



undergraduate
research '100
symposium

Tuesday, April 7, 2009



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Welcome

I am delighted to welcome you to the second annual University of Illinois Undergraduate Research Symposium. This symposium gives over a hundred undergraduates the opportunity to demonstrate the fruits of the research and creative activities they have accomplished with the mentoring of faculty across the disciplines.

Students tell us that undergraduate research experiences profoundly enrich their education here by allowing them to deepen knowledge within a field of study and sharpen skills in areas such as critical thinking and writing. Students also tell us that planning and conducting research and creative work beyond the classroom allows them to make intellectual connections with faculty members, thereby strengthening their confidence that they will succeed if they choose to pursue graduate studies.

In the years to come, we aim to involve greater numbers of undergraduates in research and creative endeavors under the leadership of faculty mentors. As an institution where discovery and innovation flourishes, we strive to make involvement in such activities a hallmark of the Illinois undergraduate experience.

Many thanks to all participants in this year's symposium—and thanks, as well, to the faculty members, postdoctoral fellows, doctoral students, and others who stand behind these participants.

Linda Katehi

Provost and Vice Chancellor for Academic Affairs

Oral Presentations

A Sessions, 9:30-10:30 a.m.

Session A.1: Health, Science and Technology I (Illini Room A)

The Effect of High Alcohol Consumption on Endogenous GDNF Expression and Emotional Behaviors in Rats

Ryoji Amamoto, Junior, Individual Plan of Study, LAS

Faculty Mentor: Dorit Ron, Neurology (University of California, San Francisco)

ABSTRACT

Glial cell line-derived neurotrophic factor (GDNF) has been shown to modulate ethanol drinking behaviors. Using intermittent-access free-choice 20% ethanol paradigm, we set out to assess a decrease in endogenous GDNF expression that could account for the high consumption of ethanol. Moreover, we measured changes in emotional behaviors linked to high consumption of alcohol. We detected a non-significant decrease of GDNF expression in the intermittent group. By employing the elevated plus maze, we also observed an increase of anxiety in the intermittent group compared to the controls. However, consumption of sweet saccharin solution was similar among groups, suggesting no clear development of dysphoria. Additionally, intra-VTA microinjection of GDNF decreased ethanol intake. These preliminary results suggest that there may be an association between GDNF, high alcohol consumption, and anxiety.

Development and Evaluation of DNA Sensor Kits for Lead Detection in Dust and Paint

Julia L. E. Willett, Senior, Biochemistry, LAS, and Human Nutrition, ACES

Jenny Wu, Junior, Chemical Engineering, LAS

Yongsoo Park, Freshman, Biochemistry, LAS

Juanzuo Zhou, Professional Scientist, Lu Research Group

Debapriya Mazumdar, Ph.D. Candidate, Lu Research Group

Faculty Mentor: Yi Lu, Chemistry, LAS

ABSTRACT

Lead found in homes poses a serious health hazard, especially to young children. Real-time and in-situ determination of lead levels in paint and dust are very important to both homeowners and lead-based paint removal professionals. Current methods such as X-ray fluorescence and anodic

stripping voltammetry, while reliable, require expensive and sophisticated equipment. Conversely, the available colorimetric spot test kits are low-cost and user-friendly but unreliable. This study describes the development and evaluation of DNA-based lead sensor kits that are both reliable and inexpensive. This work is based on patented and patent-pending technologies invented by Dr. Yi Lu's group in the Department of Chemistry. DNAzymes display catalytic activities similar to protein enzymes and function in the presence of metal ions. A typical DNAzyme consists of an enzyme strand with a hairpin loop and a substrate strand with a metal binding site. When the target ion (Pb²⁺) binds, the substrate strand is cleaved and released from the molecule. Highly specific fluorimetric and colorimetric (in both liquid and dipstick formats) sensors have been constructed. The former is attained by fluorescently tagging the substrate strand and attaching a quencher to the enzyme strand, allowing the fluorescence to be unmasked upon Pb²⁺ binding. The latter is an innovative combination of recent breakthroughs in biology and nanotechnology. In the absence of Pb²⁺, the nanoparticles aggregate to produce a color change, while the presence of Pb²⁺ prevents aggregation. We have developed a protocol for utilizing DNA sensors to evaluate lead paint and tested numerous samples supplied by the Environmental Protection Agency. Our sensors have proven successful in detecting lead in paint samples in comparison to reference values as well as Inductively Coupled Plasma (ICP) Mass Spectrometry data. Future work will continue to test and improve the reliability of these technologies for both paint and dust-based applications.

Inhibition of Fatty Acid Synthase Activity by Peptides from Hydrolysates of β -conglycinin Enriched Soybean

Maxine J. Roman, Junior, Food Science, ACES

Faculty Mentor: Elvira de Mejia, Food Science and Human Nutrition, ACES

ABSTRACT

Fatty acid synthase is highly expressed in liver and adipose tissue and catalyzes the synthesis of saturated fatty acids, predominately palmitate, from acetyl-CoA and malonyl-CoA precursors. Inhibitors of fatty acid synthase activity have been reported to reduce body weight, inhibit food intake, and increase metabolic rate. Due to the chemical instability and negative side effects of existing FAS inhibitors, it is important to search for alternative inhibitory sources. The objectives of this study were to study the inhibitory effect of soybean hydrolysates derived from pure β -conglycinin (BC) on FAS and characterize the responsible peptides. Pure BC isolated from soy protein isolates was hydrolyzed with an enzyme, alcalase from *Bacillus licheniformis*, to produce bioactive peptides. The inhibitory activities of these peptides were assayed against FAS isolated from chicken liver. Concentration of soy hydrolysates that inhibited 50% FAS activity (IC₅₀) was < 100 μ M. In conclusion, bioactive peptides derived from pure β -conglycinin soy hydrolysates produced from alcalase exhibit a potent inhibition of fatty acid

synthase. In the future, these peptides can be used as ingredients in functional foods for weight management.

Ramifications of Health Care Reforms in the Field of Physical Therapy

Darshil S. Patel, Senior, Community Health, AHS

Faculty Mentor: Susan Farner, Kinesiology and Community Health, AHS

ABSTRACT

The first baby boomers will be turning 65 in two years. With the baby-boomers aging, the population of elderly people continues to increase compared to that of the young. The social security and Medicare benefits will not be sufficient to accommodate the increasing numbers of seniors. Our Medicare and Social Security System did not take into account this sort of population disadvantage. Seniors are living longer but retiring early. They are counting on their Medicare and Social Security benefits to kick as soon as they turn 65. However, we can not afford to cover all the expenses of the expected 72 millions seniors in the year 2030. Obama believes that his Stimulus Plan will assist our country in fighting the recession. This \$787 billion plan should help us get our feet back together, but what will it do for our health care? In the upcoming years, we must analyze what is important and necessary when it comes to health care services. Specifically, I will be taking a look at the ramifications of health care reform in the field of physical therapy. Individuals are living longer because of the advances in medicine. If these advances are not funded, the life expectancy might not be as high. Physical therapy has helped in reducing the number of disabled seniors in America. Hip replacements and knee surgeries along with physical therapy has allowed seniors to enjoy their youthful spirit for a long time. Cutting away health care services such as physical therapy might impair quality of life in seniors. Will health reforms introduce a decrease in medical services, more disabilities and reduction in the quality of life?

Session A.2: Visualization Technology (Illini Room B)

The Spurlock Museum Ancient Seal Project: Polynomial Texture Mapping and Its Uses for Documenting Seals

Alexa C. Wirth, Senior, Anthropology, LAS

Andrew Truty, Senior, Classics, LAS

William Ridgeway, Senior, Classics, LAS

Faculty Mentor: Wayne Pitard, Religious Studies, LAS

ABSTRACT

Polynomial Texture Mapping (PTM) technology is an innovative form of digital documentation of historical and ancient objects. The process involves taking high-resolution digital photographs using multiple lighting angles while keeping the camera and object in place. The finished composite image allows the user to manipulate the light illuminating the digital copy of the object better than if the actual object were in front of them. The Spurlock Museum houses a custom-built PTM dome, which has been used to document and analyze its collection of 82 ancient cylinder and stamp seals from Mesopotamia (ancient Iraq). The seals are an important art form, as they are carved with intricate designs depicting a variety of scenes, but their small size makes them difficult to study. Impressions of the seals were made in modeling clay and photographed using the PTM dome. The seal impressions were significantly magnified for the PTMs, which greatly simplifies the process of studying the seal imagery. New developments have made it possible to create PTMs of large objects that will not fit within a dome. This method, informally called the "shiny ball" technique, allows researchers to make PTM images of objects in essentially any environment, including broad daylight. In lieu of a dome, the researchers must take a series of photos, manually positioning a single light in an approximation of the PTM dome. Plans are being made to use this method to PTM the collection of plaster casts of the Parthenon friezes held in the Spurlock Museum's Collection. This presentation will demonstrate how PTM technology works, showing examples made by students in the course of the Spurlock Museum Ancient Seals Project, as well as some new images using the domeless "shiny ball" technique.

Three-Dimensional Visualization of Phosphatidylinositides in Vacuole Membrane Fusion

Anna Kelner, Senior, Biochemistry, LAS

Faculty Mentor: Rutilio Fratti, Biochemistry, LAS

ABSTRACT

Membrane fusion is one of the most fundamental processes in living organisms, as it is critical for homeostasis in eukaryotes. Fusion is carried out by highly organized lipid microdomains. During fusion, the two opposing membranes assume a flattened disk formation known as the boundary. The perimeter of this boundary is called the vertex ring. It has been shown that lipids are enriched at the vertex ring of docked vacuoles. Purified vacuoles (lysosomes) from *Saccharomyces cerevisiae* have several benefits as the model system: the large organelles enable visual examination of microdomains and fusion, they are easily purified in large quantities, and isolated vacuoles contain all of the lipids and proteins necessary for fusion. High-resolution fluorescence microscopy and fluorescently labeled phospholipids will be used to examine the distribution and orientation of phosphatidylinositides in the fusion synapse.

Force Spectroscopy without Macromolecules for the Validation of Reaction Dynamics

Nicholas C. Rubin, Sophomore, Chemistry, LAS

Mentors: Roman Boulatov, Chemistry, LAS (Faculty); Timothy Kucharski, Chemistry, LAS (Graduate Student)

ABSTRACT

Tensile force along the dithiol bond of a macrocyclic disulfide and the methylene groups of a macrocycle coupled cyclobutene was used to demonstrate how bond elongation in the transition states of the dithiol/disulfide exchange and ring opening of a cyclobutene could be modeled by the relative lengthening of adjacent atoms. It was found that elongation of the S-S bond is accompanied by a contraction of the transition state bond angle at the electrophilic S atom. Consequently, the relative distortion between the methylene carbons, adjacent to the S atom, is an accurate approach to chemomechanical kinetic modeling. This differs from formal chemomechanical kinetics, which used S-S bond length elongation in its kinetic model. It has been suggested by our group that force dependent kinetics of scissile bond dissociation by a S_N2 mechanism is minimal.

Characterization of Palladium Films in the Presence of Hydrogen

Aaron J. King, Junior, Electrical Engineering, ENG

Faculty Mentor: Lynford Goddard, Electrical and Computer Engineering, ENG

ABSTRACT

In order to avoid combustion due to leaks of hydrogen, improvements in the safety, speed, and accuracy of hydrogen detection in small concentrations is needed for the advancement of many hydrogen-based technologies, including hydrogen fuel cells. Current sensors are based off of electrical circuits, which increase the likelihood of combustion due to the possibility of sparks. Palladium is used in these devices, due to its change in electrical properties as it selectively adsorbs hydrogen. An optical device using similar principles would allow for safer detection of dangerous levels of hydrogen because the changes in electrical properties of palladium are matched with changes in optical properties. The presentation will focus on measuring the changes in these optical properties of thin palladium films. Several techniques for these measurements will be discussed, as well as the results of the measurements. The first technique is variable angle spectroscopic ellipsometry, which is performed by examining the polarization of reflected light off of the sample at varying angles and wavelengths. The collected data can be used to model the refractive index of the film. This technique allows for a calculation of only the refractive index of the palladium without a controlled concentration of hydrogen, so a second technique is then used to measure the dynamic

response of the refractive index to hydrogen. The sample is placed in a chamber where nitrogen and hydrogen flow in controlled concentrations. A broadband light source is shone on the sample at ninety degrees incidence and detectors measure the input power, reflected power, and transmitted power of light through the sample. The results to be presented will include both amplitude of response as well as response time of the film to the presence of different concentrations of hydrogen to compare to current sensing techniques.

Session A.3: Current Political Issues I (Illini Room C)

Understanding Homelessness, Felony Status, and Mental Illness through Narrative: An Ethnographic Approach

Valerie R. Anderson, Senior, Psychology, LAS

Faculty Mentor: Peggy Miller, Psychology and Communication, LAS

ABSTRACT

There has been a significant amount of research conducted in the fields of psychology, social work, education, sociology, criminal justice, law, among other fields that supports the notion that there are inherent relationships between the homeless, incarcerated, and mentally ill populations. Much of the previous research literature has focused on one or two of these statuses, but upon a more extensive review of the literature they are seemingly all interrelated and cannot be teased apart or looked at as sole entities. Additionally, research methodologies examining these relationships have marginalized ethnography as a way to understand this social issue and develop interventions. The present narrative study aims to understand the complex relationships among homelessness and these other related statuses. Ten homeless men with felony status are participants in a semi-structured interview and case file study. Through understanding how these individuals interpret their life experiences and current situation service providers will be able to develop better programs and interventions. The findings will be discussed through an ethnographic perspective using discourse analysis and how these narratives can be used to inform community intervention. Finally, this tri-partite model will also be discussed in terms of recommendations made to service providers and policy makers.

Implementation of Affirmative Action Policies in Ethnically Diverse Democracies

Patricia Mathy, Senior, Political Science, LAS

Faculty Mentor: Carol Leff, Political Science, LAS

ABSTRACT

This study (small n most similar systems design) considers the factors that play a role in the implementation of affirmative action policy: Why do diverse democracies, similar in ethnic fragmentation and political structure, choose to adopt different policies of affirmative action? While affirmative action is a major social policy in many countries, its emergence on the international scale has not been thoroughly examined. The case studies conducted seeks to integrate the many factors relevant to the implementation of these policies by considering the influence of several independent variables (including history of colonial rule, level of past discrimination, political crisis that threatens the ruling elite, and presence of a politically mobile group seeking change) on policy adoption in France, Canada, and India. The hypotheses tested are based on the contention that these variables directly influence policy implementation, both in terms of the social and political conditions that surround implementation, as well as the specific type of affirmative action policy chosen. The logic behind the hypotheses considered is based on the rational-choice model of behavior, which assumes that political actors make choices in order to further their own self-interest (in this case, to stay in power). The presence of a politically mobile group seeking change, together with a destabilizing political crisis, create a situation in which adopting policies that benefit a minority are in the best interest of the political leadership, resulting in the implementation of policies of affirmative action. The rational-choice model is also hypothesized to explain which type of policy is chosen, as political actors have an incentive to implement a type of affirmative action policy that will end a political crisis with minimal disruption to the status quo.

The United Nations Commission on Human Rights: An Instrument of Change or an Instrument to be Changed?

Jennifer A. Hanley, Senior, Political Science, LAS

Faculty Mentor: Paul Diehl, Political Science, LAS

ABSTRACT

The United Nations Commission on Human Rights (now Council) has frequently been discussed by the popular press. However, studies done on their effectiveness have been indirect and have failed to address the resolutions and their effects on countries. Thus, I have set up a large scale study in which I hope to study the Commission's first attempt at resolving a humanitarian crisis in a nation and then examine one of their follow up attempts. It is my hypothesis that the stronger the call for action and the

greater the consensus, the more effective the UN resolution will be. I will test this theory by looking at follow-up reports, Freedom House ratings, Human Rights Watch reports, and news paper articles in order to uncover the ultimate effect the resolution had on the violating nation.

