

# Undergraduate Research at the Capitol - Pennsylvania



Tuesday, April 26, 2011

**East Wing  
Rotunda and Atrium**





April 26, 2011

Dear Friends:

Welcome to the eighth semi-annual Undergraduate Research at the Capitol event in Pennsylvania. This conference, which also is being held in other states throughout the nation, shines a light on Pennsylvania's brightest and best college students, giving them the opportunity to share their intellectual work with members and staff of the General Assembly.

Each student who is with us today has put in a tremendous number of hours to create and refine the knowledge they share. Please take the time to explore the projects of these exceptional students as well as recognize them for their hard work. These students represent the future leaders of our state and nation, and bring with them innovation, creativity and originality.

I would like to thank the students as well as their faculty advisors for sharing their time and their talents with us. Undergraduate research is more than just an exercise in learning, it is the impetus for future economic growth, scientific progress and Pennsylvania's key to meeting the needs of tomorrow.

Sincerely,

A handwritten signature in black ink that reads "Paul I. Clymer". The signature is written in a cursive style with a large initial 'P'.

**PAUL I. CLYMER**

Chair, Education Committee

A handwritten signature in black ink that reads "James R. Roebuck, Jr.". The signature is written in a cursive style with a large initial 'J'.

**JAMES R. ROEBUCK, Jr.**

Democratic Chair, Education Committee  
LORL Committee

## **Undergraduate Research at the Capitol – Pennsylvania**

*Undergraduate Research at the Capitol - Pennsylvania is a poster conference that showcases outstanding and award-winning projects by undergraduate students from Pennsylvania. The event provides an opportunity to bring together college students, faculty and Pennsylvania legislators and staff to share the experiences of students engaged in scholarship and creative endeavors at their colleges and universities.*

***The event has two goals:*** *To demonstrate that participating in scholarship and creative activities as an undergraduate is important to the educational development of college students; and to show that undergraduate student projects can produce important and valuable results that enrich the knowledge, cultural heritage and economic well-being of our communities, our state and our nation.*

*The URC-PA website is: **<http://www.lorl.us/URC-PA>***

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***Don't forget to visit both upper and lower levels in the East Wing***

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# THE EFFECT OF MK-801 ON ADAPTATION TO STRESS-INDUCED ANALGESIA IN THE RAT

Authors: *Corey Mola, Katrina Wagner, Christopher Schwartz*

Advisor: Joshua Blustein

Institution: Arcadia University  
Psychology Department

Currently, there are no data examining the effect of MK-801 on tolerance to stress-induced analgesia in rats; the present study examined if MK-801 would be capable of blocking adaptation to stress-induced analgesia using a three minute swim in 17.5°C water. In our laboratory, we have previously used this procedure and have successfully demonstrated both stress-induced analgesia and adaptation to the stress-induced analgesia in the rat (Blustein, Ciccolone & Bersh, 1997). The procedure used in the present study started with obtaining a baseline measure of pain sensitivity. Following this, rats were injected with 0.2mg/kg/cc of MK-801 or saline and swam for three minutes in 17.5°C water. The results indicated that Group MK-801 exhibited significantly more analgesia after the first swim than Group Saline. On the last day, both groups showed similar levels of analgesia. These data provide evidence that MK-801 failed to block adaptation to stress-induced analgesia. These data are inconsistent with the effect of MK-801 on tolerance to morphine-induced analgesia. MK-801 has been found to block the development of tolerance to morphine analgesia.



# HURRICANES KATRINA AND RITA: AN ASSESSMENT OF NEED FOR PSYCHOLOGICAL SERVICES FIVE YEARS LATER

Author: *Lauren Fisher*

Advisor: Adam Levy

Institution: Arcadia University  
Psychology Department

This study aims to examine the current psychological needs in Hurricanes Katrina and Rita-inflicted areas in Mississippi and Louisiana from data acquired through the administration of a survey. It assesses the perception and utilization of the psychological services that were available to victims within one year and after one year following the storms. Participants included victims of Hurricanes Katrina and or Rita, currently residing in the towns affected by the storms. Surveys were conducted in public locations. Fifty-one participants were recruited to complete the survey. Preliminary data analysis showed that 63.2% of participants rated their current sense of security in their home as below 79 out of 100 pts. ( $M = 68.53$ ). 46.8% of respondents indicated that they felt their life was threatened by the storms, ( $M=65.32$  out of 100 scale). 87.0% of participants indicated material loss, 57.4% lost family heirlooms, keepsakes, or photographs, 40.0% reported a loss of their social support and/or sense of community, while 46.8% lost their home. 51.1% of respondents reported feelings of helplessness due to Hurricanes Katrina and Rita. Further statistical analysis of the data is in progress.

