wires to the airfoil. The modeling showed that the airfoil material degraded and repeatability of results was not consistent. A composite airfoil was then constructed of fiberglass and carbon fiber. This airfoil is presently being tested and modeled to determine the repeatability of results.

#### Extending the Tool Life of Solid Tungsten Carbide Endmills Using Cryogenics

Stephen Feder (John Roth), Penn State Behrend, School of Engineering and Engineering Technology – Mechanical Engineering

With increasing competitiveness in the manufacturing environment, it is desirable to save funds wherever possible. Tool replacement is a major cost which can be reduced by extending the wear life of the tools. Cryogenics has proven in the past that it can have either a positive or negative effect on the life of a tungsten carbide tooling. The purpose of this research is to explain what causes these differences and also to predict what effect cryogenics will have on a tool by analyzing its microstructure. Endmilling tools from STERIS are being treated cryogenically and analyzed for microstructure alterations**.** Other tool inserts are also being cryogenically treated so that they can also be analyzed. This research is being conducted by both Behrend and Carnegie Mellon University, representing a cooperative effort in analyzing and testing. This project primarily focuses on analyzing cryogenically treating tools, testing tools for tool life, and concluding what cryogenic effects will increase or decrease tool life.

#### Smart Pen (An Optical-Based Projection Feedback Presentation Controller)

Donald E. Hackworth and Tara Curry (Thomas Hemminger), Penn State Behrend, School of Engineering and Engineering Technology – Electrical and Computer Engineering

Presentation slides are, for the most part, prepared before class and run through in sequence. One advantage of the older overhead projectors is their ability to be updated with annotations and notes during the classroom period. The objective of this work is to determine the feasibility of creating a system that will allow the user to point to a large projection screen with a non-contact transducer and update computer sides in real time via an optical feedback controller. We call this technology the Smart Pen. The goal of the Smart Pen is to take a standard USB webcam, computer, and projection system and tie them all together using a laser pointer. The laser pointer will operate as a mouse allowing the presenter to interface with the computer just by placing the laser point over the area of the projection he/she wishes to select. The laser pointer will incorporate the left click, right click functions of a standard mouse, and use pulse code modulation to differentiate between them. It will also include a scribble button that will allow the presenter to write overtop of Microsoft PowerPoint presentations just by pointing the laser at the projection screen as if they were writing on the screen itself.

#### Analysis of Electrically Aided Machining Processes

Jarred Heigel (John Roth), Penn State Behrend, School of Engineering and Engineering Technology – Mechanical Engineering

Electrical flow, applied before and during deformation, is shown to reduce the specific energy and flow stress of aged 6061 T6511 aluminum; it also creates apparent macroscopic strain-weakening in the material. When applied to annealed 6061 aluminum, the electricity not only further reduces the specific energy and flow stress but also delays the onset of necking, increasing the workability of the material. The precipitates and grains of the aluminum are investigated for alterations due to either annealing or electrical flow. Both treatments are shown to affect the size and number of the precipitates and decrease the grain size. However, the electricity has an effect on the mechanical properties beyond the changes in precipitates and grains; suggesting that electrical flow has the potential to reduce the forces generated in bulk deformation or material removal processes beyond the level that can be achieved by temperature alone.

#### Analysis of Electrically Aided Impact Tests

Jarred Heigel (John Roth), Penn State Behrend, School of Engineering and Engineering

Technology – Mechanical Engineering

Using traditional grinding operations, there is a limited selection of materials that the operation can be performed on. This limitation is due to the fracture mode of the material. Brittle materials crack, creating an undesirable surface, whereas ductile materials can be ground without cracking. If the fracture mode of a material can be controlled, a larger selection of materials can be ground. According to prior research, it has been found that by applying an electrical current to an aluminum workpiece during tensile testing, significant effects are noted. Most notable to this research, an electrical current was found to cause ductile fracture in the aluminum, as opposed to the brittle fracture experienced traditionally in aluminum. In order to investigate how electricity can affect the ductile-to-brittle transition of aluminum, Izod impact tests are performed. Various materials are tested under a variety of electrical current levels in order to demonstrate the effect that electrical flow has on the failure mode of the various materials.