Session A.4: History (General Lounge, Room 210)

From King to Country: The Evolution of England's Monarchial Image, 1500-1700

Sara E. Campbell, Senior, History, LAS

ABSTRACT

The historiography surrounding the individual reigns of the Tudor and Stuart monarchs is quite abundant. However, scholarship which looks at the period as a whole to chart the evolving image of the monarch from divinely ordained ruler, as demonstrated in the reign of Queen Elizabeth, to mere figure head, which occurs during the reign of Charles II, is lacking. My research aims to fill this gap by examining sixteenth and seventeenth century propaganda, in the form of popular images and literature regarding the monarch, to explain how this shift was reflected in the reactions of the general public to the reigns of various monarchs. By juxtaposing the view of the monarch regarding his/her right to rule with the growing unrest amongst the public, which is evident in much of the contemporary propaganda, the shift away from absolutist monarchial rule to a representative body- namely, Parliament- was inevitable. This process was aided in large part by the growing rate of literacy amongst the public and the increased use of the printing press. My argument suggests that the turning point in the sacred image of the king occurred during the reign of Charles I, who refused to recognize Parliament's role in the government, culminating in his execution by the people in 1649. After this point, the traditions and ceremonies of a "divine King," as set up by the Tudor monarchy, were severely diminished. What my research ultimately suggests is that for the successful shift of power dynamics from a single person to a body representative of the people there must necessarily be strong opinions which are openly and freely expressed by means of the arts. By examining the various images of the King both before and after the Interregnum period, more illumination can be cast upon the inherent problems of absolutist rule and the necessity of representation.

The Collegiate History Experience: Learning, Interpreting, and Using History

Anne C. Shivers, Senior, History, LAS

Faculty Mentor: Carol Symes, History, LAS

ABSTRACT

Instead lieu of a traditional paper, this senior thesis is an hour-long documentary about the history program at the University of Illinois. In doing so, it seeks to find out how history majors and non-majors alike learn to study and interpret history. By looking at the work of historians and history majors, general education classes taken by non-majors, and sources of popular history, like movies and television shows, this documentary tries to understand how history is used and appropriated by popular culture and the media today. The presentation will summarize the main points of the film, featuring relevant clips of the film itself.

Indelible Impact: The Appropriation of 1857

Rama K. Vallury, Senior, History, LAS

Faculty Mentor: John Lynn, History, LAS

ABSTRACT

The Indian Rebellion, or Sepoy Mutiny, of 1857 is one of the most compelling historical events in the histories of both Great Britain and India. In being a watershed moment, much has been written on the subject. Throughout the 150 years since the event occurred, the cultural memory has changed in accordance with times. What this thesis is focused on is how the event has been remembered across three distinct time periods: 1857-1900, 1900-1957, and 1957-now, and how the differing perceptions have effected how the Rebellion (or Mutiny) has been perceived. What I intend to prove through my research is that the Indian Rebellion of 1857 has become larger than an isolated historical event and changes meaning in cultural memory to become what is needed during specific historical time periods.

From Gum San to Ping Dai: The Chinese Experience in the Midwest, 1882-1943

Rachel L. Keung, Senior, History, LAS

Faculty Mentor: Dana Rabin, History, LAS

ABSTRACT

In a period of harsh immigration laws, Chinese immigrants continued to journey from China to the United States under legal and illegal measures. Many settled in California, and some chose to move to the Midwest. Immigration and naturalization records from the National Archives and autobiographical works express the untold story of Chinese people in the

“heartland” of America. In these sources, Chinese people spoke back to the institutions and structures that withheld freedom. Chinese immigrants and their descendants actively participated in the historical narrative of the Midwest region. Unlike their counterparts on the east and west coast, Midwestern values and ways of life uniquely shaped the experience of Chinese people in America.

B Sessions, 11:00 a.m.-Noon

Session B.1: Water and Waves (Illini Room A)

The Effects of Stochastic Temperature Change on the Hatching Success and Larvae Survival of Largemouth Bass and Smallmouth Bass

Sean J. Landsman, Senior, Integrative Biology, LAS

Cory Suski, Natural Resources and Environmental Sciences, ACES

ABSTRACT

For fish, temperature can have a profound impact on the process of recruitment—defined as the development of eggs into sexually reproducing adults of the following generation. Temperature can influence recruitment and year-class strength indirectly (e.g., altering growth rates) or directly (e.g., mortality). In this study, we attempt to delineate the direct effects of abrupt temperature change on the hatching success and larvae survival of largemouth bass, *Micropterus salmoides*, and smallmouth bass, *M. dolomieu*. Nesting male largemouth and smallmouth bass were located by snorkel survey and briefly removed (via angling) for measurements. Divers estimated reproductive success and approximately 100 eggs and two stages of larvae—egg sac fry (ESF) and fry above nest (FAN)—were removed from each nest, transported by boat back to the laboratory, and immediately placed into five water baths of varying temperature: 10° C, 15° C, control (20° C), 25° C, and 30° C. Very little mortality was recorded for any developmental stage of either species in our cool water treatments. Smallmouth bass egg hatching success was significantly lower than largemouth bass, but only in the extreme warm-water treatment. Similarly, time to 50% survival was significantly lower (roughly half) for smallmouth bass at the ESF stage. Both species took less than 10 hours to reach 0% survival at the FAN stage compared to over 100 hours at the ESF stage, implying decreasing survival as development proceeds. Overall, largemouth and smallmouth bass eggs and larvae were quite resilient to abrupt temperature change, even at extreme temperature shocks, suggesting that increasing global temperatures may have relatively little direct effect

on hatching success and larvae survival. Instead, it is likely the effects of temperature on year-class determination may be linked more so to parental male abandonment rates that leave broods susceptible to predation.

An Investigation of Egg Cannibalism in the Bluefin Killifish (*Lucania goodei*)

Benjamin A. Sandkam, Senior, Integrative Biology, LAS

Faculty Mentor: Rebecca Fuller, Animal Biology, LAS

ABSTRACT

Energy investment in eggs is more costly than energy investment in sperm. This knowledge has been used to explain many behavioral differences between males and females regarding offspring investment. Females often devote more time and resources to protecting eggs and young during incubation and development. Theory would suggest that these behavioral differences between sexes will be seen in cannibalization rates. We examined egg cannibalism in a freshwater fundulid, the bluefin killifish (*Lucania goodei*), using a series of four experiments to look at differences in cannibalization between sexes and location as well as possible consequences of these differences. We found female *L. goodei* cannibalize eggs more readily than male *L. goodei*. This raises interesting evolutionary questions when considering female energy investment per egg is higher than male energy investment per egg. We further show that cannibalism in *L. goodei* occurs faster near the bottom of the water column than the surface thus causing more eggs to be found higher in the water column. We found ultraviolet light had no influence upon egg survival in *L. goodei*. Position in the water column has significant effects upon the levels of ultraviolet (UV) light present. UV light has been shown to detrimentally effect the development of many species of fish eggs. High levels of UV light are found near the surface while very low levels of UV light are able to penetrate to the bottom of the water column. The ability of *L. goodei* eggs to tolerate UV light might suggest they have evolved a mechanism with which to cope with UV light during egg development.

Measurements of Waveguide Loss

Michael Guh, Senior, Electrical Engineering, ENG

Faculty Mentor: Lynford Goddard, Electrical and Computer Engineering, ENG

ABSTRACT

Optical waveguides help to propagate light for communications and many other applications. Light can be lost when traveling long distances and even very short distances. This is caused by the loss in waveguides. Waveguides can be fabricated in many different fashions, but they need to meet certain specifications. The most useful of those is the loss. Waveguides can be designed to be high or low loss depending on the application. Obtaining the optical loss would help to determine major steps toward device improvement.

The setup is based off the insertion technique where the device under test is inserted between two identical optical fibers. A laser emits a beam to propagate through the waveguide and couple back into the opposing fiber. This method is a simple base and from this point there are multiple ways to customize the setup to measure certain aspects like transmitted power, reflected, scattered light and others, for different data to obtain a loss factor. The choice of measurement technique depends a lot on the loss of the waveguide. Some methods are more time consuming, but are more precise while some methods are simple but give a general approximation. Techniques that will be looked at will be to use variables such as the length of the waveguide, wavelength of light, and the reflectivity of mirrors. Factors outside of the waveguide must also be paid attention to. This includes an alignment technique that will set the fibers to be straight so that as much power is coupled into and out of the waveguide. Other factors are air gaps and temperature. The main area of interest is to find methods to measure loss of a waveguide with our setup as accurately as possible, learning and possibly improving on methods that have been already published.

The Temperature Modulation Technique Applied to InGaAs Lasers

Akash Garg, Senior, Electrical and Computer Engineering, ENG

Faculty Mentor: Lynford Goddard, Electrical and Computer Engineering, ENG

ABSTRACT

Semiconductor lasers have been heavily researched in the last couple of years because of the potential advantage they offer in a variety of applications. The most common type of diode laser is a p-n junction. In semiconductor lasers, an active layer is sandwiched between a p-n diode. In this layer, electrons and holes recombine to produce photons. The emission of additional photons in lasers is then stimulated by the circulating light. Because of the large injection current densities, the temperature of diode lasers can increase. Due to the increase in temperature, the threshold current increases and also the efficiency decreases. The main aim of the current research is to determine the effect of temperature on the output stability of lasers i.e. to determine the change in threshold and slope as a function of temperature and bias current. The small signal modulation technique is used to get the required temperature modulation through thermoelectric cooler (TEC) modules. When an electric current is applied to a TEC module, heating of one junction and cooling of the other junction occurs. Thus, heat can be transferred. A copper stage is designed in which the TEC is sandwiched to perform the temperature modulation. The temperature of the copper stage was tracked by a thermistor inserted in it. The whole setup was controlled by the code written in National Instrument's LabView. LabView is used to perform the temperature modulation and for automated data acquisition. From now through March, we will be collecting data and performing our analysis so that we can present our latest results at the symposium.

Session B.2: Communication and the Arts I (Illini Room B)

“Man, I Feel Like a Woman”: Defining Female Sexuality in the Contemporary American Horror Film

Alex N. Landers, Senior, Cinema Studies, LAS

Faculty Mentors: Robert Rushing, Comparative Literature, LAS

ABSTRACT

My work for the past semester has been focused toward a study of American cinema, applied specifically toward the American Horror Film after 1978 and the notion of the “feminine” within it. My 50-page thesis sets its foundation on the theory of feminist theorist Carol Clover, referencing the basic types of female exploitation inherent in the classic “slasher” film (the origin of the male-instilled falsity of what encompasses female sexuality). From here, both traditional genre theory and an inter-textual approach to film inform a critique of more recent episodic waves of the genre: seeing the abuse of women brought to light in a period of self-parody, promptly followed by a number of films that relegate the feminine into oblivion, deeming women sinful and unimportant. The exploration culminates with a look into the strikingly progressive wave of current American horror within the last eight years, allowing women to be rediscovered, blamed, and finally empowered to identify themselves. The goals of my research and presentation of this topic are not only to demonstrate the potential for a post-feminist era of the horror film, but more importantly, to emphasize the power of the commercial film in a social and artistic context. Horror, perhaps the cheapest, most recycled genre, is often overlooked because of its commerciality. But it is this very nature that allows it to approach socio-cultural issues better than almost any other genre, and its wide breadth and history of previous titles allow it to act as an informed, self-conscious medium of artistic expression. A very brief overview of Clover’s theory would be presented, followed by my work updating the theory for this new era. Films to be discussed include *Candyman*, *Hostel*, *House of 1000 Corpses*, and *Doomsday*.

Cyber-Church: Building Virtual Community to Span the Digital Divide

Akua A. Agyeman, Senior, Psychology and African American Studies, LAS

Rhonda Averhart, Senior, Sociology, LAS

Faculty Mentor: Abdul Alkalimat, African American Studies, LAS

ABSTRACT

Cyber Church is an ongoing research project that began at the University of Toledo and now has been launched at the University of Illinois at Urbana-

Champaign under the direction of Professor Abdul Alkalimat. This research is represented through the site <http://cyber-church.us> supported by the African American Studies Department and the Community Informatics Initiative at the Graduate School of Library and Information Science. This project demonstrates research toward bridging the digital divide through the study and digitization of religious institutions in Urbana-Champaign and surrounding cities. This research is conducted via the D-7 method: definition, data collection, digitization, discovery, design, dissemination, and difference. We are reporting on research carried out as a class project in AFRO 220 (Fall 2008). There are 251 churches in the Champaign-Urbana area. Our research will report relevant socio-economic data on each institution, and our process toward digitizing this information. Why can religious institutions be used as a means to study how to span the digital divide? According to Alkalimat (<http://cyber-church.us/introduction.html>) the religious institution serves multiple purposes, beyond religion; but, it also fosters leadership, economics, networking, cultural expression and creativity, etc. of a community. Furthermore, in the context of the digital divide—which refers to the social inequality where those with very limited or no access at all to information technology, based on gender, class, race, and location are digitally divided—the Cyber Church project is meant to be a virtual expression of the actual lived experiences that are produced from religious institutions, which is a layer of community organization. This virtual expression involves the participation of the community in order to maximize digital access and use thus allowing members of communities to effectively participate as digital citizens.

Virtual Environments and Video Games for Lab Safety and Campus Security at a Procedural Memory Level

Jose R. Rico, Sophomore, Nuclear, Plasma, and Radiological Engineering, ENG
Faculty Mentor: Rizwan Uddin, Nuclear, Plasma, and Radiological Engineering, ENG

ABSTRACT

The Unreal Tournament engine is one example that has several built-in features that can be tailored to suit the demands of any safety or security training exercise. These built-in features include triggers (used to turn certain scenarios ON and OFF, such as fire, nuclear radiation and other hazardous environments), color coded radiation maps, health meter, non-player controlled avatars, virtual security cameras, multiplayer capability, and the ability to display 3D immersive environments. All of these features can be used to create virtual environments that can give students and law enforcement the ability to practice procedures in lab safety and campus security. The comprehension of lab safety procedures is extremely important for the well-being of people participating in lab experiments. One of the virtual training programs currently under development in our department is aimed at efficiently conveying the lab safety procedures to students planning to conduct experiments in the

radiation lab. A virtual model of the lab has been developed and is constantly being improved. Students being trained must perform several tasks in the virtual environment while answering questions about safety procedures. The students are given a limited amount of time to complete the objective. They can ask the TA or the instructor but will lose time in the process. They will thus be forced to repeat the scenario until such a time as they are able to complete their task with little to no help. Once they have successfully completed the training, they will be eligible to conduct the labs.

Privacy and Ethical Issues in Location-Based Tracking Systems

Jessa Liying Wang, Junior, Computer Engineering, ENG

Faculty Mentor: Michael Loui, Electrical and Computer Engineering, ENG

ABSTRACT

At a boutique in Singapore, Chris purchased a fashionable new leather jacket at a low price. Walking out of the boutique, Chris was completely unaware that around the corner, a stranger with an RFID scanner had picked up the signal from the RFID tag embedded within the threads of Chris's jacket. While Chris fished a smartphone out from a jacket pocket and tried to locate a nearby restaurant for lunch, a base station picked up the GSM signal from the phone and pinpointed its location to a telecommunications operator who was tracking customers whose cell phone fees were overdue. The operator sent a text message to Chris's smartphone with a bill reminder, which included a list of authorized payment centres in the vicinity. Chris used the smartphone's GPS feature to search for directions to the nearest payment centre and to a restaurant with decent Chinese food. Based on Chris's personal profile, the GPS server sent a couple of digital food coupons to Chris's phone, to use at the Chinese restaurant. This story illustrates some of the benefits and risks of location tracking technologies. RFID tags enabled the manufacturer, distributor, and retailer of the leather jacket to improve their efficiency in stock management and to save labor costs. The GPS and GSM location services saved Chris substantial time in finding a payment centre and a restaurant. Despite these benefits in cost and convenience, Chris was unaware of the security risks, specially the irreversible loss of privacy when Chris's personal information was shared. Location-based tracking systems (LTSs) use a variety of technologies to record the locations of objects. An LTS can increase the risks to the privacy and security of individuals. Previous studies have failed to distinguish between losses and violations of privacy when the locations of individuals are recorded by an LTS. We argue that individual privacy is threatened not by the collection of public location information but by the centralization of aggregated information, and by the combination of location information with other personal information. Further, informed consent should be required when the collection of information might cause a violation of privacy.

