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Peter Acton  

Determining the Reestablishment Rate of Terrestrial Carbon in Reclaimed Mine Sites in the Southern Appalachian Forest Region and the Restoration of the Regional Carbon Budget

My research project under Dr. James Fox in the Civil Engineering department is unfolding in the anticipated timeframe. Here is a list of work completed thus far:

1. Nearly all fieldwork has been completed. This consisted of two-to-three-day visits each week to sites in Letcher County as well as Breathitt County. I identified seven sites to sample between these two locations. Field work consisted of digging soil pits to a depth of 50 cm and gathering 5 samples throughout the soil column. Notes were taken as well as other pertinent information. Sixteen pits were dug at the old-growth forest in Letcher County, ten pits were dug along a second-growth forest in Letcher County, twenty-two pits were dug within 4 sites in a reclaimed mine site in Breathitt County, and ten more will be dug at a reclaimed mine site in Letcher County. Each of the reclaimed mine sites are at different stages of reclamation.

2. Lab work has been on-going in between field work. This work consisted of preparing materials for the field as well as processing samples from the field. As soil samples arrived weekly from the field, they were dried in an oven for three days, sieved, ground, and, finally, analyzed on an isotopic ratio mass spectrometer. This portion of the project will be very time consuming as repetitive and tedious procedures have to be completed.

3. Beginning in mid-May until early June, I refined my research interest. I am studying soil carbon in reclaimed mining soils due to the lack of existing information. There is a gap in the literature about the carbon budget as a whole in this environment. Attached is a proposal I had written in early June for Dr. Fox.

In the weeks ahead, I will be focusing on analysis of the data. The first round of samples will be returned from the IRMS next week. The second round will come two weeks after. A thorough literature review will be completed as well as a paper of publication quality.

Research Interest:
The uptake of carbon from the atmosphere into reclaimed soil will, over time, play a part in the carbon budget for the southern Appalachian forest region (SAFR). As surface mining commences in an area, nearly all terrestrial carbon, stored in soil, trees, and woody debris, is removed. This carbon is then dispersed into the atmosphere, most commonly through burning. During and after mining operations, ancient carbon termed geogenic organic material (GOM) is taken from deep below and mixed with the reclaimed soil. Indeed, this is a net increase of carbon for the soil; however, it is not a usable form for modern plants to process. As the land becomes reclaimed and the flora takes root, carbon is pulled back from the atmosphere to feed this growth. This completes the cycle.

The timeframe in which the completion of the cycle takes place is not well understood. It can be seen throughout Appalachia that forests recover quickly from logging, often within decades. It is expected to be a much slower process with reclaimed soil, because the topsoil, along with its valuable nutrients, is removed.

Method
Multiple sites will be included in this study. The included sites are: old-growth forest, second-growth forest, 0-year mining reclamation, 1-year reclamation, 5-year reclamation, and 10-year reclamation. The forested sites will act as control points for the plots. Soil pits will be dug to a depth of 50cm and five samples will be obtained from each site. These samples come from the litter, 0-5cm, 5-10cm, 10-25cm and 25-50cm. Soil conditions are known to change from valley to ridge. Therefore, in order to negate topographical effects on this project, the control pits will be dug at roughly the same elevation as well as similar land slope. These samples will be analyzed on an IRMS to determine the following properties: total organic carbon (TOC), total nitrogen (TN), C/N, δ¹⁵N, and δ¹³C. The δ¹³C of GOM will be calculated as well. A simple un-mixing model will be employed to differentiate soil organic material (SOM) from GOM.

A plot of δ¹³C vs. TOC with four points (corresponding to each depth) for each location will be created. The slope of these lines will relate to the decomposition rate,
Mark Adams

Carabid-slug interaction pathways in alfalfa

The goal of this project was to determine the strength of trophic interactions between non-native slugs and generalist predators of concern (ground beetles). Ground beetles were initially collected within alfalfa plots located at the University of Kentucky’s Spindletop Research Station. Collections occurred once weekly for 52 consecutive weeks beginning in mid-May 2008 using pitfall traps containing ethylene glycol (preserving agent). Following collection, beetles were stored in 100% EtOH until the extraction and amplification of DNA occurred. More than 1600 beetles were collected in this time period, with a peak density being reached in late-August. This distribution is largely due to Harpalus pensylvanicus, which accounted for more than 80 percent of the beetles collected and have a peak density in August. Scarites subteraneus and Scarites quadriceps were abundant during spring collections.