# QUANTITATION OF KIDNEY BIOMARKERS IN DIABETIC RATS

Authors: *Cassandra Camp, Leigh Ann Lamagna*

Advisor: Paul J. Birckbichler

Institution: Slippery Rock University  
Chemistry Department

Diabetes can lead to diabetic nephropathy, the most common cause of end stage renal disease. The effects and progression of diabetes can be studied through the examination of the glomerulus in kidney cells, an organelle that aids in the removal of waste from the body. The glomerulus becomes thickened and scarred as a result of diabetes damage ultimately leading to the alteration of the structure and functionality of the kidney. In this study, trichrome-stained kidney sections were prepared from both non-diabetic and diabetic BBZDR/Wor rats up to fourteen months of age. Diabetes progression in these animals mimics type 2 diabetes in humans. We hypothesize that changes in biochemical/biomarker expression in the early stages of diabetes will precede morphologic changes. Using a double-blind protocol, overall intra and extraglomerular changes were examined using visual semi-quantitative methods. Quantitative measurements of glomerular diameters and collagen expression reinforced the semi-quantitative results. In addition, the quantitative data showed that diabetes exacerbated the differences between the two systems. Overall, the quantitative data obtained support our hypothesis and encourage us to pursue additional studies using this approach.

# FINDING THE FARM: POSTAL ADDRESS-BASED BUILDING CLUSTERING

Author: *Christopher Eby*

Advisor: Dr. Alice Armstrong

Institution: Shippensburg University  
Computer Science Department

Geocoding, the act of mapping place names and addresses to locations on digital maps, is an important feature of many geographical information systems. Yet, traditional geocoding methods can be very inaccurate, especially in rural areas. Accuracy may be increased using land plot maps maintained by local governments, but these are not always available. A method that has the potential to greatly increase accuracy by exploiting two widely available data sources, phone book addresses and building locations derived from aerial photographs, has been proposed, but it may still be inaccurate when the number of buildings does not correspond to the number of addresses. Therefore, this research examines the accuracy of taking addresses and building locations from rural areas of Fulton County, Pennsylvania, and grouping them into clusters where each cluster contains the buildings present at a single address. Three different methods of clustering are compared to see which produces the most accurate clusters. These clusters can then be geocoded to produce more accurate results in rural areas than existing methods.

# MATHEMATICAL TECHNIQUES FOR ASSIGNING FIRST-YEAR SEMINARS

Author: *Thanh To*

Advisor: Professor Richard Forrester

Institution: Dickinson College  
Mathematics and Computer Science Department

Every first-year student at Dickinson College is required to take a first-year seminar, which is an introduction to college work including basic research methods and college-level writing assignments. The learning goals of the seminars are all the same, but the content varies depending upon the topic chosen by the professor. The summer before the students arrive they each select six seminars among all the seminar choices. Each student is then assigned to a seminar from their list. Currently, this process is performed manually, which is tedious and time consuming. This research is concerned with utilizing mathematical techniques to assign first-year students to seminars. Specifically, we developed an algorithm that not only achieves an assignment of students to seminars, but also seeks to balance the gender of the students in the classes. In addition, we used simulation to study how the number of seminars each student chooses affects our ability to make an assignment.

# THE EFFECTS OF AN ALTERED FOREST COMPOSITION DUE TO WHITE-TAILED DEER HERBIVORY ON THE CONDITION OF A PENNSYLVANIA HEADWATER STREAM ECOSYSTEM WITHIN THE CHESAPEAKE BAY WATERSHED

Author: *Kerstin Martin*

Advisor: Gene Wingert

Institution: Dickinson College  
Environmental Studies Department

This project looked at the impact of forest composition on the condition of a Pennsylvania headwater stream ecosystem within the Chesapeake Bay watershed. Two headwater streams in Pennsylvania were evaluated to determine whether an altered forest composition due to selective browsing by white-tailed deer (*Odocoileus virginianus*) impacts the greater Chesapeake Bay Watershed. The streams are located in two adjacent and similar forests. The forest at Reineman Wildlife Sanctuary, where hunting has been prohibited since 1971, was found to lack a diverse understory due to deer browsing and is moving towards a forest dominated by low herbacious species; the forest at State Game Lands 170 remains diverse in species and age composition. Water chemistry data was collected for each stream and nitrate levels were found to be three times higher at Reineman than at State Game Lands 170 ( $p = 0.01$ ). Macroinvertebrate communities were also evaluated, but show no conclusive differences: similar canopy trees in both forests may still contribute similar organic material to the streams.