#### Fluid Flow Simulation of Sail Aerodynamics

Amy McCullough (William Lasher), Penn State Behrend, School of Engineering and Engineering Technology – Mechanical Engineering

A spinnaker is a sail used in racing yachts when the boat is in a downwind sailing situation. These sails create both lift and drag forces on the boat. When a shape identical to one of these spinnaker models is imported into Fluent, a Computational Fluid Dynamics (CFD) program, this program will run a simulation to determine the force coefficients acting on the sail. CFD programs like Fluent allow aerodynamics problems to be solved much more easily. In order to understand better spinnaker aerodynamics, two model sails were previously simulated at varying angles of attack, and force coefficients for each model were determined. These calculations were done using a model that contained only the spinnaker. The values obtained were compared to the experimental values obtained using prototype models tested in a wind tunnel in order to verify the accuracy of the simulation program. Typically, in sailing situations, an additional main sail is located near the spinnaker. The addition of a main sail creates a more complicated wind flow pattern. This project studied the effect the main sail has on the force coefficients seen by the spinnaker at varying points of sail.

#### Impact of Velocity Profile and Surface Proximity on Predicted Results of CFD Simulations of Spinnakers

Terence D. Musho (William Lasher), Penn State Behrend, School of Engineering and Engineering Technology – Mechanical Engineering

Data were previously collected from two different sets of experiments involving spinnakers in both a uniform flow and an atmospheric boundary layer flow. Additionally, Computational Fluid Dynamics (CFD) simulations were performed for both cases. It was noted that there is an inconsistency in the simulation data of a spinnaker in uniform flow. The resulting polar plots of the spinnaker force coefficients show a consistent parallel trend at high and low angles of attack, though at mid-angles of attack there is a “cross-over” of polar lines. The “cross-over” in the simulated uniform flow polar plots is not in agreement with the experimental data or the simulated atmospheric boundary layer flow data. This research tries to understand the origins of this inconsistency by running a variety of simulations with varying flow conditions and surface proximity of the walls. The resulting data from simulations of two spinnakers in a non-uniform flow did not resolve the cross-over phenomena.

#### Calculation of the Aerodynamic Performance of Twisted Wings

Heather Myers (James Sonnenmeier), Penn State Behrend, School of Engineering and Engineering Technology – Mechanical Engineering

The geometric twisting of the aircraft’s wings is used to effect control of the vehicle. One way to produce continuous twist can be achieved with shape memory alloy wires wrapped around a wing. The ability to actively deform aerodynamic surfaces without the use of separate control surfaces has shown promise in improved aerodynamic performance of the wing. Research is being conducted to predict the aerodynamic performance of a twisted wing. The spanwise distribution of lift and overall lift coefficient of a twisted wing for various velocities and angle of attacks is calculated. These values are then compared against experimental data. The error between the two values is reduced by adjusting the aerodynamic equations to represent better the experimental data. The goal of the research is to provide a repeatable mathematical model for predicting the aerodynamic properties of twisted wings.

#### Effects of DC Current on the Tensile Properties of Structural Metals

Carl D. Ross and Jacob R. Clarke (John Roth), Penn State Behrend, School of Engineering and Engineering Technology – Mechanical Engineering

When electricity runs through a material it increases the internal energy of that material without significantly raising its temperature. When a material’s internal energy is changed, its properties will often change accordingly. This research investigates the effects of high levels of current running through different materials during tension tests. In order to understand better what may control the nature of these changes, a wide variety of structural materials with differing properties are tested. Steel, titanium, copper, brass, and various aluminum alloys are all tested with the levels of current appropriately adjusted for their respective resistivities. The changes observed in each material are investigated individually, and then compared with the others on the basis of crystal structure, resistivity, and alloying characteristics.