Session B.3: Current Political Issues II (Illini Room C)

Nukes in the News: How News Media Have Set the Agenda for Congressional and Presidential Arms Control Efforts

Abby G. Doll, Senior, Political Science, LAS

Faculty Mentor: Scott Althaus, Political Science, LAS

ABSTRACT

Scholars have engaged in extensive research to identify factors contributing to the United States' arms control policies agenda. Past studies, however, have failed to examine one potentially critical factor: the news media. Previous examinations have shown how news coverage can significantly alter the government's agenda on other issues in foreign affairs. As such, the question arises: does the media's attention to nuclear proliferation have an effect upon institutional elite's activity towards arms control? As the Obama administration places a new emphasis on arms control issues, the answer to this question may reveal important causal factors in the presidential and congressional nuclear schemas. A review of the literature exposes a complicated web of causal relationships in foreign policy agenda setting, oscillating from the news media to various government actors instigating issue interest. Overall, a main weakness in the majority of studies performed on this topic is the dependence upon cross-sectional and panel studies, which cannot empirically show from which direction the correlational relationship occurred. This research uses time-series analysis, comparing *New York Times* coverage on nuclear testing with presidential and congressional arms control activity from 1945 to 1998. Divided into total as well as individual country coverage, the data is currently being empirically examined, with results expected by early March. This study hypothesizes that as media coverage of nuclear proliferation increases, the amount of congressional activity concerning nuclear arms control efforts in the Senate and the House of Representatives will also increase, with the same true for presidential attention. Also, the study will test whether media coverage of communist states' (the Soviet Union and China) nuclear proliferation had a greater agenda setting power than media coverage concerning allies' (the United Kingdom and France) nuclear tests. Overall, this analysis will shed light on the newly reenergized area of the arms control process.

A Post-Cold War Fork in the Road: Social Constructivism's Challenge to the Neorealism Road of Nuclear Issue Examination

Lauren E. Twenhafel, Senior, International Studies, LAS

Faculty Mentor: Derrick Frazier, Political Science, LAS

ABSTRACT

The theory of neorealism dominated International Relations for many years, but beginning in the 1980s, a new theory began to emerge. Social constructivism revealed the gaping flaws in this dominant theory and attempted to fill in those gaps. Namely, social constructivism acknowledged that states have identities and interests that affect their decisions and behavior in the international arena. Neorealism does not take these interests and identities into account, and thus cannot adequately analyze state relations. Since its inception, academics have applied social constructivism to reexamining issues that neorealism attempted, but failed, to explain. Yet one area that social constructivism has so far neglected is examining state behavior regarding nuclear issues. This research project attempts to break that boundary and establish social constructivism as a legitimate means of analyzing state behavior regarding nuclear issues. Through a case study of Israel, Iran, and Jordan, this research examines how major Western powers react and interact with smaller powers in the Middle East whom are involved with nuclear issues in varying ways. Israel, for example, is accepted by the West both as a de-facto nuclear weapons state and as a nuclear energy producer. Alternatively, Iran is developing a nuclear energy facility and is accused by the West of having ulterior motives. Yet Jordan, who recently announced its intent to begin researching nuclear energy development, has been readily accepted by the West for this pursuit. By exploring the differing domestic and regional pressures these three states face, this project seeks to determine through qualitative means why Israel, Iran, and Jordan have pursued, are pursuing, or are interested in pursuing nuclear energy and/or nuclear weapons, and why the West has reacted to each state in a different manner. This project has concluded researching theory and is currently in the phase of researching the case study.

Session C.1: Health, Science and Technology II (Illini Room A)

Patient-Centered Care: A Complex(ity) Model

W. Richard J. Goddard, Senior, Community Health, AHS

Faculty Mentor: Susan Farner, Kinesiology and Community Health, AHS

ABSTRACT

Humans live in a complex world that is full of unpredictability, irrational thought, and systematic approaches that fail to achieve desirability. With respect to health care, the United States spends 16.8% of its gross domestic product trying to balance and achieve the three prongs of societal stability: access, quality, and cost. When confronted with initiatives to improve one or two aspects of this triad, the model responds by an inverse reaction with the third. These former poor systematic approaches and strategic planning have led to duplication of services and a waste of American's tax dollars. A patient-centered approach tied with the theory behind complexity science offer a sustainable prospective to a system that remains unbalanced in more ways than one. In a patient-centered complexity model, the patients interact more freely with the physicians which in turn develop relationships that are functional within a health care organization. With the ongoing development of health care organizations shuffling patients through combines of doctors looking to improve patient turnover, health care organizations begin to forget who is fueling the machine: the patient. This misplacement of trust between the patient and the system has created dissonance, no matter what the background of the patient, that has ultimately become irreparable. When looking at a patient population there is a large range of diversity: age, race, education, religion, special culture. Each of which has a different interpretation on how they want to receive their care and how they want the healthcare system to be structured. When the patient is given the opportunity to pair itself with the system, knowingly or unknowingly, it creates a natural outcome. Improving systematic outcomes and regaining the trust of the patient can be derived from the natural order of complexity science.

Potential Complications from Trans-generational of Parasitism from *Metschnikowia bicuspidate* on *Daphnia dentifera*

Nora H. Prior, Senior, Integrative Biology, LAS

Faculty Mentor: Carla Cáceres, Animal Biology, LAS

ABSTRACT

Models are useful in disease ecology to examine the long-term patterns of epidemics and the effects of infection on individual populations. The host-parasite system of *Daphnia dentifera* and *Metschnikowia bicuspidata* have been studied and modeled extensively in relation to timing of epidemics and interannual variation in the size of epidemics. *Metschnikowia* spores are transmitted horizontally when *Daphnia* ingest fungal spores which resemble algal of their typical diet. *Metschnikowia* infections reduce both life-span and clutch size of *Daphnia*. Prior models take these life history effects into consideration, and assume, without experimental support, that there is no trans-generational effect of parasitism. It has been found in other host-parasite systems that immunological priming occurs, individuals born to infected mothers have a reduced probability of contracting the disease. In addition an individual's life history traits may also be affected by their mother's infection status. If there are such trans-generational effects future models would need to include them. To test the assumption that trans-generational effects do not play a significant role in disease dynamics, we asked the questions 1) is there evidence that there is immunological priming 2) are an individual's life history traits influenced by her mother's disease status 3) is there an interaction between the mother's and daughter's disease status on life history traits. Our laboratory experiments demonstrated that there is no evidence for immunological priming, that there is a reduction in fitness of infected animals independent of the mother's infection status however there was also a reduction in fitness of individuals born to mothers late in the disease, and there was no evidence of an interaction between the individuals infection status and the mothers infection history. These results suggest that in major epidemics, individuals born to infected mothers late in the disease will have a different survivorship that may affect disease-dynamic models.

Manufacture of Paracetamol Crystals Using a Dual Impinging-jet Mixer

Albertus A. Tanoto, Senior, Chemical Engineering, LAS

Faculty Mentor: Richard Braatz, Chemical and Biomolecular Engineering, LAS

ABSTRACT

Control of the micro-scale size distribution of crystals is of substantial interest to the pharmaceutical industry, for the manufacture of crystals in drug inhalers. An approach is proposed for manufacturing crystals with a

desired crystal size distribution by nucleation of seed crystals using a dual impinging-jet (DIJ) mixer, followed by growth in a supersaturated well-mixed tank. The desired seed production rate and crystal growth rate are achieved by varying the IJ velocities and time spent in the tank, respectively. In theory, this coupled process enables the manufacture of product crystals with controlled size distribution. My current objective is to experimentally confirm this approach's effectiveness, which requires that seed crystals produced by the DIJ mixer are small (<5 microns). A DIJ mixer was designed in which a jet of solvent with dissolved paracetamol and a jet of antisolvent impinge in a confined geometry of 20-microliter volume to create a turbulent region of very high supersaturation. An experimental system designed to capture and "freeze" crystals immediately upon exiting the DIJ mixer enabled accurate size measurement. Video microscopy confirmed a maximum crystal size less than 5 microns. A well-mixed tank with an in-situ Attenuated Total Reflection-Fourier Transform Infrared probe and laser backscattering probe for measurement of the supersaturation and crystal size distribution, respectively, is set up for operation at controlled growth rate. The next step will be to connect the DIJ mixer with the tank and produce a wide variety of controlled crystal size distributions. This experimental confirmation is expected to be of high interest to pharmaceutical companies where greater control for the micro-scale crystal size distribution is required to control dosage rate of a pharmaceutical.

Brain-Computer Interlacing

Martin S. McCormick, Junior, Electrical Engineering, ENG

Faculty Mentor: Todd Coleman, Electrical and Computer Engineering, ENG

ABSTRACT

Conveying information via EEG signals has been a growing area of interest. Applications of EEG classification techniques have allowed those who suffer from amyotrophic lateral sclerosis (ALS, a neurodegenerative disease caused by the degeneration of motor neurons) to communicate with others and control computers. These tasks are often impossible to perform otherwise. In addition, BCI has the potential to augment other forms of general purpose human-computer interaction including gaming and flight control. This presentation discusses the implementation of some of these systems during the past semester, along with novel methods for classifying EEG signals using analytic spatial patterns.

Session C.2: Communication and the Arts II (Illini Room B)

U.S. Women Writers

Elle Destree, Senior, Journalism, LAS

Ellen Hornor, Junior, English, LAS

Kathleen Harsh, Junior, Food Science and Human Nutrition, ACES

Alex Pleasant, Sophomore, Economics, LAS

Mason Walgrave, Sophomore, Materials Science and Engineering, ENG

Alanna Hickey, Senior, English, LAS

Rosie Yang, Junior, Pre-med, LAS

Anna Gormley, Junior, Molecular and Cellular Biology, LAS

Madeline Kelsey, Sophomore, English, LAS

Faculty Mentor: Dale Bauer, English, LAS

ABSTRACT

Students in English 280 have devoted themselves to one particular aspect of U.S. Women's writing in the 20th and 21st centuries. Our video will be a comprehensive overview of these choices, with each student (of 13) devoting about a minute on the video to describing his or her project. We will also discuss our different views of the history of U.S. Women's Writing. So far, students have chosen birth control, sexuality, the single woman, the "female complaint," the culture of suffering, consent, therapy, and leisure pursuits as central themes of their outside research. As part of this video, we will chart the changes in women's approaches to American culture--from the deheterosexualization of home life for women to the increasing intent on the individual self and confession in U.S. women's artistic expression. This presentation will provide viewers with a condensed history of writing in the U.S.

Putting Our Work under the Microscope: Vital Research in the Writing Center (Video Presentation)

Beverly Tsai, Senior, English, LAS

Stacy Haynes, Sophomore, English, LAS

Mandy Hayes, Sophomore, Sociology, LAS

Monica Hofmann, Junior, Anthropology, LAS

Faculty Mentor: Libbie Morley, Center for Writing Studies

ABSTRACT

The Writers Workshop is a complex system of activities and people which function together. Traditionally consulting work has been dominated by graduate students, but lately undergraduate consultants have joined the Workshop. In addition to our training, we have each explored the workings

of the Writers Workshop in a research project. Our choices of topics grew from our observations of graduate student consultants and our reading in writing center literature. Beverly Tsai became curious about the international students at the University who bring their writing to the Workshop. Specifically she wondered why they often became frustrated with our practice to review entire documents rather than proofread for correct English. Using interviews and published articles she investigated the writing that these students do before they arrive. Her conclusions will help all consultants meet the expectations of these writers. Stacy Haynes wondered whether the interaction between consultants and writers falls into a particular style of conversation. After she researched conversation styles, she observed several sessions to analyze the discourse used. She found that, although we hope to make writers and consultants equal participants in each session, we often fall into institutionalized conversations that position the consultant as an authority. Mandy Hayes noticed the large numbers of students with first-year composition assignments in the Workshop and questioned whether the ways students write their academic papers differed from the ways speeches are written. Using course documents and texts, she looked at the courses at Illinois that fulfill the composition requirement to examine the value of rhetoric and communication courses for students' futures. Monica Hofmann drew on her background in anthropology to conduct qualitative research into nonverbal behaviors in consulting sessions. Using a coding system she found in her research, she recorded the nonverbal behavior of one consultant and the writers she worked with one evening. Her results will help consultants notice ways they could make writers more comfortable and motivated. The findings of these projects will impact the strategies and styles our consultants use during their sessions and will become incorporated into the training of new consultants, both graduate and undergraduate. For the Undergraduate Research Symposium these four projects will be combined into one short video which will explain the research that each consultant completed.

Performing Arts Sustainability: A Fundamental History Lesson for the Next Generation

Matthew D. Van Dyke, Senior, Music, FAA

Faculty Mentor: Edward Rath, Music, FAA

ABSTRACT

My research incorporates experiences that I have had both at the Chicago Symphony Orchestra (CSO) and Krannert Center for the Performing Arts (KCPA). I have spent both my last spring break and summer at the CSO participating in an internship with the Development department under the Director of Governmental and Foundation Relations. In addition, I am currently working with Rebecca McBride, Executive Director of KCPA, working in similar departments to the CSO. Dr. Edward Rath, Associate Director of the School of Music, is helping me put together my internship experiences into a project

that is integral for my degree. The economic turmoil present in this country is undeniably affecting arts organizations. I consider my research topic to be extremely relevant and precisely involved with a very real problem non-profits encounter. The research that I will present will be beneficial to my peers and I because we will have a greater understanding of what is necessary to keep an arts organization thriving under financial stress. My research is still preliminary, but I am confident that this fascinating niche I am researching would reflect the academic diversity that the symposium strives to achieve.

Session C.3: Current Political Issues III (Illini Room C)

dot.org: HRC and the Internet

Stephanie U. Murphy, Senior, International Studies and Gender Studies, LAS
Faculty Mentor: Mimi Nguyen, Gender and Women Studies, LAS; and Shefali Chandra, History, LAS

ABSTRACT

HRC legitimizes homonational sentiment as it espouses liberal reform to argue for LGBT rights. HRC's imagined activism becomes a way for well-to-do GLBT Americans to exhibit their commitment to their personal inalienable rights. This commitment to posits members as trendy cosmopolitan actors within Westernized ideologies of modernity and progress. The organization relies on the internet as a portal to facilitate neo-imperialism. As a child of neoliberalism, the organization ultimately reiterates neoliberal notions of citizenship, activism, and identity politics. Heralding itself as the premier LGBT rights organization, HRC invests itself within a non-profit industrial complex. Its success as part of the liberal LGBT movement depends on creating and expanding a space for LGBT consumers that focuses on privatization and personal responsibility. The entire HRC website operates as a conceptual map by which we can trace the discursive and institutional constructions of proper LGBT citizenship. I have chosen to focus on three specific examples: HRC's fashion line and Corner Store, its template action guide Speak Out, and its International Rights and Immigration Issues webpage. These three examples speak to how disciplinary LGBT citizen subjects are fashioned (both literally and figuratively). At its core, this research focuses on an interrogation of the relationship between liberalism, neoliberalism, notions of democratic participation, neo-imperial organizing strategies, homonationalism, the discursive production of queer subjectivity, and the internet. In order to imagine more effective organizing strategies, we must also have the analytic skills to make visible the simultaneous resistances and complicities that the above mentioned relationships foster. My research adds itself to a growing body of work that attempts to do so.