# EVOLVING ROBOTIC DESIRES: A NEW APPROACH TO BRIDGING THE REALITY GAP

Author: *Russell Toris*

Advisor: Grant Braught

Institution: Dickinson College  
Computer Science Department

Since the emergence of the field of Evolutionary Robotics, new breakthroughs have been made to further its development and prove its effectiveness. While from an engineering standpoint the modeling of biological evolutionary phenomena may not seem to be the most efficient means of implementation, it has proven to be able to solve interesting problems within the robotics world. The approach of evolving controllers for autonomous robots has had proven benefits when compared to a more traditional hand-coded approach.

Like most fields of research, Evolutionary Robotics contains its own set of problems. One such problem involves using simulators to speed up the evolutionary processes. When transferring the robotic controller from the simulation to the physical robot it tends to perform poorly on a given task. This issue is referred to as the reality gap. In this research, a new approach to bridging the reality gap is explored. The idea is to evolve a robotic controller that generates desires based on its current state and uses reinforcement learning to select actions that achieve these desires. By doing so, the goal is to have a robotic controller adapt to differences, uncertainties, and perturbations within the real world once transferred from simulation.

# **LANGUAGE ABILITY AS A MEDIATOR BETWEEN EMOTION REGULATION AND SOCIAL COMPETENCE IN SECOND GRADE STUDENTS**

Author: *W. John Monopoli*

Advisor: Dr. Sharon Kingston

Institution: Dickinson College  
Psychology Department

Research suggests a connection between verbal ability and social competence, and emotion regulation and social competence in pre-school children. However, research has not investigated how these relationships hold during the transition to elementary school. This study examines language ability as a mediating factor between emotion regulation and social competence in second grade students. This means that it is the mechanism by which the emotion - social skills relationship works because by demonstrating good language ability, children can regulate their emotions more effectively and thus be considered socially competent. We expect that when the association between language ability and social competence and emotion regulation is controlled, the relationship between emotion regulation and social competence will weaken. Children completed a measure of receptive vocabulary, and teachers rated each student's emotion regulation and social competence on standardized scales. This study seeks to increase understanding of the mechanisms related to social competence in children.

# ADDING SUPPORT FOR SPECIFICATION

Author: *Fabio Drucker*

Advisor: Professor Timothy Wahls

Institution: Dickinson College  
Mathematics and Computer Science Department

This project explores the use of the Krakatoa/Why program. In particular, it focuses on adding support for specification inheritance and generic use. For the project we use JML, a formal specification language for Java that allows us to make formal assertions about code behavior. We work with the Krakatoa/Why platform, an open source program that seeks to statically prove that code complies with the JML specifications provided. We seek to expand this platform to add support for previously unsupported features of Java and JML, mainly specification inheritance and the use of generics.

Support for specification inheritance has successfully been added. Additionally, some minor extensions to the syntax accepted were implemented, bringing the syntax accepted by Krakatoa closer to JML. Support for generics has been mostly implemented for generic classes, and work has begun and a promising approach has been identified to add support for classes that use generics.



# MODELING AND COST ANALYSIS OF ENERGY STORAGE SYSTEMS

Author: *Adam R. Sparacino*

Advisor: Gregory F. Reed, PhD

Institution: University of Pittsburgh  
Swanson School of Engineering

Research and development in the field of electric generation through the use of renewable resources is advancing at an ever expanding rate, and is definitely the future of electricity generation. One of the last hurdles hindering widespread use of renewable resources is energy storage. There are currently many methods of accomplishing and implementing energy storage, ranging from pumped hydro storage to sodium-sulfur batteries. Using currently existing energy storage technologies, analysis will be performed to determine their economic viability. Computer aided simulation will be used to determine the most cost effective means of implementing energy storage into an electrical distribution system. The study will comment on the benefits and limitations of the tested energy storage technologies. The largest identified limitation was determined to be the high cost of currently existing energy storage technologies. Among the many benefits of being able to store electricity, smarter and more environmentally friendly usage of limited resources such as fossil fuels, was the most apparent.

Research Sponsors: Pitt Power and Energy Initiative and the Pennsylvania Department of Community and Economic Development: Ben Franklin Technology Development Authority

# **EFFECTS OF CHOLINERGIC LESIONS AND ESTRADIOL ON ESTROGEN RECEPTOR MRNA EXPRESSION IN SPECIFIC REGIONS OF THE RAT BRAIN**

Author: *Aditee Shinde*

Advisor: Robert B. Gibbs, PhD

Institution: University of Pittsburgh  
School of Pharmacy

Studies have shown that estrogen therapy may have beneficial effects on cognition in animals and humans while protecting against neurodegenerative disorders such as dementia and Alzheimer's disease. Studies also suggest that the beneficial effects of estrogen on cognition decrease with age and time following menopause. Several of these diseases have been associated with deficits in cholinergic function in the brain, yet estradiol has shown to significantly enhance cholinergic functions and improve performance in many cognitive tasks. Unfortunately, the mechanism via which estradiol modulates cholinergic functions is unknown yet theories have been presented involving the binding to any of three key estrogen receptors: ERa, ERb, and GPR30. In this work I evaluated the effects of basal forebrain cholinergic lesions and estradiol treatments on the levels of estrogen receptor mRNA in different regions of the brain. It was found that in two major brain regions, cholinergic lesions had decreases estrogen receptor expression which may reduce estrogen effect. The estradiol treatment increased the estrogen receptor expression, thus increasing the estrogen effect. Further studies will be done to verify the significance and functional impact of these results.