A molecular analysis was implemented to elucidate interactions between the carabid beetles collected and non-native slugs. Before the molecular analysis occurred, primers specific for the prey of interest were designed. One set of primers was designed to amplify mitochondrial COI sequences of Deroceras laeve slugs, and a second set of primers was designed to amplify mitochondrial COI sequences of Deroceras reticulatum slugs. Both of these species are present within Kentucky and are associated with crop damage. Data collected during a feeding trial suggests that the DNA sequences of interest have a half-life of approximately eight hours within carabid beetle digestive tracts.

Qiagen DNeasy extraction kits were used to extract DNA from the digestive tracts of the beetles obtained. The molecular analysis of field obtained carabid beetles suggests that there is a strong trophic linkage between several carabid beetles and Deroceras slugs. S. subteraneus and H. pensylvanicus showed high rates of predation during the spring collection period. During the spring, many crops are susceptible to slug damage. Therefore, these results show that carabid beetles are an important component of agricultural ecosystems.

Refuge trapping was used to examine slug abundance within the alfalfa plots while collections took place. Slugs were found in high numbers while spring and late fall collections occurred. Few slugs were obtained during summer collections, offering an explanation for the low levels of predation experienced through summer. Low slug densities are likely due to the dry conditions that existed in much of Kentucky during the summer of 2008.

The results of this work show that there is a strong trophic linkage between two carabid beetle species and Deroceras slugs. During time periods in which the prey species of concern were available, high predation rates were associated with carabid beetles. Future work will include further differentiation of data collected. Several aspects of the project have not yet been analyzed, including beetle sex as well as predation rates within alfalfa plots vs. predation rates along borders of alfalfa plots. More than 95 percent of the beetles collected have been identified while the remaining ~5 percent will be identified within the coming weeks. Following the identification of these specimens, DNA will be extracted and amplified.

Michael Baird

Homosexuality in America
The Children’s Hour was immediately banned from performance in Boston, Chicago, and London due to the play containing homosexual content. The play was made into a film in 1936, but it was adapted with a heterosexual love triangle and the controversial name of the play was changed to These Three for the film. The Children’s Hour made its way to film later on with its lesbian theme intract in 1961 — almost three decades after the play was first produced. Homosexual themes were still considered too controversial for audiences during the early half of the century, but it is interesting to note that only three decades later the play would become accepted for viewing audiences. Perhaps homosexuality was beginning to become so widespread that the country could no longer censor it.

Venturing further into the century, another play was produced in America in the late 1960s that would leave the audience to question their own sexuality. The Boys in the Band, written by Mart Crowley, is a play that is centered around seven homosexual friends who came together to celebrate one of their birthdays. While setting up for the party, however, Alan, a friend from college, calls Michael, the main character, wanting to visit for a short period of time. Michael, being embarrassed about the fact that he is a homosexual, tries to convince his friends to disguise the fact that they are all gay. Tempers flare when Alan feels uncomfortable about the flamboyant men, and he begins to show his masculinity by hitting one of the men in the face. Michael has always questioned whether Alan was a homosexual himself and Alan came to his house that night to have a heart-to-heart talk with Michael.

As the play progresses, Michael begins to investigate Alan’s sexuality by putting it to the test with a game in which each person must call one person and tell them that they love them. Michael becomes shocked to find that the person that Alan calls is in fact his wife and the audience is left to wonder if Alan didn’t “out” himself because he was repulsed by all of the men’s behavior.

The Boys in the Band is still a risqué play even by modern standards, but the mere fact that it was produced in the 1960s is even more shocking. The content of the play yields many thoughts regarding how homosexuals were perceived at this time. By the mere fact that Michael wanted to hide that he was gay from one of his friends, it is obvious that it was still not something with which everyone was comfortable. It also created this awkward atmosphere for Alan as he became very uncomfortable by the flamboyance of the men.

There is also the sense that the homosexual men had formed a bond with one another and became a part of their own social group. This bonding showed that homosexuality was still an underground activity in America. They were more comfortable being together within the confines of a person’s home then out in public, which demonstrates that maybe America wasn’t ready to see homosexuals in public displaying their affection for one another. The play also leaves open question of whether Alan really is gay and just married to his wife because heterosexuality is what is socially accepted. Crowley really left the audience with something to think about by leaving Alan’s sexuality ambiguous. Despite the content of the play, however, The Boys in the Band was able to make it through an astounding 1001 off-Broadway performances and within two years of its debut was adapted into a film.