### GEOSCIENCE

#### Stratigraphy and Paleoenvironmental Interpretation of Meadville Shale Formation (Cuyahoga Group) in Northwestern Pennsylvania

Angie Bell (Eric Straffin), Edinboro University of Pennsylvania, School of Science, Management, and Technology – Geology

The Meadville Shale Formation of the Cuyahoga Group (Mississippian) was recently exposed in a quarry one-half mile west of Cochranton, Pennsylvania. A laterally continuous measured section was examined with a focus on lithologic description and interpreting the depositional environments. The outcrop was divided into three packages: a 1 m thick marine sandstone, 4 m of channelized turbidite beds, and 1.5 m of marine sandstone (ascending order). The basal sandstone contains large load cast (0.5-1.5 m long) and hummocky beds. The second package consists of several 16–20 cm thick graded beds containing load casts and scour and fill. Fossilized bryozoans, bivalves, and fish scales were found in this coarsening upward package. The upper sandstone package is the coarsest package. The graded beds, or turbidites, characterize sediment laden currents that pulsed down the shelf during storm events. The fossils and structures are indicative of deposition on a shallow marine shelf above storm-wave base, but below fair-weather wave base. These features, associated with the coarsening upward of the measured section, are consistent with features found in a prograding delta. The Meadville Shale Formation in northwest Pennsylvania is interpreted to represent a shallow marine shelf environment during a time of epicontinental sea regression.

#### Analysis of a Soil Chronosequence of Three Terraces along the Conneautee Creek, Crawford County, Pennsylvania.

Nathan R. Harris (Eric Straffin), Edinboro University of Pennsylvania, School of Science, Management, and Technology – Geosciences

The study of river terraces serves as a primary means to study soil evolution because each successive terrace in a sequence gets progressively younger with decreasing elevation. The purpose of this project was to analyze the soil development of three floodplain terraces of different relative ages to describe differences in soil development as a function of age (a soil chronosequence). The secondary purpose of the study was to interpret the depositional environment that may have led to the formation of the soils observed at each terrace.Each terrace was described by the degree of horizonation, the change in pH with depth, the relative grain size distribution, field properties and the elevation with respect to the Conneautee Creek. It was determined that the river terrace at the highest elevation exhibited the greatest degree of soil development and the terrace with the least development was at the lowest elevation. These findings were supported by a steady decrease in horizonation, and in soil structure as the terraces got progressively younger.

#### Behrend Atmospheric and Climate Observation Network

Timothy Reed, Thaddeus Ruefthaler, Matthew Stanton, and Joshua Walker (Ronald McCarty, Kevin Norton, and Gary Walker), Penn State Behrend, School of Science – Geoscience

The BACON Project was developed by our student team to provide a geoscience research resource for Erie-centric GOES and NOAA satellite images as well as seismic data. We are installing a ground receiving station to retrieve data from NOAA satellites that are in polar orbit. These satellites will broadcast images of the atmosphere and ground surface of the Erie area. With the current satellites in orbit, we will receive approximately 10-12 images per day. Images from the geosynchronous GOES satellites will be retrieved from a NASA data source and stored in our system. These images will show atmosphere and ground surface of the eastern portion of the United States. The data from both sources will be stored in a database and accessed through a Web site. Data from the Behrend campus seismometer is being retrieved from the Incorporated Research Institutions for Seismology to convert the seismic data into a readable graph and accessed by the site.

### MANAGEMENT

#### Project Management: The Difference in Business and Engineering Students

Timothy J. Schultheis II1 and Michael A. Wiseman1 (Diane Parente2), Penn State Behrend, 1School of Engineering and Engineering Technology and 2Sam and Irene Black School of Business – Management

Many skills that are needed for a successful project manager come from two different areas of study. Business management brings the organizational behavior and communication skills to the table that are necessary to survive as a project manager. Engineering and engineering technology, on the other hand, have the intense technical background to thoroughly understand the problems projects face during their life cycle. The purpose of this study is to highlight the personalities, expectations, and results of the different students in the two areas of study. The *Big Five Personality Dimensions* will access the different qualities these students possess. It is clear that neither curriculum covers all aspects of being a successful project manager, but the results of the study will help identify the areas that need further development in the respective schools.