# **GOT TO GET YOU INTO MY SONGS: A STUDY OF HINDUSTANI MUSIC, ORIENTALISM, AND THE BEATLES**

Author: *Trent Cunningham*

Advisor: Andrew N. Weintraub, PhD

Institution: University of Pittsburgh  
School of Arts and Sciences

The Beatles gave many people their first taste of Indian music, through songs like "Within You Without You" and "Norwegian Wood." These songs have been likened to a "reflecting surface" that transmits exotic sounds to the West but warps them into song forms Westerners could recognize. But is "transmitting" the proper word? Did the Beatles truly imitate or accurately convey the real, authentic content of Indian music? Or did they follow the Orientalist model: creating a representation of India, an imaginary Orient to serve their own expressive ends? I will suggest the latter, by placing their Indian-influenced songs into a cultural and biographical context. The Beatles construct their own Indian-influenced musical style, and use it to mask expressions of taboo values or deeply personal themes. In doing so they construct an imaginary vision of a mystical India, far removed from the reality, that furthered their own artistic goals.

# ENDOCRINE REGULATION OF VITELLOGENESIS IN *DROSOPHILA MELANOGASTER*

Authors: *Emily Strittmatter, Jessica McGill,  
Samantha Berkheimer, Adam Petrone*

Advisor: David S. Richard, PhD

Institution: Susquehanna University  
Biology Department

*Vitellogenesis*, the synthesis and uptake of yolk protein (YP) by developing oocytes, is hormonally regulated in the fruit fly *Drosophila melanogaster*. Juvenile hormones, produced by the *corpus allatum*, and *ecdysteroids*, produced by the ovary, may drive early YP synthesis by follicle cells and late YP synthesis by the fat body respectively. YPs are internalized into the developing oocyte via receptor-mediated endocytosis. Proteins such as Sex Peptide, a male accessory gland protein transferred during copulation, and the insulin-signaling pathway protein CHICO may also be involved in the control of these processes. Females lacking CHICO are sterile and appear to lack functional receptor-mediated endocytosis pathways. The relative ovarian expression of several genes previously identified by microarray analysis as being involved (*chico*, Rab7, *yolkless* and dynamin) were examined by quantitative Real-time PCR as measured against the expression of the RP49 housekeeping gene. In each case two possible peaks of expression were noted coincident with the timing of onset of early and late YP synthesis. Furthermore, laser confocal immunofluorescence was used to localize CHICO and dynamin to follicle cells in developing egg chambers.

# THERMAL INFRARED EVALUATION OF SUSQUEHANNA UNIVERSITY BUILDINGS

Author: *James Luke Carll*

Advisor: Jennifer M. Elick

Institution: Susquehanna University  
Department of Earth and Environmental Sciences

Five Susquehanna University buildings were examined using thermal infrared (TIR) imagery for heat loss. Though all of the buildings were built using energy efficient construction, heat loss was identified along building seams, corners and window seals. The buildings examined in this study included dormitory facilities, West Village B (est. 2007) and West Village G (est. 2009), Blough-Weis Library (ren. 1989), Fisher Science Complex (est. 1990) and the New Science Building (est. 2010). While building materials, quality of construction and building design were factors that influenced heat loss, this study found that the greatest contributor of heat gain and loss was related to the building's orientation with respect to the sun.

Comparison of Fisher Science Complex to the New Science Building demonstrates the superiority of the green materials and quality of construction of the New Science Building. Its windows and doors were well sealed, and there were fewer areas of heat loss. As for the Fisher Science Complex (and other buildings on campus), poorly sealed windows and doors were the areas with the greatest amount of heat loss. This study recommends that Susquehanna University should continue to use green materials and quality construction to ensure its commitment to sustainability.