How Race and Ethnicity Condition Partisanship's Effect on Policy Preferences

Lhea L. Randle, Senior, Political Science and Communication, LAS

Faculty Mentor: James Kuklinski, Political Science, LAS

ABSTRACT

Social identity research has highlighted that most people identify with several social groups and that these identities vary in salience due in part, to changes in the social context. This paper argues that two crucial social identities in American politics are partisan identification and race or ethnic group identification. The major research question that this paper aims to address is how one's self-proclaimed race or ethnicity condition the relationship between his or her self-proclaimed partisanship and support for or opposition to government policies. In order to investigate this question and its implications, this paper uses regression analysis to test two central hypotheses: first, that when policies do not target a specific racial or ethnic group, policies will be judged as Democrats versus Republicans using partisanship as the major marker for policy decisions. Second, that when the party with which various racial and ethnic groups belong target one of the specific groups, judgments will be made using targeted versus non-targeted groups, which will identify striking differences within the political parties. Using combined data from the 1996, 2000, and 2004 American National Election Studies, this study examines responses to sixteen policy items—twelve of which are general and do not refer to any particular racial and ethnic group and four that refer to a target group of either Hispanics or African Americans. The results reveal that intraparty heterogeneity increases when policies refer to a specific target, for instance racial and ethnic groups.

From Regional Economic Institutions to Regional Security Institutions: What Accounts for Variation in Security Institutionalization?

Modica Alisa, Senior, Political Science, LAS

Faculty Mentor: Derrick Frazier, Political Science, LAS

ABSTRACT

There are numerous regional security institutions in the world, with diverse responsibilities and jurisdictions. A recent compilation of regional organizations with security functions found almost fifty distinct organizations. Interestingly enough, many of these regional institutions were conceived for economic purposes, but then developed security functions later. For example, every regional economic institution in African has developed varying levels of security institutionalization. This raises the question, why do some regional security institutions not include any form of security cooperation, while others have developed to have significant security functions? That is to say, what

accounts for the variation in evolution of regional economic institutions into regional security institutions? To answer this question, I will look at factors that make it likely for a regional economic institution to develop security functions. The factors that I propose are economic institutionalization, economic interdependence, major powers in the region, deep rivalries, and intraregional security issues. I will look at three case studies of regional economic institutions to see how those factors have caused variation in security institutionalization.

40 Years Later: Comparing Black Life of the Past and Present

Simone N. Williams, Junior, Psychology, LAS

ABSTRACT

My research is a compilation of nine interviews to understand how African American student experiences have changed over time? The proceeding questions were supporting questions to provided insight into student experiences. What is the role of the African American Cultural Center in student life on campus? How does dorm life play a role in the student experience on campus? How does the Black Greek System effect student life on campus? The interviewees ranged in diversity based on age, hometown location, high schools, and majors. The results of the research concluded that current students use and refer to the African American Cultural center as home where as a couple of alumni were unaware of the center and wished they had the opportunity to take advantage of its resources. Interviews revealed that many students believed the dorms to programs to promote culture, and lastly there was an overwhelming consensus that the Black Greek System is a social outlet and that the system needs to improve. Although the research is extensive it relies on personal experiences therefore results change per person.

D Sessions, 3:00-4:00 p.m.

Session D.1: Health, Science and Technology III (Illini Room A)

Characteristics of Clients Using a Free Health Center

Stephanie Shaw, Junior, Community Health, AHS

Kathryn Spencer, Junior, Community Health, AHS

Sam Lites, Senior, Community Health, AHS

Faculty Mentor: Steve Notaro, Kinesiology and Community Health, AHS

ABSTRACT

Approximately 46 million Americans are without adequate health insurance, and in conjunction with the rising costs of care, many people forgo treatment. Free clinics serve as the foundation in providing primary care for the uninsured population, as well as in alleviating emergency department (ED) overcrowding. The main focus of this study explored the demographic characteristics and health service utilization among clients using a free health clinic, the Champaign County Christian Health Center (CCCHC), in Champaign, Illinois. Throughout the study, an emphasis was placed on the health disparities that exist across ethnic lines, patient's demographic makeup and the impact lacking adequate health care has on small and rural ED utilization, specifically in regard to overcrowding and high costs of care. Using survey studies, patient information, health service utilization and barriers to care were analyzed. This study found that a disproportionately high number of minority, female and clients between the ages of 25-64 used the free clinic. Compared to the national average (0.39), clients of the CCCHC were more likely to utilize the ED for non-urgent reasons, with an average of 1.04 visits per patient. Implications for reducing unnecessary ED visits and costs were assessed in this research. This study emphasized the increasing need for primary health care availability to help alleviate emergency department overcrowding.

Illini Prosthetics Team First Year Report of Progress in Developing a Prosthetic Arm for People in Underdeveloped Countries

Jonathan J. Naber, Sophomore, Materials Science and Engineering, ENG

Richard Kesler, Sophomore, Bioengineering, ENG

Luke Jungles, Sophomore, Mechanical Engineering, ENG

Adam Booher, Sophomore, Engineering Mechanics, ENG

Natalie Swider, Sophomore, Materials Science and Engineering, ENG

Faculty Mentor: Brian Lilly, Technology Entrepreneur Center, ENG

ABSTRACT

We represent the Illini Prosthetics Team, a group of five engineering students working in the Student Innovation Incubator provided by the Technology Entrepreneur Center of the University of Illinois at Urbana-Champaign. We started under our own initiative to design, build, and test a prosthetic arm for amputees in underdeveloped countries. Following our inception in August 2009, we divided up the work of designing the arm among ourselves and created a design paradigm to build the arm in a top-down, logical way. Our presentation at the 2009 Undergraduate Research Symposium is a culmination of the research and development we have accomplished towards the design of the arm. The big picture designs of the hand, wrist, elbow, and socket components of the arm are presented. Specifically, the mechanics, dynamics, tolerances, and applications of these designs are covered. Much of the past year has been spent researching ways to actuate movement in the

components and designing the bulk mechanical structure of the components. Additionally, general observations on current prosthetic technology and ways it could be adapted for people in underdeveloped countries are presented.

The Incorporation of 3-Fluoro-Tyrosine in Dsba

Elliott J. Brea, Junior, Biochemistry, LAS

Faculty Mentor: Chad Rienstra, Chemistry, LAS

ABSTRACT

As more Americans become addicted to methamphetamine, the cognitive deficits this drug causes are becoming an increasingly significant problem. Determining exactly how methamphetamine damages the brain is a crucial step toward developing treatments that can help these individuals recover brain function. Previous research shows that methamphetamine causes a sizeable release of stress hormones in the brain. Over time, this could alter the user's brain and cause these cognitive deficiencies. Sensitization is the process by which an animal reacts more strongly to the same dose of the same drug with each successive exposure. This differential reaction to the same stimulus indicates some persisting change in a subject's brain. Substances that interfere with sensitization convey something about how the drug in question causes these persisting changes. To determine whether stress hormone release plays a part in the brain changes caused by chronic methamphetamine use, a stress hormone antagonist (RU-486) was co-administered with methamphetamine in a rat model throughout a five day sensitizing regimen. Three days after completing this series of methamphetamine injections, subjects were challenged with methamphetamine alone to see if sensitization had occurred. Although systemic administration of the stress hormone antagonist did not prevent sensitization, other concurrent research shows that injecting the stress hormone antagonist directly into the medial prefrontal cortex does prevent sensitization. Therefore, the stress hormone release caused by methamphetamine likely does play a role in the brain changes associated with chronic use of the drug. Our experiment also produced a second, unexpected result: Animals given RU-486 during the initial series of methamphetamine injections still behaved in a non-stressed manner (as measured by center crossings, compared to controls) when given methamphetamine alone. This indicates that stress hormone release plays a role in the type of behavioral sensitization exhibited and could influence the subjective experience of the drug.

Session D.2: Communication and the Arts III (Illini Room B)

Recovering Lucy Larcom's *An Idyl of Work*

Alanna Hickey, Senior, English, LAS

Faculty Mentor: Justine Murison, English, LAS

ABSTRACT

Scholars of nineteenth-century American poetry emphasize two key figures: Emily Dickinson and Walt Whitman. Despite ongoing efforts to rescue lesser-known women's poetry from the era, little scholarship exists beyond anthological recognition. This lack of analytical attention becomes most wanting in current studies of class-concerned literature from the late 1800s. As its absence from literary criticism proves, nineteenth-century poetry is still perceived as unable to speak to a historical context as directly as nineteenth-century fiction can. The poetic narrative of *An Idyl of Work* forces the reader to rethink the New Critical understanding of the lyric as an ahistorical, culturally transcendent text. In her poem, Larcom includes lyrical interjections to relieve her otherwise blank verse. This atypical use of the lyric refuses its role as a self-referencing, free-standing poetic form. Using her poetic narrative to ground textually each lyric in social and historical context, Larcom forces the form to speak to the unique conditions of an educated, female working class. *An Idyl of Work* introduces new ways of thinking about home, work, and national space that literary scholarship has previously overlooked. Larcom's poetic expression of her marginal positioning provides us with a new vantage point from which to consider nineteenth-century literary conventions. Beginning with the poem's treatment of the home, my analysis argues that in order for educated, working class women to participate in sentimental culture during their immersion in masculine industry, the domestic had to be converted from an external dwelling to an abstract sentiment. As she manipulates traditional domesticity to accommodate the girls' lack of personal space in the mills, Larcom risks blurring the binary between free labor and slavery. In order to prevent the collapsing of mill girls and slaves, Larcom's characters exercise their freedom through westward movement and doctrines of Manifest Destiny. In my conclusion, I turn to another poem of Larcom's as a way to complicate *An Idyl of Work's* praise of national expansion and progress.

The Perverse Comedy: Masochist Play in Gibson's *The Passion of the Christ*

Ashley A. Albrecht, Senior, English and Psychology, LAS

Faculty Mentor: Jim Hansen, English, LAS

ABSTRACT

As a simultaneously hyper-violent and religious film that also earned the rank of "highest-grossing R-rated film of all time," Mel Gibson's *The Passion of the Christ* exists as a unique filmic phenomenon. Although millions flocked to theaters, the movie itself received mixed reviews, the consensus between film critics and general viewers being one of disgust. Functioning as a substantial departure from the graphically-subdued, traditional canon of Passion films, the violence in Gibson's approaches the pornographic. Attempts to reconcile the film's viscerally-provocative content with its overtly religious message cause myriad problems of religion, philosophy, and psychology to emerge. Though left unexplored in their critiques, numerous film critics have conjectured about the film's latent sado-masochistic impulses. In order to test the validity of such film critics' conjectures, I applied the theory and criticism of several neo-psychoanalytic theorists (primarily Gilles Deleuze and Slavoj Žižek) to an analysis of *The Passion of the Christ*. In my research, I investigate the extent to which masochism operates within the context of the film, as well as in the relationship between viewer and film. As masochism operates within the confines of a contract (involving "victim" and "torturer"), I explore the contractual relationships developed between figures within the film, as well as the dynamic between viewer and the depicted Christ. For both the subject of Christ, as well as the viewer, what is anxiously and painfully anticipated (i.e. the crucifixion) eventually confers pleasure. Further analysis reveals the performative nature of the masochistic act: Christ's Passion serves as a staged spectacle for a receptive audience. In terms of the film's aesthetics, the primary formal qualities of masochism - namely, waiting and suspense - are also exemplified throughout. I conclude that in both formal and contractual terms, Christ's Passion (as depicted in Gibson's film) operates as an act of masochist play: contractually perverse and viscerally titillating.

El Cid Revived Through the Voice of W. S. Merwin

Lauren E. Naylor, Junior, English, LAS

Faculty Mentor: Charles Wright, English, LAS

ABSTRACT

The work done by W. S. Merwin during the past 50 years in poetry, literature, and translation can be regarded as part of the modern day canon of influential and profound work. This status is further justified through the impressive Merwin collection at the University of Illinois at Urbana-Champaign's Rare Book and Manuscript Library. It is a valuable and extensive collection of his manuscripts, books, notes, correspondence, ideas for poems, published

and unpublished works, critical writings by Merwin, and personal notes written by Merwin. In an effort to utilize the unique resources at Illinois and Professor Charles Wright's comprehensive knowledge regarding medieval literature and languages, I performed a focus study specifically on Merwin's translations. Though he has translated a vast amount, I chose to focus on his rendition of the medieval Spanish epic of El Cid Campeador. This is one of the first translations Merwin made (1959). The goal of the study was to come to a better understanding of his early methods of translation. This includes methods and trends seen throughout the scribbled on envelopes or the backs of hotel stationary. Humbly the manuscripts that have survived till today show the present day scholar the taxing task of trial and error. Word choice is also a vital undertaking as shifting from old Spanish to modern English could leave much open for interpretation. Therefore the study of Merwin's documents proves how great of agency and voice he has. Finally, beyond systematic aspects, the manuscripts show that Merwin's personal life affected his translations and gives reason to his devotion to certain classical pieces of literature. Merwin has had a profound effect on how contemporary readers understand many of the great works in literature.

Session D.3: Theoretical and Technological Advances (Illini Room C)

Aerosol Deposition of Nanoparticles and Optical Assisted Scanning Tunneling Microscopy of Aerosol Deposited Carbon Nanotubes on Thin Gold Films

Stevia Angesty, Junior, Chemistry, LAS

Mentors: Martin Gruebele, Chemistry, LAS (Faculty); Gregory E. Scott, Chemistry, LAS (Graduate Student)

ABSTRACT

Many techniques have been attempted for depositing single nanoparticles onto surfaces for study by scanning microscopy. Dry contact transfer (DCT) is a technique currently used for depositing carbon nanotubes onto surfaces in ultra high vacuum. This technique has limitations; thus, we are developing alternative deposition methods that would work for a variety of nanoparticles. An aerosol deposition method has been applied to deposit both single walled-carbon nanotubes (SWCNTs) and quantum dots. A solution of nanoparticles is sprayed onto the surface in microdroplets leaving isolated nanoparticles on the surface. The aerosol deposition technique provides the most consistent result—evenly distributed isolated nanoparticles. The aerosol deposited SWCNTs on thin gold films are observed with Scanning Tunneling Microscope to investigate their molecular optical absorption. Thin gold films are utilized as it allows the study of single molecule absorption at broader ranges of wavelengths in comparison to other semi-conductive materials.

Electrical Characterization of Semiconductor Nanostructures

Serena D. Liou, Senior, Electrical Engineering, ENG

Faculty Mentor: Xiuling Li, Electrical and Computer Engineering, ENG

ABSTRACT

The primary goal of this senior thesis project is the electrical characterization of III-V semiconductor nanostructures. In particular, focusing upon planar nanowires grown upon (110) semi-insulating GaAs substrate in the <110> direction. These structures grow along the surface, allowing for easier formation of two-terminal resistive devices and more importantly nanowire metal semiconductor field effect transistor (MESFET) devices. Characterization of these devices is vital to determining the correlation of electrical dependencies to physical characteristics, including length, width, and diameter, which help us to determine more desired growing conditions. Accomplishing these tasks includes observation of the physical device using scanning electron microscope (SEM) as well as various two- and three-terminal measurements. These techniques will lead to future work involving control of device growth in order to fully utilize the potential advantage of smaller dimension capability and high mobility of III-V semiconductors.

Object Search: Searching the Web the Object-oriented Way

Abhishek G. Pradhan, Sophomore, Computer Science, ENG

Penn Su, Sophomore, Computer Science, ENG

Faculty Mentor: Cuong Kim Pham, Computer Science, ENG

ABSTRACT

The average student concerned with the academia searches for information on the internet concerning their course curricula and related topics, to do this there are many a means to sift through the abundance of websites on the internet. Search engines such as Google, and Yahoo are examples of some of the tools that are used to research and gather information; the good part about these engines is that they are very helpful when the user has a specific idea of what he or she is looking for, but what happens in a situation where the user is unable to provide the correct keywords needed to produced a desired result. What is needed is a directed search engine that helps in producing germane results when the user is unable to achieve their result due to limited information. It is due to this reason that we are developing an application that will help students to find course related information by allowing for directed searches based on a limited amount of information or keywords. Our research focuses on developing this method of effectively targeting course websites on top of an "object search framework" developed by the Database and Information Systems Laboratory.