### MATHEMATICS

#### Visualization of Chaotic Fractals

Kyle Szklenski1 and Daniel Scannell2 (Blair Tuttle1), 1Penn State Behrend, School of Science and 2Penn State University Park, College of Engineering – Mathematics

This poster presents research on fractals generated from chaotic algorithms. Chaotic algorithms are deterministic in that the rules are known for generating a series of points. The chaotic nature of these algorithms is that the points generated are not predictable because the trajectories of the points are highly sensitive to the initial conditions. In the first project, JAVA was used to write a code that generates a fractal called the Serpinski Triangle. The code allows a user to graphically choose a variety of options including the positions of the vertices. In the second project, a C++ code was written to generate a one-dimensional logistic map common for modeling population species. The fractal image generated is visualized and the user can explore the fractal through a graphical interface.

### PHYSICS

#### Amorphous Silicon Models Using Monte-Carlo Simulations

David Gilson (Blair Tuttle), Penn State Behrend, School of Science – Physics

This poster presents research to generate atomic models of amorphous silicon. Amorphous silicon is an interesting material used in semiconductor devices such as solar cells. In amorphous silicon, atoms are bonded to four neighbors with bondlengths and angles similar to those of crystalline silicon. However, amorphous silicon has no long-range order. Atomic models of amorphous silicon are useful for other scientists in order to examine solid state chemical reactions that may limit device performance. A C++ program has been written to generate atomic models for amorphous silicon using a two- and three-body inter-atomic potential and a random bond switching algorithm. The bond switching algorithm starts with a crystalline model and creates an energetically relaxed model of amorphous silicon. Models generated have 64 or 216 atoms. The properties of the final amorphous silicon models have been analyzed and compared to previous work. The models of amorphous silicon generated so far match the best models reported in the literature. Future work will involve examining model properties as a function of system size and adding more atomic species into the C++ code.

#### Statistical Study of the Dynamics of Ant Search Paths

Daniel J. Slomski and Stephanie Covert (G. William Baxter), Penn State Behrend, School of Science – Physics

In an effort to understand how ants “think” we let them search for food on a 2-D surface and study their search patterns to determine if they are following a mathematical model. We think the model most appropriate for representing a searching ant is that of a non-reversing random walk. A “random walk” is a mathematical paradigm in which steps are made consecutively in random directions, with a probability of changing directions after each step. These walks generate a displacement from the point of origin proportional to the number of steps taken. What we see in the average over many sets of data is a time proportionality that closely matches that of a non-reversing random walk, which is a random walk in which the organism never retraces its previous step. These findings could increase our understanding of simple brain function, and find application in artificial intelligence and understanding of swarm behavior.

### PHYCHOLOGY

#### Stress, Working Memory, and Change Detection in College Students

Christine M. Anderson, Rebecca L. Gordon, and Sandra Grgic (Dawn Blasko), Penn State Behrend, School of Humanities and Social Sciences – Psychology

This project examined whether differences in working memory influenced the ability to detect changes in visual scenes. In Experiment 1 we measured working memory using the operation span task (Turner & Engle, 1989). Participants were asked to detect a change between two rapidly alternating scenes (Rensink et al., 1997). Consistent with past work (Rensink et al., 1997), participants detected changes more quickly if they were the central focus of the scene. Those with lower working memory spans detected changes more slowly if the changes were outside the central feature of the scene and involved the addition and deletion of an element. This difference is accounted for by Engle’s controlled attention view of working memory. Experiment 2 examined how stress affects change detection performance. It is expected that since participants will have no perceived control over an environmental distracter, the participants in the experimental condition will have slower reaction times in the detection task. Also expected is an interaction between stress conditions and working memory. According to Engle’s theory of working memory, high-span individuals are better able to inhibit interference. If so, then high-span individuals should be less affected by the auditory distracter than low-span individuals.