# EFFECT OF COUNTER IONS ON THE REACTION BETWEEN IRON (III) AND THIOSULFATE

Authors: *Christine McCarl, Philip Weiser*

Advisor: Carl Salter

Institution: Moravian College  
Chemistry Department

The redox reaction between ferric and thiosulfate ions results in the rapid formation of a deep violet complex, which then decays to tetrathionate and ferrous ions. When mixed in equal concentrations and volumes, the kinetics of the reaction follows a second order decay curve. When the initial anion complexing the ferric ion was altered, the rate of the reaction was dramatically affected. Individual solutions of 0.05 M ferric ion complexed with nitrate, chloride, perchlorate, and sulfate were mixed with 0.05 M thiosulfate and the kinetics were followed by measuring the absorbance of the violet complex over time. The most rapid decay curve was observed for ferric perchlorate thiosulfate, followed by ferric nitrate thiosulfate. Ferric sulfate and ferric chloride thiosulfate were much slower, with ferric sulfate being the slowest. Although the rates of reactions were altered, the overall reaction order still followed second order behavior. To examine these catalytic effects, the spectra of the violet complex's decay was analyzed for each ferric thiosulfate mixture. The observations from the kinetics and the absorbance spectra indicate that altering the anions present in the ferric solution alter the identity of the ferric thiosulfate complex and the rate at which it decomposes.

# A STUDY OF PHYSICAL AND CHEMICAL WEATHERING OF THE MARCELLUS SHALE IN CENTRAL PENNSYLVANIA

Author: *Justin M. Paul*

Advisor: Dr. Ryan Mathur

Institution: Juniata College  
Geology Department

Marcellus shale is well known as a natural gas play in the northeastern United States of America. A fracture density and geochemical study was conducted on Marcellus outcrops in central Pennsylvania to understand physical and chemical weathering processes and relationships within the weathering profile of the Marcellus.

The fracture density study served to provide quantitative data on the abundance of fractures in exposed Marcellus shale. As hypothesized, progressively higher fracture density values (FDV) were calculated closer to the soil profile. Understanding fracture densities and their associated depths can be used to explain why soil formation rates are faster directly below the soil profile. A study of this kind also has applications to natural gas extraction.

The geochemical study was conducted to observe elemental depletion and movement within the soil profile. Lysimeters were installed to collect soil water in which major and trace elements were measured along with Cu isotope compositions. These concentrations and isotope ratios are important to understand the extent of biogeochemical reactions.

Research Sponsor: CZO NSF EAR 07-25019 in coordination with PSU

# COMPARATIVE GENOMIC CHARACTERIZATION OF A NOVEL MYCOBACTERIOPHAGE

Authors: *Catherine Mageeney, Stephanie Recklau*

Advisors: Dr. David Dunbar, Dr. Melinda Harrison

Institution: Cabrini College  
Biology Department

Mycobacteriophages are viruses that infect a class of bacteria called mycobacteria such as *Mycobacterium smegmatis* and *Mycobacterium tuberculosis*. In spite of the fact that mycobacteriophages are the most abundant life form in the biosphere they remain relatively poorly characterized. Currently, there are over 80 mycobacteriophages that have been sequenced and comparatively analyzed. Marvin, a mycobacteriophage isolated and characterized by students at Cabrini College is very unique and unlike that of any other of the currently characterized mycobacteriophages. Of the 111 genes in the genome, only 22 are similar to that of other mycobacteriophage genes. The remaining genes have no known homologs in the Genbank database. Marvin also has many unique properties that have not been seen in other mycobacteriophages such as structural proteins that look unlike those of other mycobacteriophages. Studies are currently underway to determine the host ranges specificity of Marvin, whether it be *M. smegmatis*, another mycobacteria or bacterial species.



# BACTERIOPHAGE RECOMBINEERING WITH ELECTROPORATED DNA

Author: *Stephanie Recklau, Catherine Mageeney*

Advisor: Dr. David Dunbar, Dr. Melinda Harrison

Institution: Cabrini College  
Biology Department

We are currently working in conjunction with University of Pittsburgh in an attempt to reproduce their BRED (Bacteriophage Recombineering with Electroporated DNA) protocol on our recently isolated novel mycobacteriophage Marvin. The BRED protocol was developed by the Pittsburgh Bacteriophage Institute and Department of Biological Sciences Lab in an endeavor to generate mutations in bacteriophages that have a lytic cycle of reproduction. The BRED protocol can be used to construct unmarked gene deletions, gene replacements, base substitutions, point mutations, and small insertions. Using recombineering proficient strands of *Mycobacterium smegmatis* and an isolated bacteriophage Marvin we have been able to successfully electroporate Marvin DNA into electrocompetent cells. Further research much be completed but we are hoping to construct a deletion substrate using polymerase chain reaction. With the use of this deletion substrate, a gene deletion will be performed with the hopes of discovering if the sequence is essential, and if so its function.