On the Use of Annihilation Operators in Solving 1-D Viscoelastic Wave Problems with Absorbing Boundaries

Sarah E. Fullmer, Senior, Aerospace Engineering, ENG

Faculty Mentor: Harry Hilton, National Center for Supercomputing Applications

ABSTRACT

The analytical solution of a 1-D wave problem with single Maxwell viscoelastic type behavior is discussed. The effects of various absorbing boundary conditions on the solution is compared with the use of annihilation operators. Generalized annihilation operators for use with any kind of isotropic viscoelastic medium is then discussed. It is seen convolution integral transforms are required for more complex general cases, which can be analyzed in terms of asymptotic expansion of viscoelastic moduli.

Poster Presentations

PA Session: Morning Poster Presentations, 10:00 a.m.- Noon (Pine Lounge)

PA.01. Accessibility of Attachment Orientation and the Affective Consequences

William J. Chopik, Senior, Psychology and Sociology, LAS

Faculty Mentor: Chris Fraley, Psychology, LAS

ABSTRACT

The presence of neuroticism within romantic relationships has a well documented history of adverse effects. As predictive of relationship length and satisfaction, higher levels of anxiety can be problematic. Furthermore, research has also indicated that relative accessibility of attachment orientation may actively shape the way people conceptualize any given relationship. Here, we present a study that attempts to manipulate this very accessibility to reveal changes in an individual's overall neuroticism. After undergoing a visualization exercise, participants reported higher and lower levels of neuroticism contingent on the attachment orientations with which they were primed. This finding is even more surprising when these changes were achieved irrespective of a contemporary self-report measure of adult attachment. Not only do these results corroborate the connection between attachment anxiety and neuroticism, but can also provide insight into the dynamic nature of internal attachment states.

PA.02. Personnel Selection, Facebook, and the Dilution Effect: Is More Information Really Better?

Paige J. Deckert, Senior, Psychology, LAS

Faculty Mentor: Neal Roese, Psychology, LAS

ABSTRACT

When an individual is faced with a decision or prediction, they will use all the information available to them, even if it is not applicable. The dilution effect asserts that when this non-diagnostic information is present, it will distract the decision maker from the diagnostic information, diluting its effect and resulting in suboptimal decisions. Facebook.com has become a popular way to check up on job applicants by personnel decision makers. The goal of this study is to determine whether through the dilution effect, if non-negative, non-diagnostic information hurts a candidate's chance at receiving a position? Participants in this study were shown resumes of varying credentials were paired with Facebook profiles in the experimental condition to examine how non-diagnostic information effects the impressions and personnel decisions made by participants. We found no significant difference between the quality of the Facebook profile and either the impressions or the personnel decisions that were made. This suggests that the dilution effect may not hold when non-diagnostic information is presented on the internet, or when the evaluators are not experienced personnel directors.

PA.03. Encumbrance Impairs Slope Perception

Alex C. Essenmacher, Senior, Psychology, LAS

Faculty Mentor: Ranxiao Wang, Psychology, LAS

ABSTRACT

Visual judgment of a slope's inclination is often exaggerated. This overestimation of steepness can be affected by ones psychological and physiological circumstances, such as exhaustion and discomfort. We examined the influence of these factors on slope perception in tabletop scale with steep and shallow target slopes. Participants judged the slant of cardboard slopes both while standing unencumbered and while wearing a weight-appropriate backpack. Our results showed that systematic overestimation occurs in visual judgments of tabletop scale slopes as in real hills. Moreover, we also found that the rate of increase in overestimation differed between shallow and steep slopes. That is, initially overestimation errors increase rapidly as the steepness of the slope increases. When the slope reaches a certain angle (around 30-40 deg.), however, the errors no longer increase with the slope much and may even begin to decline. This finding suggests that steepness range is an important factor in the study of slope perception, which has been overlooked in the previous research. The data also demonstrated an effect of encumbrance, but only in the small slope range. When the slopes were relatively shallow, subjects made larger errors while encumbered than while

not, replicating past research conducted in real hills. With steeper slopes, however, this effect disappeared. The results also showed an order effect. Subjects performing the control condition first displayed the encumbrance effect. Those performing under encumbrance first continued to show similar errors in the control condition when the backpack was removed, suggesting the effect of encumbrance has a relatively long recovery period. Psychological factors such as the ability to focus attention may play a role in the slope judgment error.

PA.04. The Long Term Effects of Childhood Trauma on Anxiety and Depression

Jessica L. George, Senior, Psychology, LAS

Faculty Mentor: Wendy Heller, Psychology, LAS

ABSTRACT

Generalized anxiety disorder (GAD) and major depressive disorder (MDD) are two commonly comorbid psychological disorders that afflict many people world wide. Because the symptoms of these two mood disorders vary greatly, it is often difficult to determine what factors may cause these disorders. One theory suggests that victims of past childhood trauma or abuse may be particularly susceptible to mood disorders, especially anxiety and depression later in life. The goal of this study is to examine whether there is a relationship between childhood trauma, generalized anxiety disorder, and major depressive disorder. Childhood trauma can be measured and classified by the Childhood Trauma Questionnaire. This neuropsychological measure is given to adults to retrospectively assess levels of emotional abuse, physical abuse, sexual abuse, emotional neglect, and physical neglect that were experienced during childhood. Participants in this experiment were also given a series of neuropsychological assessments that measure components of generalized anxiety disorder and major depressive disorder. In addition to the neuropsychological data, all subjects performed a cognitive task while in a functional magnetic resonance imaging machine. The cognitive task used was an emotional Stroop task, where participants are presented a series of emotionally charged words appearing in colored ink. Participants are directed to indicate the color of the word quickly and accurately, while ignoring its meaning. The functional magnetic resonance imaging was used to measure which regions of the brain were active during the Stroop task. The results from the neuropsychological questionnaires suggest that there are relationships between specific subtypes of abuse and components of the two mood disorders (GAD and MDD). Additionally, specific brain regions, measured by functional magnetic resonance imaging, may also be associated with childhood trauma.

PA.05. Predators May Be Inviting Parasites to the Party

Christine J. Knight, Senior, Integrative Biology, LAS

Faculty Mentor: Carla Cáceres, Animal Biology, LAS

ABSTRACT

By selectively culling infected hosts, some predators can reduce the spread of disease within the host population. However, not all predators select prey in the same way, hence predator effects on host-parasite interactions may vary with the species of predator. Since 2002, epidemics of the parasitic fungus (*Metschnikowia bicuspidata*) have been followed in 19 lake populations of *Daphnia dentifera*. Epidemics only occur in nine populations, and only in the late summer and early fall. Predators likely play a role in the timing and distribution of this disease. Visually-orienting fish predators are highly selective on infected individuals and hence may inhibit epidemics in some lakes by selectively removing infected hosts. Invertebrates such as the midge *Chaoborus* are also effective predators in lakes, but their potential role in disease transmission is unknown. We hypothesized that *Chaoborus* may facilitate disease transmission by liberating spores from infected hosts. Experiments revealed that *Chaoborus* do liberate many of the spores from *Daphnia*; furthermore, the spores are viable for future infection.

PA.06. Identification and Characterization of *H. pylori* Acidocalcisome-like Granules

Eun Ik Koh, Junior, Molecular and Cellular Biology, LAS

Faculty Mentors: Steven Blanke, Microbiology, LAS; and Manfredo Seufferheld, Natural Resources and Environmental Sciences, ACES

ABSTRACT

Acidocalcisomes are polyphosphate storage organelles described in several eukaryotes, ranging from slime molds to human platelet cells. In this work, we propose that polyphosphate granules of *Helicobacter pylori* possess properties similar to acidocalcisomes. *H. pylori* cells were collected and the polyphosphate granules were isolated using a collection of lysis buffer, DNase and silica. The granules were separated from other particles in the cell through a density gradient formed using an ultracentrifuge. Fluorescent microscopy using 4',6'-diamino-2-phenylindole (DAPI) staining has localized the presence of polyphosphate molecules within the granules. Transmission electron microscopy of the isolated granules has revealed that each intracellular granule was surrounded by a membrane. Biochemical analysis indicated that the granules were dense and contained large amounts of long and short chain polyphosphate molecules. The results suggest that acidocalcisomes have been conserved from prokaryotic to eukaryotic cells, and also raises the question of the presence of organelles within bacteria. In addition, it has been found that

the virulence of *H. pylori* decreases when the polyphosphate kinase gene has been knocked out. This has implications on the formation of polyphosphate granules and how the organism would respond to stress without the polyphosphate kinase gene. All of these factors can aid us in understanding *H. pylori* infections and possible targets for treatment.

PA.07. Functional Analysis of Neurovascular Adaptations to Exercise

David A. Krone, Junior, Molecular and Cellular Biology, LAS

Faculty Mentor: Justin Rhodes, Biological Psychology, LAS

ABSTRACT

The discovery that aerobic exercise increases adult hippocampal neurogenesis and can enhance cognitive performance holds promise as a model for regenerative medicine. This study adds two new pieces of information to the rapidly growing field. First, we tested whether exercise increases vascular density in the granular layer of the dentate gyrus, whole hippocampus, and striatum in C57BL/6J mice known to display procognitive effects of exercise. Second, we determined the extent to which new neurons from exercise participate in the acute neuronal response to high levels of running in B6D2F1/J (F1 hybrid of C57BL/6J female by DBA/2J male). Mice were housed with or without a running wheel for 50 days (runner vs. sedentary). The first 10 days, they received daily injections of BrdU to label dividing cells. The last 10 days, mice were tested for performance on the Morris water maze and rotarod and then euthanized to measure neurogenesis, c-Fos induction from running and vascular density. In C57BL/6J, exercise increased neurogenesis, density of blood vessels in the dentate gyrus and striatum (but not whole hippocampus), and enhanced performance on the water maze and rotarod. In B6D2F1/J, exercise also increased hippocampal neurogenesis but not vascular density in the granular layer. Improvement on the water maze from exercise was marginal, and no gain was seen for rotarod. Running increased the number of c-Fos positive neurons in the granular layer by fivefold, and level of running was strongly correlated with c-Fos within 90 min before euthanasia. In runners, ~3.3% (± 0.008 S.E.) of BrdU positive neurons in the middle of the granule layer displayed c-Fos when compared with 0.8% (± 0.001) of BrdU-negative neurons. Results suggest that procognitive effects of exercise are associated with increased vascular density in the dentate gyrus and striatum in C57BL/6J mice, and that new neurons from exercise preferentially function in the neuronal response to running in B6D2F1/J.

PA.08. Program Development of Empowerment Methods for Homeless Veterans in the East St. Louis Community

Casey Loving, Junior, Urban and Regional Planning, FAA

Jakendra Williams, Senior, Urban and Regional Planning, FAA

Maria Kaidas, Sophomore, Psychology, LAS

Julia Crowley, Senior, Urban and Regional Planning, FAA

Mentor: Abbilyn Harmon, East St. Louis Action Research Project, FAA
(Graduate Student)

ABSTRACT

The college of Fine and Applied Arts has begun sponsoring an action research course in conjunction with the East St. Louis Action Research Project program. Our mission is to apply theoretical research of homeless persons towards action for the Eagle's Nest Program in East St. Louis involving the prospective opening of the Joseph Center, for homeless veterans. Our focus is creating home like atmospheres for the veterans related to the findings we have from research and interviews with members of the Champaign Times Center. We are looking to apply this research towards life skills and other beneficial programs. Some projects that have been undertaken by the class have been in applying for grants for exterior improvements including a rain garden. Efforts for a healing garden is to help alleviate stress by providing a tranquil, therapeutic atmosphere through nature, something absent in the East St. Louis area. Programs involving community members are also potentials for reintegrating residents into the community. The garden is a potential method for teaching life skills. Interior funding is also a cause of the class. Efforts to sustain funding have been conducted through solicitation of organizations for an adopt-a-room project, or domestic donations. Data collection will be conducted by interviews with residents of the Times Center. Some methods of data collection will be in asking questions, providing images, and asking residents for their input as to design and home aspects of the Joseph Center. This method is being used to better understand how to create home and empowerment procedures in the East St. Louis shelter. Currently the class is in the period of data collection. Results will be finalized by the conclusion of the semester. Our efforts are just one small part of the continuous process of rehabilitating the East St. Louis area that ESLARP works towards.

PA.09. The Impact of Ethnic Fragmentation on Democratization

Nadia L. Nammari, Senior, Political Science and Communication, LAS

Faculty Mentor: Carol Leff, Political Science, LAS

ABSTRACT

The main focus of the proposed research is gaining a better understanding of the connection between ethnic fragmentation and democratization.

The major research question is “How does ethnic fragmentation impact democratization?” Several hypotheses are discussed and tested. The first hypothesis discussed has to do with the overall ways in which ethnic fragmentation can impact democratization. Special attention is paid to the probability of ethnic violence and obstacles in the sharing of power in a democratizing state. The second hypothesis discussed has to do with the impact of ethnic political parties on democratization. Special attention is paid to the relationship between powerful or numerous ethnic political parties and the impact that they have on the democratization process. The last hypothesis deals with the presence of political elite continuity. Political elite continuity refers to the presence of political leaders in power before a state begins democratizing and after the democratizing process has begun. Emphasis is placed on how political leaders of ethnic groups are able to have established roles in the government both before and during democratization, and how this can impact successful democratization. The research uses four case studies to test these concepts. The research seeks to gain a better understanding of how democratization can be strengthened and supported in states with high levels of ethnic fragmentation.

PA.10. Termite Warfare and Dear Enemies: Territoriality in *Nasutitermes corniger*

Timothy K. O'Connor, Senior, Integrative Biology, LAS

ABSTRACT

Territorial battles between colonies of the tropical termite *Nasutitermes corniger* may at times reach epic proportions, embroiling thousands of individuals and occasionally annihilating entire colonies. In other cases, encounters between colonies are entirely peaceable. This spectrum of aggressive behavior is thought to be a tuned response to the relative costs (such as loss of energy and colony members) and benefits (such as preventing resource loss) of defending the colony’s territory against a given opponent. However, as of yet the underlying patterns and broader ecological consequences of such behavior remain unclear. Many territorial animals discriminate between neighbors from strangers and are less aggressive towards familiar individuals, a pattern known as the dear enemy phenomenon. I investigated inter-colony aggression in *N. corniger* to determine a) if evidence for the dear enemy phenomenon exists in this species, and b) if this pattern is caused by familiarity among colonies. First, I assessed responses of individuals from 38 colonies when presented with individuals from alien colonies collected at each of three distances (25m, 100m, 200m) from the original colony. I next experimentally created “neighbors” by allowing individuals from two colonies to habituate to each other, then assessed aggression and compared their behavior to unhabituated nestmates. Results from aggression assays of field colonies and experimental “neighbors” did not support a dear enemy system based on neighbor-stranger discrimination, though closer

colonies were less aggressive than more distant ones. While the cause of this pattern remains unexplained, reduced aggression has important consequences. Territorial species which reduce intercolony aggression have been shown to more effectively exploit their environment, and due to *N. corniger*'s key role as a key decomposer throughout the Neotropics, the observed patterns have critical role in ecosystem functioning.