#### Local and Long-Distance Relationships and their Effect on Stress Levels and Self-Esteem in College-Aged Students

Elma Bico, Erin Gustafson, and Greg Parker (Victoria Kazmerski), Penn State Behrend, School of Humanities and Social Sciences - Psychology

An individual’s romantic relationships play a large role in determining his or her quality of life. This is especially true for college-aged students because life’s changes have added increased stress and emotional strain. The goal of this study was to determine whether relationship status affects stress levels and self-esteem, and whether distance between partners had an effect on relationship satisfaction. Relationship status was divided into four groups: monogamous long-distance, monogamous local, dating, and not currently in a relationship. It was hypothesized that involvement in a relationship would increase both stress levels and self-esteem, and that distance between partners would negatively affect relationship satisfaction. Inventories related to stress and self-esteem were administered to each group, and participants completed a demographic survey in which they self-reported relationship status and satisfaction. A 4x2 ANOVA was computed to detect differences between self-esteem and stress based on these statuses; t-tests were used to determine where significant differences existed. A linear regression was performed in order to predict relationship satisfaction as a function of distance. An understanding of relationship status and their effects on emotional well-being could help better educate college students on their readiness for a serious relationship and increase awareness about stress and time management.

#### Social Norms in Romantic Relationships

Bethany Crooks and Kristie McCann (Victoria Kazmerski), Penn State Behrend, School of Humanities and Social Sciences – Psychology

Much of the previous research indicates that relational aggression is more common in women than men, but not much is known regarding gender differences for romantic relational aggression. This study focused on that specific aspect along with the normative beliefs of romantic relational aggression in association with length of the relationship. Participants’ normative beliefs of romantic relational aggression were measured using short scenarios and their level of relational aggression and victimization were measured using a self-report scale. We expected that relational aggression would be less socially accepted in short-term relationships than in long-term relationships. Also, because women desire closer relationships and value social status more than men, we hypothesized that female perpetrators and male victims of romantic relational aggression would be more likely to be viewed as normative. Finally, participants who scored higher on the relational aggression scale would be more likely to accept relational aggression than those with lower scores of relational aggression. Gaining a deeper knowledge of the normative beliefs for relational aggression can help with the understanding of abusive romantic relationships.

#### An Evaluation of the Math Options Program for Attendees of the Years 1997 through 1999

Erin M. Ferguson and Jessica A. Knapp (Dawn Blasko), Penn State Behrend, School of Humanities and Social Sciences – Psychology

The Math Options Program is offered to middle school girls every year to encourage girls to consider getting involved in math and science classes and to think about these areas as a future career path. This study assessed the program’s strengths and where improvement is needed. A survey was administered to 688 students who attended the program in the years 1997 through 1999. Findings suggest that overall the Math Options program was successful and that it had a positive effect on the students’ interests in math and science.

#### Presence of Self-Monitoring: Dispositional vs. Situational Attributions and Explaining Behavior

Lyndsay Ferrara, Holly Greiner, and Annie Jordan (Victoria Kazmerski), Penn State Behrend, School of Humanities and Social Sciences – Psychology

Research suggested social behaviors can be predicted by the way an individual attributes their own behaviors, either dispositionally or situationally. The following research examined how both dispositional and situational attributions of behavior are related to the tendency to self-monitor. It was expected that individuals who use dispositions (traits) to attribute their behavior are less likely than those who use the situation to monitor their emotions and conduct given the circumstantial context. This hypothesis was assessed using a series of questionnaires measuring trait attribution, behavioral cues, and self-monitoring. Scores on each questionnaire were averaged and correlated using Pearson’s correlation coefficient. Given that a significant correlation between these two assessments exists, it could open a new window for studying personality and behavior. Both assessments could perhaps be combined to create an even more valid and reliable measurement of predicting behavior via personality scores. This finding has implications important to the person-situation debate, providing even more evidence that situations and dispositions are equally important and interact to show bidirectional causality of personality and behavior.

#### Sibling Relationships and Their Effect on a Child’s Network of Relationships: A Marital Status Study

Eileen Haase and John Crane (Victoria Kazmerski), Penn State Behrend, School of Humanities and Social Sciences – Psychology

Divorce in American families has become an epidemic. Adjustment problems among siblings have increased stress within the family. The quality of the relationships between siblings had a direct effect on relationships with peers. The current study postulated that the stronger the quality of a sibling relationship the more likely a child perceived a favorable network of relationships within the household. Participants in the study responded to a series of questionnaires to show a relationship among sibling imbalance in divorce families compared to intact. Participants’ siblings also participated in the study through mail surveys. According to Church (1993) the return rate for mail surveys was increased by providing incentive to participant for replying. Anticipated outcomes included responses from intact family’s siblings and were more accurate in their assessment of their sibling. The current research also proposed that children from divorced families reported a lower quality of their sibling relationship and therefore a higher quality of relationships outside the family.