# THE PINE FOREST ACID MINE DRAINAGE TREATMENT SYSTEM, ST. CLAIR, SCHUYLKILL COUNTY, PA: AN ANOXIC LIMESTONE DRAIN WITH AN OXYGEN PROBLEM

Author: *Justin Idzenga*

Advisors: Dr. Cynthia Venn, Dr. Christopher Hallen

Institution: Bloomsburg University of Pennsylvania  
Geography and Geosciences Department  
Chemistry and Biochemistry Department

In order to assess the effectiveness of the Pine Forest AMD Passive Treatment System (an anoxic limestone drain or ALD) in St. Clair, Schuylkill County, Pennsylvania, we analyzed conductivity, pH, dissolved oxygen (DO), and temperature at 9 sites in the system. In addition, we analyzed collected samples for alkalinity and acidity on site and later analyzed for selected metals and anions in the lab. In addition, iron precipitate samples were collected at each site and examined using SEM/EDS (scanning electron microscope with energy dispersive spectrometer). After we sampled at sites throughout the system, the drain was flushed and we collected and analyzed the flushing effluent in the same manner. Settling ponds were covered in iron precipitate, with abundant cattails growing in the lower two shallow ponds. The DO leaving the ALD was higher than that coming initially out of the mine, indicating leakage of oxygen into the drain. Microbes observed in the effluent support this hypothesis. The chemistry indicates that the system is performing as designed (raising alkalinity and reducing iron load and acidity), but the expected lifespan of 20 years with limited maintenance appears to be much less than half that with drastically increased maintenance.

# DEVELOPMENT OF TOUCH MAPS TO AID THE VISUALLY-IMPAIRED IN DEVELOPING SPATIAL AWARENESS OF OCEANOGRAPHIC AND GEOGRAPHIC FEATURES

Author: *Kathleen Paiva*

Advisors: Dr. Cynthia Venn, Dr. Christopher Hallen

Institution: Bloomsburg University of Pennsylvania  
Geography and Geosciences Department

A spatial understanding of locations of seafloor features and continental locations is vital for a student to visualize and understand the processes of plate tectonics, the patterns of atmospheric and oceanic circulation, and other key components of earth system science. For the sighted, the learning of locations of geographic features and even the concepts of latitude and longitude is straightforward; for the visually-impaired, developing a spatial understanding of earth's features is much more challenging, requiring additional effort in both time and resources. Working as a team (professor and pre-teacher) we developed touch maps to aid in training a visually-impaired student in an oceanography class, using a raised relief map of the world and adding materials of different textures to represent different features. A modified approach to the sequencing of the lesson was needed as well, starting with latitude and longitude then covering continents and associated features sequentially. The outcome was successful, with the student outperforming many classmates on the map quizzes. We believe the team approach to be an effective model for both student learning and pre-teacher skill development.

# SMALL MOBILE INSTRUMENTS FOR LABORATORY ENHANCEMENT (SMILE)

Authors: *Alyssia Miller, Melissa Gettle, Cole McDonald*

Advisor: Dan Sykes

Institution: Penn State University  
Chemistry Department

The ability of many programs and institutions to maintain and improve the quality of their educational missions is compromised because of escalating student enrollment, the aging of existing resources, the increasing costs to maintain state-of-the-art instructional facilities, and the shrinking nature of funding sources. These barriers affect curricular programs at the secondary and college-levels. However, it is possible to provide rugged, low-cost, low maintenance, low-power instruments capable of providing accurate quantitative information for a fraction of the cost of commercial instructional- and research-grade instrumentation. Access to low-cost instruments as demonstration and laboratory teaching aids greatly expands the breadth of chemical concepts accessible in a classroom/lab environment and/or allows more in-depth exposure of select topics. Our aim is to develop low-cost, custom-built instruments that facilitate the practical application of spectroscopy, chromatography and electrochemistry in general and analytical chemistry laboratory courses. Current projects include a colorimeter, fluorimeter, Karl-Fischer apparatus, electrical conductivity meter, cyclic voltammeter, capillary electrophoresis-on-a-chip, and NMR probe among other instruments.

# THE DEVELOPMENT OF PAH-SPME PHASES FOR THE SELECTIVE ABSORPTION OF NITROAROMATIC EXPLOSIVES

Authors: *Alyssia Miller, Jana James*

Advisor: Dan Sykes

Institution: The Pennsylvania State University  
Department of Forensic Science

The development of efficient and sensitive analytical methods to detect and quantify trace amounts of explosives and explosive residues is significant both for environmental protection and public security. SPME is a rapid, re-usable, environmentally-benign and cost-effective, field sampling technique when compared to liquid-liquid extractions and solid phase extractions. Our work focuses on the development of new poly aromatic hydrocarbon (PAH) silane phases for HPLC, GC and SPME applications. The PAH phases exhibit a high-degree of selectivity towards nitro-aromatic compounds. The PAH silane-based SPME fibers serve a dual purpose: 1) fluorescence quenching of the PAH silane by nitro-aromatics can be monitored by attaching the fiber to a field-portable fluorimeter allowing real-time quantitative detection of nitro aromatics in ambient air, and 2) the analytes can be thermally or chemically desorbed from the fiber upon return to the laboratory and undergo "normal" chromatographic analysis. The principal aim of the research has been to develop a suite of silane coatings with a high-degree of selectivity towards specific nitro aromatics and/or develop a mixed-mode phase with broad selectivity and use multiple component analysis to recover individual analyte species.