PA.11. Civil Unrest and Large-Scale Natural Disasters: A Case Study

Jennifer Osiol, Senior, Political Science, LAS

Faculty Mentor: José Cheibub, Political Sciences, LAS

ABSTRACT

Two thirds of the world's population lives at risk of a life-altering disaster event. As natural disasters strike with increasing frequency over the past few decades, researchers in the natural sciences have responded with a variety of studies assessing geographic risk patterns. With few exceptions, the same attention has not been afforded to natural disasters by social scientists. Little research exists assessing the relationship between the natural disaster events and the resulting transformations on political systems, especially of developing nations most susceptible to disasters. A number of large-N studies have indicated that natural disasters can act as catalysts for popular political action such as protests, riots, and even violent civil conflict and model these as responses to a sudden resource scarcity; however, these studies necessarily overlook all but the most general variables for comparison between countries and are therefore difficult to use in predicting post-disaster civil unrest or to integrate findings into policy responses to large-scale disasters. This project addresses the current gap in the literature by investigating the impact of a sudden-onset regional natural disaster on the frequency of political participation events preceding and following a disaster, as studies have before, but considering case-specific conditions such as land use of damaged territory and the presence of a separatist group. Honduras, Nicaragua, Guatemala, and the Chiapas state of Mexico provide a cross-section of countries affected by Hurricane Mitch in 1998. Because these cases are drawn from a temporal and regional control, variations in frequency of post-disaster demonstrations are expected to reflect differences in how the disaster affected each case rather than some other variable. If this project shows a strong relationship between different types of damage and different levels of frequency of public demonstrations, further research could explore regions outside of Central America.

PA.12. Towards Improving Bioenergy Crops: A Comparison of Photosynthetic Rates and Cold Tolerance in *Miscanthus*

Adrienne T. Perkins, Junior, Integrative Biology, LAS

Ashley Spence, Graduate Student, Botany, LAS

Faculty Mentor: Stephen P. Long, Plant Biology, LAS

ABSTRACT

In recent years the problem of global climate change has gained international attention due to the increase in atmospheric CO₂ caused by anthropogenic influences and the burning of fossil fuels. Since the 1970s, the potential of biomass energy as a carbon neutral and sustainable source of energy has been recognized. My research explores photosynthetic CO₂ fixation and cold tolerance as criteria for potential biomass productivity in *Miscanthus*, a biofuel crop. *Miscanthus x giganteus* is a sterile hybrid between *Miscanthus sinensis* and *Miscanthus sacchariflorus*. Perhaps the most important feature of *Miscanthus* is its high yield potential. *Miscanthus x giganteus* is highly productive, in part due to its C₄ photosynthetic pathway. However, most C₄ species including maize, sugarcane, and some species of *Miscanthus*, are native to the tropics, and are sensitive to low temperatures. Recent studies [1] have been able to maintain high levels of photosynthesis at chilling temperatures because it can maintain and increase levels of pyruvate orthophosphate (P_i) dikinase (PPDK), a rate limiting enzyme in the C₄ pathway. Maize shows the opposite reaction—PPDK exponentially declines with exposure to chilling temperatures, effectively shortening its growing season. Nevertheless, as a sterile hybrid *Miscanthus x giganteus* cannot be improved through selective breeding. Therefore new sterile hybrids must be created. In this project, I will compare photosynthetic rates with PPDK activity in 10 *Miscanthus* germplasms to assess which varieties have concomitant photosynthetic capacity and cold tolerance. I will use plants grown at 25/20°C and 14/12°C in addition to field grown plants to take photosynthesis measurements (LI-6400) and assay PPDK concentration. The PPDK enzyme activities and photosynthetic rates will then be compared and statistically analyzed to determine whether PPDK activity is related to photosynthetic rate. The results will then be used to make suggestions about *Miscanthus* varieties as candidates for future breeding programs. Note [1]: Wang, D., Portis, A. R., Moose, S. P., and Long, S. P. (2008). Cool C₄ photosynthesis: Pyruvate P_i dikinase expression and activity corresponds to the exceptional cold tolerance of carbon assimilation in *Miscanthus x giganteus*. *Plant Physiology*, 148: pp. 557-567.

PA.13. Assessing Agricultural Disaster Experience and Preparedness in Southern Illinois

Lisa Pickert, Senior, Natural Resources and Environmental Sciences, ACES
Faculty Mentor: Courtney Flint, Natural Resources and Environmental Sciences, ACES

ABSTRACT

This project explores how farmers in Southern Illinois prepare for and respond to emergencies and disaster. While there has been extensive research on community preparedness and response, there has been considerably less on farmers. It is therefore important to understand how the definition of a disaster might vary for different farmers. Agriculture is a complex system inherently dependent on climatic conditions such as temperature, moisture, and the timing of frosts as well as climate-related factors such as pests and disease. Changes within the system are driven by a combination of environmental, economic, political, and social effects of the forces. The agricultural sector is exposed to risks arising from changing ecological, social, and economic conditions, all of which increase the sector's vulnerability. During the summer and fall of 2008, contacts with state and local emergency and disaster mitigation organizations were made to establish a basic understanding of prevention and management strategies. In addition, thirty-six in-depth interviews with farmers in Southern Illinois of various types of production operations and farm sizes were conducted to assess disaster experiences and preparedness efforts. The results revealed a broad interpretation of the meaning of "disaster" among farmers. There also seemed to be a culture of self-reliance and mutual assistance among farmers which affected local capacity to mitigate risk and respond to emergencies. Informal activities and community planning were more influential than formal emergency preparedness efforts. In sum, recommendations for future disaster management strategies should include a participatory approach that addresses stakeholders, and more in-depth qualitative social studies should be conducted.

PA.14. Winery Consulting: How to Develop on the International Market and Emerge into Touristic Destination

Boris L. Pilev, Senior, International Studies, LAS
Faculty Mentor: Ruth Aguilera, Business Administration, BUS; and Carla Santos, Recreation, Sports and Tourism, AHS

ABSTRACT

This project is designed to resemble a hypothetical consulting for an underdeveloped winery "client." It is based on two major platforms—international business and tourism. The goal of the project is to suggest

methods to a midsize winery on how it could develop effectively on the international wine and tourism markets. On the business side this will be achieved by starting with some basic concepts in the field of international business and by suggesting “know-how” evolved at wineries that already have become well known internationally, such as Freixenet in Spain and Robert Mondavi in the United States. Topics such as human resourcing, e-commerce, business strategy and venture capital will be explored in order to extract concepts to offer to the “client.” The tourism side of the project will deal with the emergence of the winery beyond the wine selling business to the point where the winery is visited because it offers tourism accommodations. It has been a worldwide trend and it appears in the list of suggestions that this project will bring to the winery. This part will be achieved by surveying wineries that already have build upon being focal touristic point. The project will demonstrate how strengthening the human resources, strategy, e-commerce and venture capital will lead to a successful international business company. Along with that the project will suggest how “client” could become a tourism destination by creating accommodations for tourists. The project explores information that has not been offered academically before. Therefore, it uses combined knowledge from different Business and Tourism Classes.

PA.15. Distinct Phosphorylation and Desensitization of β -2-Adrenergic Receptors in Cardiac Myocytes

Biswarathan Ramani, Senior, Biochemistry, LAS

Faculty Mentor: Kevin Y. Xiang, Molecular and Integrative Physiology, LAS

ABSTRACT

The β -adrenergic receptors are responsible for mediating the increase in heart contraction upon stimulation with epinephrine, an endogenous compound released during stress. The β -2-adrenergic receptor (β -2-AR) is believed to be desensitized against further stimulation primarily through its phosphorylation. While the β -2-AR's phosphorylation by two different protein kinases has been well-characterized in different model systems, little is known about the physiological consequences of these kinases' actions on the receptor. These kinases, cAMP dependent kinase (PKA) and G-protein coupled receptor kinase (GRK), phosphorylate specific amino acid residues on the β -2-AR after the receptor's stimulation. Here we show that abolishing these specific phosphorylation sites on the receptor modulated real-time cardiac myocyte contraction rate upon β -2-AR stimulation with isoproterenol. Specifically, mutation of the PKA sites significantly enhanced maximal contraction rate compared to wild-type receptor, whereas mutation of the GRK sites resulted in a smaller, but more prolonged contraction rate increase. In revealing the mechanism of these differences, we show that inhibiting the inhibitory G-protein (G_i) with pertussis toxin or a C-terminal competitive inhibitor (G_i CT) enhanced wild-type β -2-AR mediated contraction rate, but not the mutant β -2-ARs. Additionally, the wild-type and PKA-site mutated β -2-ARs

internalize into the cell after stimulation, while the GRK-site mutated β -2-AR's internalization is significantly slowed. We continue to explore the different stages at which cardiac myocyte contraction rate may be controlled by using fluorescent biosensors to analyze levels of different signaling molecules downstream of receptor activation.

PA.16. Early Postnatal Genistein Exposure Alters Sexually Dimorphic Behavior in Mice

Jessica L. Shaw, Senior, Psychology, LAS

Faculty Mentor: Susan Schantz, Veterinary Biosciences, VMED

ABSTRACT

With the recent dramatic increases in consumption of infant soy formula, it is becoming more important to understand what effects its components could have on developing infants (Henkel, 2000; Mendez et al., 2002; Strom et al., 2001). Genistein, one of the compounds in soy, is a phytoestrogen that is highly estrogenic and has been shown to have a high affinity at estrogen receptor β (Lee et al., 2004; McCarty, 2006). This is significant because estrogens can facilitate sexual dimorphisms when introduced during early development (Bonleon de Castro, 1998). Much of the research on the action of genistein has been done in rodents using an administration regimen that models chronic exposure over a lifetime or with indirect exposure during early life, rather than the direct early exposure human infants experience (Flynn et al., 2000; Lund & Lephart, 2001; Wisniewski et al., 2004). The current study uses an administration model that mimics human infant exposure to understand the effects of early postnatal exposure to genistein on sexually dimorphic behaviors including anxiety, aggression, and taste preference. C57/BL6 mouse pups received oral treatment of either 50mg/kg genistein or 24% soy milk vehicle on the day of birth and the next four consecutive days. Pups and dams were kept on a phytoestrogen-free diet during lactation and following weaning to ensure any differences found were due to genistein exposure on postnatal days (PND) 0-4 and not due to phytoestrogens present in the diet. On PND 55, anxiety was assessed using an elevated plus maze. After anxiety testing, mice were isolated and tested for salt water preference. Finally, aggression was examined using an intruder paradigm. Differences between control and experimental mice are inferred to be due to early postnatal exposure to genistein. Positive findings imply that human infants could be similarly affected by early developmental soy-formula intake.

PA.17. Henrik Ibsen's Poetics

Garrett N. Traylor, Sophomore, Creative Writing and Scandinavian Studies, LAS

Faculty Mentor: Anna Stenport, Germanic Languages and Literature, LAS

ABSTRACT

Henrik Ibsen is widely famed as the father of modern drama and is the most frequently performed dramatist in the world second only to Shakespeare.

Throughout his extensive writing career, Ibsen published 26 works of drama, also receiving high acclaim for his ability as a painter. His career as a poet, however, has been largely overlooked in modern review. Though Ibsen's poetry was largely indicative of the earlier half of his career, it was hardly less developed than his later prose. Contemporary reviews of his verse were largely positive, making the lack of study of Ibsen's verse today all the more of a mystery. By exploring the strategies that made Ibsen famous for his drama, I hope to expose those same aspects in Ibsen's verse and bring to light an integral part of Ibsen's work that has long been ignored in the modern literary world. To do so, I will be examining a representative corpus of his poetry, examining both translated and original works. By using my background in poetry and Scandinavian studies, I will better be able to highlight the critical and historical aspects of Ibsen's verse that make him worth study and review, while at the same time expanding my own knowledge in both areas of study.

PA.18. Assessment of Peer-Led Team Learning in an Engineering Course for Freshman

Niranjan Venkatesan, Sophomore, Electrical Engineering, ENG

Faculty Mentor: Erik Johnson, Electrical and Computer Engineering, ENG

ABSTRACT

ECE 110 is a required course for all freshman in the Electrical and Computer Engineering department. Starting in Fall 2007, Supervised Study Sessions were introduced to implement peer led team learning workshops. These sessions were optional and met for 90 minutes every week. The objective of these sessions were to help students practice difficult problems from past exams. We then obtained implicit consent from the students who took the course and filled out the surveys. After analyzing the data acquired from these surveys from Fall 2007 and Spring/Fall 2008, we expect to find students who attended the Supervised Study Sessions scoring significantly higher on the final exam than those who did not. In addition, regular attendance to these sessions do not guarantee retention among Electrical and Computer Engineering majors.

PA.19. Group Analysis of White Matter and Internal Brain Connectivity by Fractional Anisotropy

Gene J. Yu, Sophomore, Bioengineering, ENG

Faculty Mentor: Brad Sutton, Bioengineering, ENG

ABSTRACT

As the years go by, the mind decays. In order to better preserve brain function, the cause behind this deterioration must be understood. Through advances in imaging technology, it is known how the aged brain is anatomically different from the younger brain. Most evident is the reduction of white matter in older subjects. White matter consists of bundles of axons which are surrounded by myelin. These axons transfer nerve impulses throughout the brain, connecting

them to the gray matter that processes them. If less white matter is the cause of a less efficient brain, how can we quantify the loss in connectivity and the loss in function? Most of the research is based on a software tool called FMRIB's Diffusion Toolbox (FDT). FDT is used to analyze the brain images that are taken via MRI. The subjects include both the young and the old to properly compare the differences in brain by brain. A fractional anisotropy map is obtained for every subject that displays the principle diffusion direction in each voxel of the brain. After obtaining the maps, the connectivity between various regions of the brain is tracked focusing on the relationship between the left and right hemispheres of the brain. The final output is the probability of the fibers of one region of the brain being connected to the target region. By finding the probabilistic connectivity between the same sets of regions among all the old and young subjects, we can see how the connectivity between different areas of the brain changes as a human becomes older. By understanding how the brain ages, we can better deal with the complications that old age brings.

PB Session: Afternoon Poster Presentations, 1:30-3:30 p.m. (Pine Lounge)

PB.01. Mothers' Attitudes about the Innateness of Ability Effects Emotional Experience During Challenge

Elizabeth A. Babcock, Psychology, LAS

Faculty Mentor: Eva Pomerantz, Psychology, LAS

ABSTRACT

Individuals' beliefs about the stability of ability can shape emotional functioning (Dweck & Leggett, 1988; Pomerantz & Dong, 2006). The current research examines whether differences in beliefs about ability cause differences in mothers' and children's emotional functioning in the face of challenges. Such research about parent-child interactions can be beneficial in providing parents and educators with effective methods for educating children. Mothers of 1st and 2nd grade children were randomly assigned to either a condition in which they were told a difficult task children worked on was diagnostic of children's intellectual potential or innate intelligence. Emotional response was measured by observation and self-reports for both mothers and children. Results indicate that when mothers were told the task assessed children's intellectual potential, they reported experiencing positive emotion while working on the task with their child. In contrast, when mothers were told the task assessed children's innate intelligence they reported experiencing negative emotion. These findings suggest that the ways in which mothers view the stability of children's ability may have implications for mothers' emotional response in the face of challenges.

PB.02. Adolescent Development of the Basolateral Amygdala in Long Evans Rats

Chesea E. Belden, Senior, Psychology, LAS

Faculty Mentor: Janice Juraska, Psychology, LAS

ABSTRACT

The basolateral amygdala is an area of the brain that has been found to be critical for fear learning and modulation. Problems in the development of this brain area are believed to contribute to the adolescent onset of many psychological disorders such as schizophrenia and major depressive disorder. Previous studies have shown that this structure grows throughout adolescence and into young adulthood while the number of cells in this structure was found to decrease over the same time period. This study is concentrating on what is contributing to this volumetric growth. It is believed the remaining cells are increasing in size while becoming more inter-connected to one another. This study is measuring the size of the remaining cells as well as comparing the dendritic spine densities across pre-adolescent, peri-adolescent, and young adult Long Evans rats.

PB.03. Impact of Various Forms of Ionizing Radiation on *E. coli* Biofilms

Richard A. Boettcher, Senior, Nuclear, Plasma, and Radiological Engineering, ENG

Neal Balaoing, Senior, Nuclear, Plasma, and Radiological Engineering, ENG

Val Myers, Senior, Nuclear, Plasma, and Radiological Engineering, ENG

Faculty Mentor: James F. Stubbins, Nuclear, Plasma, and Radiological Engineering, ENG; and Stoyan Toshkov, Food Science and Human Nutrition, ACES

ABSTRACT

Research has been performed exposing *E. Coli* and other bacteria biofilms to gamma based ionizing radiation. Our goal is to perform an experiment similar to this but with the added separate components of beta and X-ray radiation for comparison. The idea is to observe the impact these ionizing radiation modalities have on bacteria as a biofilm and not. We will also try to observe the minimum radiation exposure required at various dose rates to effectively destroy the bacteria. Understanding these differences (if there are any) can help engineering choose weather the higher penetrating gamma and X-ray radiation is better than the shallow penetrating beta radiation. If efficient equipment doesn't require radioactive sources for sterilization/preservation of food; instrumentation can be marketed that does not require special radiation safety requirements for transportation.