What I hope to learn/achieve by the end of the summer:
I hope by the end of the summer I will have grasped a better knowledge of how homosexuality has aged in America. I have already researched so many hardships, and the plays convey so much of the different struggles and fears that gay people have endured. If nothing else, I hope that I will have reached a better understanding of the life homosexuals live and an appreciation for what they have endured.

**Works Cited**


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**Chris Barton**

*Development of Poly(ethylene glycol)-based Hydrogel Nanocomposites Containing Carbon Nanotubes for Thermal Therapies*

Because nanocomposites have been shown to have unique properties, a variety of applications in medicine are possible. Through the introduction of nanoparticles that can absorb radiofrequency (RF) fields and dissipate heat, nanocomposites can be applied for remote controlled thermal therapies, such as in hyperthermia cancer therapy. Hyperthermia is a type of treatment in which body tissue is exposed to moderate temperatures (up to 106°F) to selectively treat cancer cells and/or for combination therapies in which the heat can make cancer cells more sensitive to the effects of radiation and certain anticancer drugs.

In this research, hydrogel nanocomposites based on poly(ethylene glycol) (PEG) and carbon nanotubes were fabricated via free-radical polymerization for implantation in thermal cancer therapy applications. Specifically, it is hypothesized that these hydrogel nanocomposites can be used to administer remote heating of tumor sites by exciting the implantable hydrogels using an external RF field. Carbon nanotubes are particularly interesting because they have been shown to enhance the mechanical properties of composites. The nanocomposites were remotely heated via a radiofrequency field at 13.56 MHz to achieve the hyperthermia temperature range.

Results show that multi-walled carbon nanotubes and single-walled carbon nanotube nanocomposites responded differently to the RF fields. In preliminary studies, the single-walled carbon nanotubes have shown greater promise due to higher differential response to that of the control. The effect of different carbon nanotube loadings and different RF power levels on the nanocomposite heating is also being studied. In the future, the properties of these hydrogel nanocomposites will be further evaluated for biocompatibility and thermal therapy applications.

**Daniel Birkenhauer**

*Cellulosic ethanol derived from plant biomass*

Cellulosic ethanol derived from plant biomass offers one of the most promising solutions to meeting U.S. energy independence goals. A major barrier to industrial processing of lignocelluloses, however, is the relative expense, mostly due to the necessity for chemical and enzymatic pretreatment (saccharification) to release simple sugars that can be utilized by yeasts. Plant biomass consists primarily of lignin, cellulose, and hemicellulose. Cellulose yields hexose sugars upon saccharification, whereas hemicelluloses yield pentose sugars. Most brewing yeasts can only utilize hexoses for growth and fermentation. Our goal is to eliminate or reduce the need for chemical and enzymatic saccharification by replacing it with a less expensive biological saccharification process.

There are many filamentous fungi that can reduce plant biomass to simple sugars. The fungus Fusarium graminearum, which causes corn stalk rot, is a particularly promising candidate. F. graminearum can utilize pentose sugars as a sole carbon source for growth. Our objective is to develop a strain of F. graminearum that can be grown on plant biomass (corn stalks and leaves, also called stover) and break down the complex structure, while utilizing pentoses preferentially and leaving the hexoses for the yeast to use. Recently we have demonstrated that F. graminearum is capable of producing ethanol on its own; this finding may potentially allow us to develop an even more economical single-step process to produce ethanol from biomass.

My experiments are focused on several mutant strains of F. graminearum that were derived from strain PH-1 after UV-treatment and selection for increased
growth on hemicellulose (xylan). It has been shown that some of these strains produce up to four times more xylanase enzyme than the wild type strain. My objectives are to compare the mutants to the wild type with regard to several traits including: xylanase production under inducing and non-inducing conditions; fungal growth in different solid and liquid media, including corn stover; spore production; and fertility.