Research Sponsor: Supelco

# ASSOCIATION OF BACTERIA WITH INFANTILE POST-INFECTIOUS HYDROCEPHALUS IN EAST AFRICA

Author: *Sylvia Ranjeva*

Advisor: Dr. Steven Schiff

Institution: The Pennsylvania State University  
Department of Engineering Science and Mechanics  
Center for Neural Engineering

Infantile hydrocephalus in East Africa is predominantly post-infectious. The microbial origins remain elusive, since most patients present with Postinfectious Hydrocephalus after antecedent neonatal sepsis has resolved.

To characterize this syndrome in Ugandan infants, we employed polymerase chain reaction targeting bacterial 16S Ribosomal DNA from cerebrospinal fluid, to determine if bacterial residua from recent infection were detectable. Bacteria were identified based on the relationship of genetic sequences obtained with reference bacteria in public databases. We evaluated samples from patients presenting during dry and rainy seasons, and performed environmental sampling in villages of patients.

Bacterial DNA was recovered from 94.8% of patients. Gram negative bacteria in the phylum Proteobacteria were the most commonly detected. Within this phylum, Gammaproteobacteria dominated in patients presenting following infections during rainy season, and betaproteobacter was most common following infections during dry season. Acinetobacter was species were identified from the majority of patients admitted following rainy season infection.

Postinfectious hydrocephalus in Ugandan infants appears associated with predominantly enteric gram-negative bacteria. These findings highlight the need for linkage of these cases with antecedent neonatal sepsis in order to develop more effective treatment and prevention strategies.

# STUDY OF CELLULOSE IN BIOMASS AND MOLECULAR WATER ON GLASS SURFACES WITH SUM FREQUENCY GENERATION SPECTROSCOPY

Authors: *Laura Bradley, Anna Barnette, Yung-Bum Park*

Advisors: S.H. Kim, Daniel Cosgrove, Carlo Pantano, S. Park

Institution: The Pennsylvania State University  
Department of Chemical Engineering

Sum frequency generation (SFG) spectroscopy was used to examine cellulose structure in native plant samples, as well as adsorbed water structure on glass surfaces. It is important to understand the role of cellulose crystal structure in conversion of biomass to biofuels such as ethanol. We found that SFG spectroscopy is more sensitive to different types of cellulose structure than X-ray diffraction scattering (XRD) and nuclear magnetic resonance (NMR) techniques. SFG will be able to observe changes in cellulose structure during separation or treatment processes and provide unprecedented opportunity to fundamental study of cellulose structures in plant growth and plant material processing.

The environmental effects on mechanical properties of glass have been studied thoroughly; however, the molecular interactions between the glass surface and vapor molecules are not well understood. The sensitivity of SFG is able to both detect carbon contamination as well as identify different molecular structures of adsorbed water layers on glass. SFG spectroscopy can be used to characterize adsorbed water structure on glass to gain a full understanding of the environmental effects on glass surface chemistry.

# A WEB-BASED VISITOR EXPERIENCE TO THE TYLER ARBORETUM TREE HOUSES WITH GOOGLE EARTH

Author: *Abbey Dufoe*

Advisor: Dr. Laura Guertin

Institution: Penn State Brandywine  
Earth Science Department

Located in Media, Pennsylvania, Tyler Arboretum is marking its third year of providing its visitors with a limited season display of seven tree houses. The project goal is to create an interactive Google Earth tour of the tree houses for the Arboretum website for visitors to explore before visiting the displays.

The project began with meetings with the Arboretum education and horticulture staff who expressed great need for a Google Earth-based outreach tool. The location of tree houses were mapped with a handheld Global Positioning System (GPS) unit. Locations were then placed in Google Earth, free software that compiles satellite data to create a virtual globe. The coded locations of tree houses along with a pathway tour from house to house was included in this Google Earth file, allowing the virtual participant to travel on the same journey as a visitor of the Arboretum. At the geographic location of each house, photos and audio clips are available.