PB.04. Overcoming Identity in Counterinsurgency

Christopher W. Boyer, Senior, Political Science and Speech
Communication, LAS

Faculty Mentor: Paul Diehl, Political Science, LAS

ABSTRACT

Counterinsurgency theory, though half a century old, has found new life due to insurgent conflicts in Iraq and Afghanistan. At the same time, political science has neglected the study of counterinsurgency, or more specifically, the political processes that must take place to augment military, counter-guerrilla operations. This paper explores the political conditions that facilitate successful counterinsurgency campaigns. The author uses a complex-systems model of counterinsurgency to inform his hypotheses, which focus on restoring general stability and predictability to daily life. Through case studies on the Rhodesian Bush War of 1965-1979 and the Algerian Civil War of 1990-1998, this paper suggests that counterinsurgency is most successful when it devolves security to the local level, restores the rule of law, and works to improve the quality of daily life for the average civilian. The author argues that even when the civilian population is ethnically similar to the insurgency, it will prefer security, stability, development, and rule of law to the rule of its insurgent co-ethnics.

PB.05. Drivers' Risk Assessment and Awareness of Distraction, Mental State, and Roadway Danger

Sara d'Ann Butler, Senior, Industrial Engineering, ENG

Faculty Mentor: Yi Ching Lee, Institute of Aviation

ABSTRACT

The objective of the current study was to use a driving simulator to validate behavioral differences and differences of scanning efficiency between two groups of drivers in order to use their performance data and subjective evaluations to build a training program that aims to transfer risk assessment strategies from safer, experienced drivers to novice drivers. Background: Drivers may not be aware of their own performance under various roadway (external) and mental (internal) situations. In addition, it is not given that behaviors collected from simulated driving reflect what drivers do on the road. Method: Controlled experiments in a driving simulator following two sets of instructions and post-drive interviews were used to gather objective and subjective evidence on how drivers scanned and attended to roadway objects and events and how they handled various hazardous situations. Experimental manipulations included time pressure, simulated phone conversations, concurrent memory task, and heavy traffic. Results: Older, more experienced drivers were more likely to detect visual targets and were more aware of various mental demands related to distractions and roadway danger. Awareness of risks was associated with different combinations of strategies and internal factors. Conclusions: Instructions given to participants

and design of scenarios affect the degree to which behaviors transfer from real-world driving to simulated driving. Application: Outcomes of the study will lead to the design and implementation of a training program that focuses on educating novice drivers to better assess internal and external risks and their own mental state to improve overall safety and driving experience.

PB.06. Inverse Problems with Boundary Measurements

Woon Lyn Esther Chiew, Senior, Mathematics, LAS

ABSTRACT

Impedance imaging has received a lot of attention in the past two decades, as a means for non-destructively imaging the interior of a conductive object. One injects a known electrical current pattern into an object at the exterior boundary, then measures the induced potential (voltage) on some portion of the boundary. The goal is to recover information about the interior conductivity of the object, which (we hope) influences the voltages we measure. Of course one can also use multiple input currents and measured voltages. In this project, we take a continuous situation and model it using the discrete case, in particular by applying different electrical potentials to the boundary of a square grid of nodes and wires of known resistance. By gathering the current and voltage data from these boundary nodes, we then analyze these so as to find out more information regarding the inside of the square grid of nodes. Another variation of the project would be to apply heat to the nodes and measure the heat flux and temperature of the boundary nodes. By analyzing this information using Ohm's Law and the heat equation, we discover patterns and vital clues that give us information about the inside of the square grid.

PB.07. Effects of Ice Accretion on Propeller Blade Performance

Austin B. Ellis, Senior, Aerospace Engineering, ENG

Faculty Mentor: Mike Bragg, Aerospace Engineering, ENG

ABSTRACT

This study consists of performing wind tunnel experiments on two-dimensional airfoils of propeller blades with simulated ice shapes attached. The purpose is to quantify the effects that ice accretions have on propeller blade performance factors. The airfoils are tested in a 15" x 15" wind tunnel test section. Ice shapes are simulated by attaching off-the-shelf materials and roughness elements to each airfoil surface. A wake rake is used to measure effective drag and pressure taps on each airfoil measure effective lift. Experiments thus far have shown a general decrease and increase in maximum lift and drag respectively. The ultimate goal is to develop a computational method for predicting propeller performance in various icing conditions.

PB.08. The Effect of Enriched Environment on a Rat Model of Parkinson's Disease

Sara Daleiden, Molecular and Cellular Biology, LAS

Faculty Mentor: William Greenough, Psychology, LAS, Center for Advanced Study, and Beckman Institute

ABSTRACT

Parkinson's disease is a common neurodegenerative disorder that affects many people in the aging population. Although the cause for Parkinson's disease has not been determined, it has been found that the pathological cause for the disease involves the degeneration or dysfunction of dopaminergic neurons within the substantia nigra pars compacta. Exercise is thought to have a protective effect in the brain due to increased vasculature and oxygen levels. Using the 6-OHDA Parkinson's Disease model in rats we found that rats that were put into an exercise conducive environment had a higher retention of dopaminergic neurons in the substantia nigra compared to rats that were not. These findings indicate that exercise may have protective effect on the loss of dopaminergic neurons in the substantia nigra.

PB.09. Structural Analysis of an Engineered Heme-Copper Center in Myoglobin (swMb L29H, F43H, V68T) that Mimics Cytochrome c Oxidase

Junhong Gao, Senior, Molecular and Cell Biology, LAS

Faculty Mentor: Yi Lu, Chemistry, LAS

ABSTRACT

Heme-copper oxidases (HCO) are terminal proteins of the respiratory chain in eukaryotes and bacteria. They are large membrane-bound proteins that catalyze ninety percent of molecular oxygen reduction in the biosphere. During the catalytic reaction, oxygen is reduced to water. The energy released in this reaction is harvested for pumping proton across the mitochondrial membrane. HCO deficiencies or naturally occurring mutations have been linked to Alzheimer's disease, Leigh syndrome, and aging. Therefore, understanding the structure and function of this enzyme superfamily will provide an important understanding and contribution to human healthcare. Since HCOs are large and membrane-bound proteins, it has been difficult to isolate HCOs in a single homogeneous form. Sperm whale myoglobin (swMb) is a small protein that consists of single polypeptide chain (153 amino acid residues) and contains a single heme center. Therefore, Myoglobin can be obtained in a single homogeneous form and designed and engineered the heme-copper site of HCO. This biosynthetic model will be free of other chromophores. We designed and engineered of a heme-copper site in swMb based on the structure of swMb (L29H, F43H) (called CuBmb). The role of copper ions was also studied by replacing the copper ions with Zinc (II),

another divalent metal ion, in the engineered protein. We have successfully obtained crystal structures of Myoglobin (L29H, F43H, V68T) as well as this triple mutant contained Zinc (II) at the resolution of 1.6 Angstrom. The kinetic study of the O₂ reduction indicated that the rate of heme degradation was decreased. The results indicate that the threonine plays an important role in design and engineer the protein scaffold of HCO.

PB.10. Effects of Action Video Game Playing on Driving Performance under Single and Dual Task Conditions

John G. Gaspar, Senior, Psychology, LAS

Faculty Mentor: Art Kramer, Psychology, LAS

ABSTRACT

Driving is a complex task which places a substantial strain on attentional resources. Past research has shown that secondary tasks impair driving performance (Strayer & Drews, 2003; 2007). One explanation offered for degraded performance is that the addition of a demanding secondary task reduces the amount of attention a driver can allocate to driving. Experienced action video game players have shown superior performance on visual attention tasks and action video game training has been shown to transfer applied settings, such as piloting (Green & Bavelier, 2003; 2006; Gopher et al, 1994). The purpose of this study was to examine the effect of action video game experience on simulated driving behavior under single and dual task conditions. experienced drivers completed two simulated drives in which they encountered a series of potentially hazardous events. One drive was performed while the driver was engaged in a naturalistic, hands-free phone conversation. Cell phone conversations impaired driving performance. Experienced action video game players outperformed non-players on measures of visual attention. However, this difference showed limited transfer to driving performance. These results suggest that the improvements in visual attention associated with video game experience do not strongly translate to improvements in driving for experienced drivers.

PB.11. Public Pension Plan Finance

Kathy Y. Gu, Senior, Actuarial Science, LAS

Faculty Mentor: Rick Gorvett, Actuarial Science Program, LAS

ABSTRACT

Retirement plans across the United States are in a precarious condition. Exposure to longevity risk, volatility in the financial markets, inadequate funding, and the lack of accountability by plan sponsors to rein in costs are among the major issues faced by private pension plans, Social Security, and public pension plans in general. In particular, the differences in funding and accounting rules between private and public pension plans raises incentives to further decrease the funded status of public pension plans. The inherent

differences between a public and a private employer have played a role as well; a public employer's ability to tax and its vulnerability to pressures in the political arena have produced incentives to increase benefits or shift the costs to a later time and generation. This paper describes and examines several suggested mechanisms that might contribute to the financing of public pensions. Approaches examined include pension obligation bonds, home pensionization, and especially the securitization of pensions. In particular, we describe and consider a collateralized pension obligation (CPO) as a long-term, integrated solution that addresses the demographic, macroeconomic, and incentive risks to increase the financial viability of public pension plans. A CPO could enable employers to trade their unmatched pension assets and liabilities to the capital markets, with the risks and associated returns tranching. These possible mechanisms will be examined relative to alternative economic and financial scenarios. This paper will overview the current problems with public pension plans, examine previous efforts to securitize, analyze the economic viability of securitization, and use the CAS/SOA financial scenario model to estimate the effect of a CPO.

PB.12. Investigating Possible Conformational Changes in Horseradish Peroxidase Due to Choline Chloride-Urea

Angela K. Hsieh, Senior, Bioengineering, ENG

Wiktor Stopka, Senior, Bioengineering, ENG

Faculty Mentor: Mary-Grace Danao, Agricultural and Biological Engineering, ACES and ENG

ABSTRACT

Deep eutectic solvents (DES) are solvents formed when two solid compounds are heated and the resulting mixture has a lower melting point than those of its components while remaining in the liquid state at room temperature. DES exhibit similar properties as ionic liquids (ILs), salts with melting points below 100° C that have negligible vapor pressure, are non-flammable, thermally and chemically stable, and variably miscible with water and organic solvents. Both DES and ILs are capable of dissolving organic, inorganic, and polymeric materials. In our previous study, it was determined that the activity of horseradish peroxidase (HRP) was significantly decreased upon being dissolved in choline chloride-urea, one type of DES. This was done using a colorimetric 2,2'-azino-bis(3-ethylbenzthiazoline-6-sulphonic acid) (ABTS) assay. It was discovered that a notable decrease in enzyme activity was observed with increasing concentrations of DES, though the exact mechanism by which DES inhibits HRP activity was unknown at the time. This study attempts to further clarify this phenomenon by investigating whether the structure of the HRP protein is changed upon exposure to choline chloride, a known denaturant. HRP was immobilized in a thin agarose hydrogel film cast on a hanging drop slide. The HRP was then wetted with a certain concentration of ionic liquid

and a UV-VIS absorbance measurement was recorded at defined time intervals. The IL and DES used in this study were (a) 1-ethyl-3-methylimidazolium acetate; (b) 1-ethyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide; and (c) choline chloride:urea (1:2 mol:mol). Since HRP has functional heme group in its structure, it forms a well defined wavelength peak known as a Soret band, which is indicative of a properly folded protein conformation. Deviations in absorbance of this Soret band peak over time were examined to provide insight on which ionic liquids enhance HRP's stability and activity.

PB.13. Gene Expression Profiling and Characterizing the Photosynthetic Health of a Soybean Mutant

Tristesse Catessa Jasmine Jones, Junior, Crop Sciences, ACES

Faculty Mentor: Steve Clough, Crop Sciences, ACES

ABSTRACT

Plants deal with stress in their everyday environment, and how well they deal with this stress determines if they will be able to adapt to fluctuating growth conditions. Excess light stress is an important issue for a plant and, therefore plants have evolved many mechanisms to deal with excess light. As chloroplasts absorb light for photosynthesis, they must also prevent photodamage from excess light energy. A soybean mutant that appeared to be defective in its ability to handle excess light was identified, that displays a brownish shimmer color that may be due to light-induced oxidative stress. The purpose of this experiment was to characterize this soybean mutant to allow a further understanding of how plants protect themselves against light stress and possibly biotic stresses as well. Hydrogen peroxide levels were tested, which is one indication of oxidative stress, using a peroxide sensitive dye, along with a microarray analysis and a photosynthetic measurement, all comparing the mutant vs. the parent line. The hydrogen peroxide test showed little change in the mutant vs. the parent. The microarray analysis showed that there is a defect in the expression of a superoxide dismutase (SOD) gene and the photosynthetic measurement showed a 3.5% decrease in photosystem II efficiency in younger leaves and a 26.1% decrease in older leaves in the mutant compared to the parent. The soybean mutant may be defective in handling light energy as a consequence of poor expression of the superoxide dismutase gene. The future direction for this experiment is to sequence the corresponding SOD gene in the soybean mutant to understand why its expression is defective.

PB.14. Plasticity in the Auditory Thalamus Following Exposure to Complex Acoustic Sequences

Kathleen M. Mettel, Senior, Speech and Hearing Science, AHS

Faculty Mentor: Pritesh Pandya, Speech and Hearing Science, AHS

ABSTRACT

Powerful plasticity mechanisms can substantially alter tuning of auditory

neurons under appropriate conditions. Unfortunately, relatively little is known about how plasticity in the auditory thalamus is expressed. To determine if and how plasticity is expressed in the auditory thalamus, I report our preliminary analysis of neuronal data that was recorded from this region (n=7 animals, 251 thalamic sites). A subset of these animals were exposed to a simple spectrotemporal acoustic sequence that consisted of a 12 kHz high-frequency tone (H), a 5 kHz low-frequency tone (L), and broadband noise (N) separated by 100 msec. Exposure to this target sequence was for ~300 times per day for ~25 days. The “H-L-N” sequence was reinforced using chronic deep brain stimulation techniques. Frequency-intensity tuning curve properties were analyzed using a blind procedure to minimize experimenter bias. We analyzed bandwidth, timing in response to tones, response strength, and spontaneous activity. Overall, the preliminary results are encouraging and suggest several significant differences across the entire data set. The results suggest that neurons in the auditory thalamus, like the auditory cortex, show plasticity when exposed to a complex acoustic sequence. The results will be discussed in the context of previous work on experience-dependent plasticity in the auditory system.

PB.15. Fabric as Fine Art

Christina D. Michelon, Art History and Sculpture, FAA

ABSTRACT

Fabric as Fine Art will explore the evolution of textiles in art throughout the past century. Through art historical research, a concise study of the role of textiles in fine art will be assembled. Additionally, the work of contemporary artists, such as Mike Kelley, Annette Messager, and Elaine Reichek, will be included. In conjunction with samples of my own artistic experimentation with textiles, Fabric as Fine Art will investigate fabric’s conceptual and physical properties, its gender associations, its capabilities, and its limitations. Special attention will be paid to the qualities and origin of the textiles. Reclaimed or recycled fabrics present additional opportunities for conceptual exploration, while the material properties of other textiles can also lend themselves to visual and structural investigation. It is my hope, through physical artistic experiments and art historical research, to realize the future possibilities of textiles. I intend to further investigate how fabric can be seen as a serious medium in the world of fine art.