My results so far demonstrate up to a two-fold increase in radial growth rates of the mutant strains on xylan medium. I have also observed that the hyphae of most of the mutant strains are thicker and less branched than the wild type. My current experiments in the laboratory include analyses of the ability of the mutants versus the wild type to produce glucose and ethanol from xylan or directly from corn stover, in cooperation with the USDA forage lab. I am also evaluating the growth of the mutant strains on stover in liquid or solid culture over a twenty-day period in the presence of different nitrogen sources (NH4NO3 or KNO3) and levels of aeration. Furthermore, I am studying the effect of the mutant versus wild type on the stover during solid cultivation, by evaluating the lignin, cellulose, and hemicellulose content before and after inoculation and growth. Finally, I will be testing the stover samples with or without fungal colonization for their amenability to saccharification. These experiments are being done in cooperation with the Biosystems and Agricultural Engineering department.

Another goal is to decipher the genetic basis for the increase in xylanase production by the mutant strains. I will observe the segregation patterns of this trait in the progeny of a cross. I have crossed the mutant strains derived from the F. graminearum strain PH-1 with another F. graminearum strain, Gz3639, which has been tagged with green fluorescent protein (GFP). Visualization of GFP fluorescence under a stereo-microscope will be used to screen for crossed perithecia (F. graminearum is self-fertile, and so the majority of perithecia will be the result of selfing). A list of single nucleotide polymorphisms (SNPs) between the strains PH-1 and Gz3639 is available from The Broad Institute. The SNP analysis will be used to accurately identify recombinant progeny for further genetic analysis.

I am also doing some experiments to evaluate pathogenicity of the mutants to living corn stalks. This information is important because F. graminearum is a significant pathogen that causes crop yield loss in the U.S., and we would not want to release a strain for industrial use that was more pathogenic than the wild type. If the mutants are more pathogenic, further steps would be necessary before the strain could be released commercially, for example, mutating it so that it cannot produce spores. Filamentous fungi can still be propagated in the absence of spores by use of mycelial fragments.

I hope to have most of these experiments completed by the end of the summer, and to obtain enough data to justify continued work on this problem by my lab supervisor and collaborators. If the outcome is successful, the data I generate will certainly be part of a future publication on which I will be one of the authors.

Jenna Brashear

Remembering World War II in New Berlin

In the fall, I will undertake a thesis that will be a comparative analysis of Vietnam memorials in the United States and World War II/Holocaust memorials in Germany. This project is to fulfill requirements for the Gaines Center for the Humanities and my capstone in International Studies. Before the spring semester ended, I completed a detailed prospectus for the project and assembled my thesis committee. Professor Karen Petrone from the History department will serve as the chair, and will be joined by Professors Hillary Herzog of the German department and a newcomer to the History department, Akiko Takenaka.

When school ended in May, I was able to visit the most significant Vietnam memorial in the United States, the black marble V that Maya Lin designed, while participating in a seminar in Washington, D.C. through The Washington Center. At this time, I have been home less than a week from my trip to Germany to see some of the World War II and Holocaust sites in person. The most interesting to me was the Memorial to the Murdered Jews of Europe in Berlin, which was designed by Peter Eisenmann and is comprised of 2,711 concrete stelae of varying heights and slants.

Though these two sites may sound disparate, there are meaningful architectural connections. Both are purposefully abstract and heavily reliant on viewer interpretation and experience. Before the summer ends, I hope to have a solid start to the writing of the paper and a final handle on which monuments and memorials I will analyze. At the present, I am leaning toward writing on the two monuments mentioned with an included section on other sites of significance. When school begins, I hope to have a working rough draft of 10 or so pages and an outline of the paper, which does not have to be completed until spring of 2010.
Tuoxin Cao

Neural inflammation and synaptic plasticity gene expression induce behavioral deficits after traumatic brain injury

According to the Centers for Disease Control and Prevention, 1.4 million civilian traumatic brain injuries (TBI) occur in the United States annually. Most TBIs result in mild to moderate injury and are treated in the emergency department. Survivors often demonstrate functional deficits such as changes in personality, memory, and emotional volatility. Pathology indicates cellular survival with cellular inflammation and neural regeneration after TBI. Our lab hypothesizes that behavioral alterations are due to inflammation-driven circuit reorganization initiated by primary physical damage to the brain. These unregulated neuroplastic events cause circuit restructuring and disruption, which is thought to underlie behavioral modification in TBI patients. Therefore, studying changes of inflammatory and neuroplasticity protein expression will help elucidate the processes involved with the development of behavioral deficits, and isolate new targets for treatment.