The final product provides a snapshot of the tree house display, enhanced with audio and images, before visiting the Arboretum. This Google Earth file will provide online visitors an enhanced experience and interaction with the Tyler Arboretum Tree Houses.



# AN EVALUATION MEASURING THE PATTERNS AND EFFECTS OF NONPROFIT MESSAGING THROUGH FACEBOOK

Author: *Brooke Ballard*

Advisors: Dr. Susan Fredricks, Dr. Laura Guertin

Institution: Penn State Brandywine  
Communications Department

Social media allows people to explore relationship building outside of traditional venues. That ability, when coupled with the capacity to reach a global audience, has allowed social media to become a valuable tool for-profits and non-profits can utilize to build, maintain, and solicit new relationships. In this study, the patterns and effects of nonprofit messaging were measured through Facebook. The research evaluates three areas: the types of messages nonprofits send, the types of responses received from supporters, and which messages produce data supporting the building of more meaningful relationships.

The researcher assessed the messaging of three nonprofits: Special Olympics, Cystic Fibrosis Foundation and Philabundance. The outgoing nonprofit messages and supporter responses were reviewed and categorized. Lastly, the supporter responses were compared to the Social Penetration Theory, which states there are four levels of disclosure; clichés, facts, opinions and feelings. Comparing the responses to the Social Penetration Theory allows a closer look into what kind of relationships certain types of messaging solicit (Adler, Procter II, & Towne, 2005).

The research shows there may be a return on investment for nonprofits when using Facebook for relationship building, and may lead to a model of “best practices” for nonprofits to consider.

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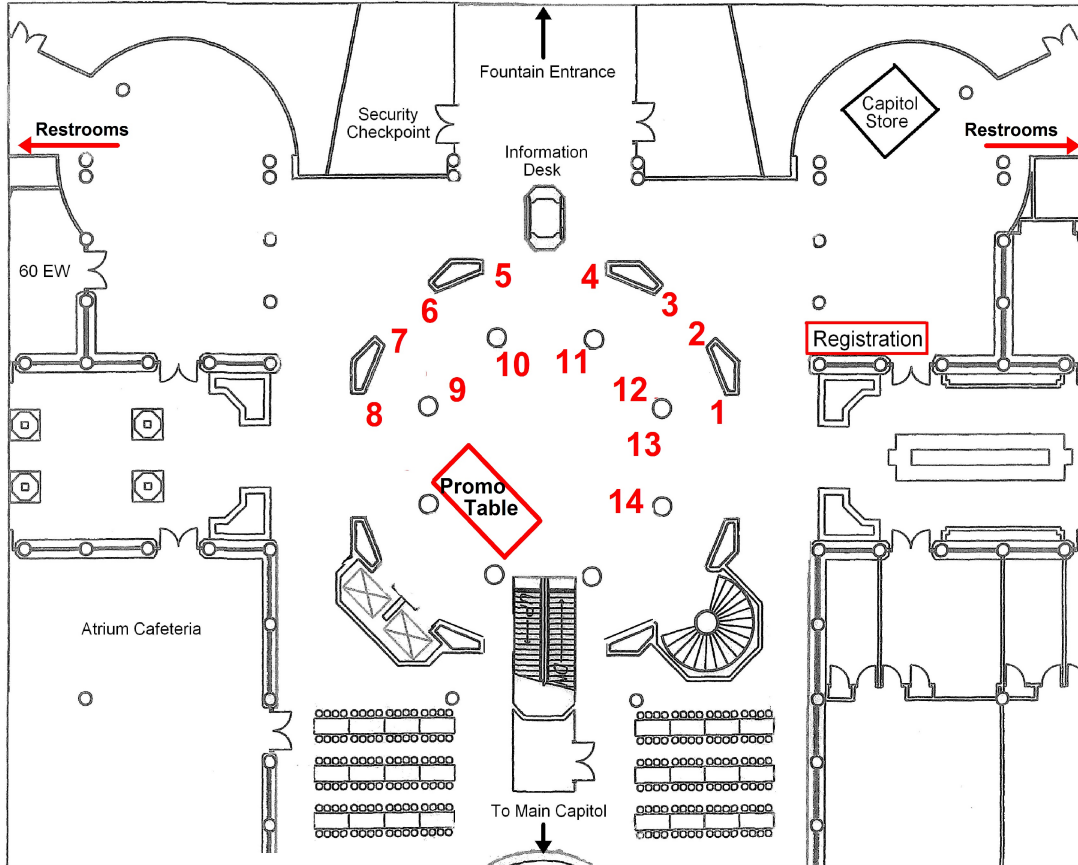
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***Don't forget to visit both upper and lower levels in the East Wing***

# East Wing Rotunda (Lower Level)



# East Wing Atrium (Upper Level)