PB.16. Neuroanatomical Specificity of Brain Activity Elicited by Contextual Cues Paired with Cocaine vs. Lithium Chloride in Male Outbred Hsd:ICR Mice

Daniel S. Miller, Sophomore, Molecular and Cellular Biology and Psychology, LAS

Faculty Mentor: Justin Rhodes, Psychology, LAS

ABSTRACT

Neural pathways involved in reinforcement to both aversive and rewarding stimuli overlap extensively. The purpose of this study was to determine whether differences in brain activation (as measured by immunohistochemical detection of c-Fos) can be detected in response to a contextual stimulus paired with an injection of cocaine (reward) versus lithium chloride (aversive). Male, outbred Hsd:ICR mice were conditioned to a context (either hole or grid texture) by pairing with either saline, cocaine or lithium chloride. In the first phase, animals were measured for conditioned place preference or aversion. In the second phase, animals were placed into the paired or unpaired context, then euthanized for measurement of c-Fos. Animals showed significant place preference for cocaine and place aversion to lithium chloride, and the magnitude of the effects were comparable. The c-Fos response to the conditioned stimulus was similar for cocaine or lithium chloride. c-Fos increased in the prefrontal cortex (PFC) and paraventricular thalamic nucleus (PV) and decreased in the dentate gyrus. The magnitude of place preference or aversion was strongly correlated with c-Fos in the PFC and PV.

PB.17. Role of FimW, FimY, and FimZ in Regulating the Expression of Type I Fimbriae in *Salmonella enterica* Serovar Typhimurium

Jeffrey A. Pearl, Senior, Bioengineering, ENG

Supreet Saini, Graduate Student, Chemical Engineering, ENG

Faculty Mentor: Christopher Rao, Chemical and Biomolecular Engineering, LAS

ABSTRACT

Type I fimbriae in *Salmonella enterica* serovar Typhimurium are surface appendages that facilitate binding to eukaryotic cells. Expression of the fim gene cluster is known to be regulated by three proteins - FimW, FimY, and FimZ - and a tRNA encoded by fimU. In this work, we investigated how these proteins and tRNA coordinately regulate fim gene expression. Our results indicate that FimY and FimZ independently activate the PfimA promoter which controls the expression of the fim structural genes. FimY and FimZ were also found to strongly activate each other's expression and weakly activate their own expression. FimW was found to negatively regulate fim gene expression by repressing transcription from the PfimY promoter, independent of FimY or FimZ. Moreover, FimW and FimY interact within a negative feedback loop as FimY was found to activate the PfimW promoter. In the case of fimU, expression of this gene was not found to be regulated by FimW, FimY, or FimZ. We also explored the effect of fim gene expression on Salmonella Pathogenicity Island 1 (SPI1). Our results indicate that FimZ alone is able to enhance the expression of hile, a known repressor of SPI1 gene expression. Based on our results, we were able to propose an integrated model for the fim gene circuit. As this model involves a combination of positive and negative

feedback, we hypothesized that the response of this circuit may be bistable and thus a possible mechanism for phase variation. However, we found that the response was continuous and not bistable.

PB.18. Variations in Incompatible Volatile Element Concentration in the Sonju Lake Intrusion, Minnesota

Ryan J. Quinn, Senior, Geology, LAS

Faculty Mentor: Michael Stewart, Geology, LAS

ABSTRACT

The Sonju Lake intrusion (SLI) is a 1.1 billion year old igneous intrusion approximately 1200m thick located on the shores of Lake Superior. This intrusion of molten igneous rock was emplaced within granitic country rock during failed-rifting of North America in Precambrian time. The molten body cooled and crystallized in-place and now serves as an example of fractionation in a relatively simple system resulting internal layering of minerals throughout the intrusion. Not only is SLI layered in mineralogy but it also shows variations in volatile elements, specifically Cl, F, and SO₄. In this study our aim is to use the variations in volatile concentrations to better understand the chemical evolution of the intrusion and shed light on the origin of the mineral layering. Park et al. (1996) proposed a hydrothermal fluid passed through SLI after it solidified, separating normally associated platinum group elements and Cu. We have studied Cl and F to see if their results support Park's et al. hypothesis. The hydrophilic and hydrophobic nature of Cl and F, respectively, makes them quintessential in studying the history of a possible hydrothermal fluid. Such a fluid is important to understand if we are to understand the mineral layering of SLI. So far there have been 9 samples spanning 700m of SLI analyzed. Results of which seem to support Park et al. Here I add the results of 5 new samples spanning 200m of unstudied SLI to provide further support.

PB.19. Analysis of Metamorphism Found in the Alta Contact Aureole

Justin A. Rosenblume, Senior, Geology, Economics, LAS

Faculty Mentor: Michael Stewart, Geology, LAS

ABSTRACT

The Alta Contact Aureole, located at the head of Little Cottonwood Canyon, UT, is a classic example of contact metamorphism produced by high temperature, low pressure, low strain and variable fluid pressure. This type of metamorphism is normally produced by igneous rocks such as granites intruding into older colder rock sequences within a few kilometres of the Earth's surface. A contact aureole is defined as the zone or ring of alteration found around the intruded igneous body. The Alta Aureole is commonly used in textbooks as a model for thermal metamorphism of calc-silicate rocks. The Tertiary Alta stock (an igneous body) intrudes Paleozoic calcareous and silicate

sedimentary country rock of the Maxfield Limestone and Ophir formations that are specifically Cambrian in age. More than 25 samples were collected from outcrop exposures in the Albion Basin area of Little Cottonwood Canyon during the 2008 summer field season. This study will focus on ~5 key samples of the igneous stock and metamorphosed sediments. To date, my research has consisted of creating polished petrographic thin sections, and their examination under a petrographic microscope to identify mineralogy. These same samples will be analyzed by Secondary Electron Microscopy (SEM) with the purpose of using equilibrium phase compositions to calculate metamorphic conditions (i.e., pressure and temperature) in the contact aureole.

PB.20. Dendrimer Encapsulation and Release of Nile Red Dye, A Model for Doxorubicin

Alexandra L. Rutz, Sophomore, Chemistry and Molecular and Cellular Biology, LAS

Faculty Mentor: Andrew Zill, Chemistry, LAS

ABSTRACT

The hope of this dendrimer is that drug molecules will bind to this molecule, and once inserted into the body will migrate to a specific region. Once at their target, the dendrimer will degrade and release its drug. The benefits of drug delivery include lower doses and specificity of the location of the drug. The specific dendrimer studied is ideal to carry anticancer drugs. Its properties that make it ideal include a molecular weight that migrates to tumors and degradation in acidic pH (some tumors are acidic). The dendrimer provides a hydrophobic region into which the drug molecules can partition. Nile red is used in this experiment as a model for Doxorubicin, an anticancer drug. Both Nile red and Doxorubicin will partition into the hydrophobic region accompanied by a change in fluorescence. This change in fluorescence can be measured by a fluorometer to identify the location of the drug or dye molecules. Nile red is fluorescent in hydrophilic regions but its fluorescence will be quenched once it enters the dendrimer. An observed decrease in fluorescence indicates the molecule is located in the dendrimer. Doxorubicin behaves in an opposite manner with increase in fluorescence in hydrophobic regions. The degradation of the dendrimer and the release of the drug molecules are also studied. Acid is added to a solution containing the dendrimer encapsulating Nile red dye. If the dendrimer falls apart, there will be an increase in fluorescence since the dye molecules are leaving the hydrophobic region.

PB.21. Creating Clinical Partners in Discourse Elicitation Tasks

Fatima Salem, Senior, Speech and Hearing Science, AHS

Faculty Mentor: Julie Hengst, Speech and Hearing Sciences, AHS

ABSTRACT

Broadly, the goal of speech-language pathology is to develop diagnostic and treatment approaches that enhance the communicative abilities and quality of life of individuals with communication disorders. Critical to this goal is the study of how particular communicative impairments impact discourse. In the clinical area of adult neurogenetics, much work has been done to study the discourse level skills of individuals with acquired cognitive-linguistic disorders (e.g., aphasia) due to brain injuries (e.g., strokes, trauma). These studies have been grounded in two traditions with very different approaches to eliciting discourse samples. The first approach conceptualizes discourse as part of the linguistic system, and utilizes formal elicitation and assessment measures. In this approach clinicians minimize their talk and provide prompts to elicit monologues from clients (e.g., Aphasia Bank Protocol—ABP). The second approach conceptualizes discourse as in interactional, collaborative process using dynamic elicitation and assessment techniques. In this perspective, the clinician is a partner in the discourse elicitation, and the Mediated Discourse Elicitation Protocol (MDEP) is an example. This current research project is designed to explore how easily and effectively novice clinicians can be trained to use these two discourse elicitation techniques. To accomplish this, three student clinicians will be trained to use the ABP and the MDEP and will collect discourse samples from three healthy college students. The samples will be transcribed and analyzed first as a whole (e.g., number of turns, words, topics and conversational narratives), second for the role and contributions of the clinician and student/client, and third to compare clinicians' patterns of participation in the ABP and MDEP sessions. This project will support the development of a training module to train novice clinicians and the identification of discourse markers to be used as fidelity measures in future discourse elicitation and treatment studies.

PB.22. Potential Use of Choline Chloride-Urea Mixtures in Metals and Protein Extraction

Wiktor G. Stopka, Senior, Bioengineering, ENG

Faculty Mentor: Mary-Grace Danao, Agricultural and Biological Engineering, ACES and ENG

ABSTRACT

Deep eutectic solvents (DES) are solvents formed when two solid compounds are heated and the resulting mixture has a lower melting point than those of its components while remaining in the liquid state at room temperature. DES

exhibit similar properties as ionic liquids (ILs), salts with melting points below 100° C that have negligible vapor pressure, are non-flammable, thermally and chemically stable, and variably miscible with water and organic solvents. Both DES and ILs are capable of dissolving organic, inorganic, and polymeric materials. In our previous study, it was shown that a DES mixture of choline chloride and urea could be used to extract a metal, e.g., cobalt chloride (CoCl₂) from an aqueous solution. The extraction entailed slowly adding DES to a dilute aqueous solution of CoCl₂. The DES dissolved CoCl₂ and formed the bottom layer of a biphasic mixture (1:1 vol:vol). CoCl₂ has a strong absorbance in the blue region of the visible spectrum when it is dissolved in DES; it has a strong absorbance in the red region when it is dissolved in water. Using UV/VIS spectroscopy, the relative concentrations of CoCl₂ in the aqueous and DES layers could be quantified and extraction rates and limits to be estimated. This extraction procedure is currently being applied to solutions containing trace bovine serum albumin (BSA). The relative concentrations of BSA in the aqueous and DES layers will be measured colorimetrically using Bradford reagent.

PB.23. One-Year Predictors of Triadic Family Interaction Patterns at Three Years

Kirsten M. Thomas, Senior, Psychology, LAS

Faculty Mentor: Sarah Mangelsdorf, Psychology (Northwestern University)

ABSTRACT

Families have traditionally been studied in the context of dyadic relationships (e.g. marital, parent-child relationships). However, there has been a missing piece in family studies: the study of mother-father-child (or triadic) relationships. According to family systems theory, families are a complex whole, which is formed from related parts, or subsystems (e.g., Cox & Paley, 1997). All subsystems within the family are interdependent. Not only do individuals and dyadic relationships, but also triadic relationships provide a unique context for social and emotional development of the child. Triadic family interaction may, therefore, provide additional clues into how a child embedded within the family develops. We hypothesized that parental depression would predict negative triadic family interaction patterns, because research indicated that parental depression (mostly maternal depression) had a negative impact on parental behavior (Cohn, Campbell, Matias & Hopkins, 1990; Downey & Coyne, 1990; Gelfand & Teti, 1990). We also hypothesized that child temperament would predict negative interaction patterns in a triadic context, because difficult temperament has been associated with negative parenting behaviors (Belsky, 1984; Lindsey, Caldera & Colwell, 2005). When the child was one year of age, parents reported their own depression and their view of their child's temperament. Approximately two years later, a semi-structured family play task was observed in the families' homes and coded using the Young Family Interaction Coding System (Paley, Cox &

Kanoy, 2001). Results showed that fathers' depression at one year predicted lower sensitivity, lower positive affect, and higher intrusiveness during the three-year family interaction observation. Mothers' perceptions of the child's difficult temperament at one year predicted lower sensitivity and higher negative affect during triadic family interaction. These results indicate the interdependent nature of family subsystems, including individuals and mother-father-child relationships.

PB.24. Data Mining Driven Parallel Product Design Optimization

Aukrit Unahalekhaka, Junior, Computer Science, ENG

Michael Hernandez, Sophomore, Electrical Engineering, ENG

Mentors: Harrison Kim, Industrial Engineering and Systems Engineering, ENG (Faculty); and Conrad Tucker, Industrial Engineering and Systems Engineering, ENG (Graduate Student)

ABSTRACT

Cyberinfrastructure plays a significant role in addressing the complex challenges often faced in the engineering design community. This report presents the fundamental benefits of Cyberinfrastructure as it relates to Data Mining and Multidisciplinary Design Optimization. The role of parallel computing software and hardware architectures is presented in relation to managing large data sets and making both data mining algorithms and engineering design optimization models easier to solve. A Java-based Data Driven Product Design (DDPD) Platform is developed that integrates the powerful supercomputing resources at the San Diego Super Computing (SDSC) facility with complex engineering design simulation platforms such as Matlab in an effort to streamline the product design and development process.

PB.25. Detection and Enumeration of Algal Cells via Laser Scanning Cytometry

Derek R. Vardon, Junior, Civil and Environmental Engineering, ENG

Faculty Mentor: David Ladner, Civil and Environmental Engineering, ENG

ABSTRACT

Automated field methods are needed to track phytoplankton growth over the wide range of concentrations encountered during a bloom event. Many field-deployable devices estimate cell concentrations by examining a fluid sample in situ to measure the fluorescence, chlorophyll concentration, impedance signal, and light-scattering properties. Unfortunately, these fluid-phase analytical devices are limited due to their narrow concentration detection range or inability to identify cell characteristics. To address these shortcomings, we developed a novel field-deployable laser-scanning cytometer (LSC) that accurately detects algal cells over an extended range of concentrations (50-150,000 cells/ml), and characterizes cell shape, size, and distribution

parameters through fluorescent signal imaging. Water samples are filtered to collect algae on a 0.2- μm membrane surface. Sample volume is variable so that cells can be concentrated. The membrane surface is scanned with a 635-nm diode laser and the fluorescence signal above 685 nm is recorded. The signal is then processed automatically to generate a cell count and cell distribution image. Through a comparative laboratory study with fluorescence microscopy and flow cytometry, we show that the LSC performs comparably to commercial devices and demonstrates the potential of laser-scanning cytometry for remote detection of algal blooms.

PB.26. Temperature Independent Lead Sensing Based on a Fluorescent DNAzyme

Jenny Wu, Junior, Chemical Engineering, LAS

Faculty Mentor: Yi Lu, Chemistry, LAS

ABSTRACT

Heavy metal contamination affects both the environment and the human health; therefore, developing metal sensors with high specificity, selectivity, efficiency, and accuracy, is vital to protecting the environment and health. DNA based biosensors have been previously designed to specifically detect heavy metal ions and contaminants in water. In previous studies, an in vitro-selected deoxyribozyme was found to specifically bind to lead; this discovery helped to develop a metal-specific sensor. The lead sensing system (+5_17E) was found to detect lead efficiently at room temperature, but the efficiency decreased significantly at lower temperatures. However, when a single mismatch on the enzyme strand was introduced, the system was able to detect lead efficiently at 4° C. Therefore, we have been able to successfully detect lead from 4° C to 25° C. Its detection limit was at 50nM for 4° C and 20nM for 25° C. This mutant DNAzyme sensor was labeled with a fluorophore and a quencher, and fluorescence-based experiments were carried out for studying its activity and its lead dependence. Polyacrylamide gel assays have also been carried out to better understand the activity of the DNA sensor.

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