#### The Effect of the Own-Sex Bias on Recall of Crime Situations

Brant Hamilton and Adam Esser (Victoria Kazmerski), Penn State Behrend, School of Humanities and Social Sciences – Psychology

Some evidence has shown that an own-sex bias exists in facial recognition; meaning males are better recognizers of male faces while females are better recognizers of female faces. Results have shown that generally, no sex difference exists in confidence level among males and females, but males tend to be overly confident when incorrect. Because of a possible own-sex bias, it was believed that crimes committed by someone of the same sex as the subject will lead to higher accuracy in post accounts. It was also believed that accuracy would increase with the addition of a same sex victim. We also believed that confidence in males, even in female on female crime, will be significantly higher than confidence in females when incorrect answers are given. To assess this, the researchers showed four simple assault crimes with the gender of the culprit and victim different in each one. A two-day lapse was given, and then context questions and a facial recognition question with a confidence rating were asked to assess the participants’ recall. A 2x2x2 ANOVA and a correlation was used. The results have importance into the differences in sex recall accuracy and our judicial system.

#### Reactions to Sexist Humor: A Factor of Gender, Relational Aggression, and Personality

Renee E. Jerge, Aimee Frey, and Randy Martell (Victoria Kazmerski), Penn State Behrend, School of Humanities and Social Sciences – Psychology

In this study we will examine the effects that gender, relational aggression, and personality have on reactions to sexist humor. This will be measured by participants rating a series of jokes on how humorous or offensive they are to them, using scales of 1 to 7. Participants will also complete a relational aggression questionnaire and the mini-marker personality questionnaire. It is hypothesized that males will find jokes about females more humorous and less offensive than females and vice versa. It is also predicted that the participants higher in relational aggression will find the jokes more humorous and less offensive than those with low relational aggression scores. Finally, it is believed that those who have an extroverted personality will find the jokes more humorous and less offensive than introverted people. A significant interaction between all factors is also predicted. The results will be tested using an ANOVA measurement as well as a Pearson’s R correlation. This study will aid people in the public relations field as well as comedians because if they know their audience they will be able to filter the sexist humor used so that no one will be offended.

#### Some Lawyers Are Sharks, But Are Some Sharks Lawyers?

Dotty Shaffer, James Morosky, and Eric Johnson (Dawn Blasko and Victoria Kazmerski), Penn State Behrend, School of Humanities and Social Sciences – Psychology

How is figurative language interpreted in the brain? The neurological underpinnings of metaphor processing were examined in this study. Two major classes of theories conflict on how metaphors are processed. According to structure mapping theory, metaphors are comprehended via two events: analysis of the commonalities of the topic (subject) and vehicle (predicate), followed by directional inferences from the vehicle to the topic. According to this theory at the earliest stages of processing some *lawyers are sharks* should be processed the same as some *sharks are lawyers*. Reaction time data has shown support for this model. But according to the categorization approach, metaphor processing is always asymmetrical as the vehicle names the category created by the interaction of topic and vehicle (vicious and predatory). In this research, the early and late effects of metaphor judgment were analyzed using a more sensitive on-line measure, event-related brain potentials (ERPs). In support of the categorization approach differences were found very early in sentence processing.

#### A Study of Variables Affecting Body-Image Distress

Nathan G. Zimmerman and Timothy Lyon (Charisse Nixon), Penn State Behrend, School of Humanities and Social Sciences – Psychology

The purpose of this study is to examine the relationship between body-image distress and a number of lifestyle variables. Body-image distress is linked to very serious conditions such as bulimia and anorexia. Recently, body-image distress has been viewed as its own psychological and physical condition by doctors and physicians. A well established test, the MBSRQ, will be used to address five subscales consisting of appearance evaluation, appearance orientation, overweight preoccupation, self-classified weight, and the BASS. Additional questions which will address lifestyle will be given. Multiple regression analysis will be performed to identify potential predictors of body-image distress. Implications of this study will show relationships between lifestyle variables and body-image distress.