The goal of this research project is to determine changes in gene and protein expression after diffuse TBI. In our lab, midline Fluid Percussion Injury is used to induce a diffuse TBI in rats. After a recovery period (one week and four weeks), sensory sensitivity is determined by whisker stimulation, and their brain tissues from the cortex and thalamus are collected. Both of these brain regions serve as a part of the whisker barrel circuit — a circuit that transmits and process information from a rat’s whiskers to its brain. mRNA and protein from those regions are isolated and quantified using real-time PCR and Western Blot, respectively. Several proteins and genes responsible for neural inflammation and structural plasticity will be chosen to describe the injury induced inflammation and regeneration. Quantified neural inflammation and structural plasticity proteins and genes are then correlated to the result of Whisker nuisance task. This correlation will show us if there is a relationship between gene/protein expression level and abnormal behaviors. Results from traumatic brain injured animals and uninjured animals will be compared.

Preliminary results show trends of increasing inflammatory gene expression in both cortex and thalamus. This finding may be indicative of TBI-induce neural inflammation in both the cortex and the thalamus. Following the increased neural inflammatory gene expression, an increase in synaptic plasticity genes expression is evident in the cortex, suggesting increased synaptic plasticity. Also, in the cortex strong correlations exist between abnormal behavior and increased synaptic plasticity genes, indicating that neural plasticity genes may play an important role in the development of behavioral morbidities.

Further quantification of injury-induced inflammatory and synaptic plasticity gene and protein expression in other brain regions is currently underway. Results from this study will help us gain a better understanding about the connection between inflammation, synaptic plasticity, and behavior change in diffuse traumatic brain injured animals and, thus, reveal important information regarding possible new treatments.

Joshua Cason

Computing Modern Endangered and Ancient Languages in the Lexical Knowledge Representation System DATR

Thanks to support from the eUreKa! summer grant program, I have been privileged to participate with UK’s linguistics faculty in their current research activities. I am a linguistics major with interests in computer science. This project is a special opportunity for me, because my part in this project involves the intersection of those two fields: computational linguistics. My work will contribute to what others have been doing in the Shughni project. Shughni is an endangered language spoken in the Pamirian region of Tajikistan. Native speakers, UK professors, and undergraduate and graduate research assistants have all contributed to our collected knowledge of Shughni. This information consists of raw data such as the audio of elicitations from native speakers, and analyses such as the database of the Shughni verbs, which is a project involving other undergraduate and graduate researchers. My role is to develop a computational model of the verb. Work has already begun on it by some of the professors involved, and I will endeavor to extend their work.

I began this summer by taking time to learn the DATR language, the formalism selected for the computational model. Reading the several articles and book chapters introduced me to technologies available to the DATR theorist (see my appended reading list). Below I provide a short summary of what I learned about DATR and its advantages for language study.

DATR is a language designed for modeling natural language grammar. A DATR theory is stated entirely in terms of equations. An equation is a node/path pair declared equivalent to a value. Here is an example theory:

NODE:

< > = = NODE2
< path > = = value
< path2 > = = < value2 >
Nodes appear at the head of each sentence. A sentence ends in a period. The two sentences seen in NODE and NODE2 are actually compound abbreviations. In other words, the first and second equation of NODE might be equivalently written: NODE: < > = = NODE2. and NODE: < path > = = value., period punctuated simple sentences.

Nodes are commonly concepts that one identifies in a language, such as a noun class or a verb class, which share grammatical properties with other such classes. Nodes might distinguish classes that appear in writing or in speech in different forms. For instance, NODE might have been NOUNS_X, where X sets apart the class of nouns that pluralize with an -es rather than -s.

The left side of the equation is always a path, which is formed by enclosing atoms (strings with no spaces) within <> symbols. Paths name grammatical properties such as plural. Thus, the value on the right hand side for NOUNS_X: < plural > might be < stem > _es.

Notice that on the right hand side one may incorporate paths as well as atoms. This fact shows one of the most useful tools in DATR. It is called inheritance. When the value of an equation includes a path, then the program will attempt to evaluate that path at the local node, e.g., < stem > would evaluate to NOUNS_X: < stem > , whatever that value is. When the program reaches an atom, such as _es, that is the value returned finally. This result allows one to share values and build values based on that of other grammatical properties. In an entry for sheep, for instance, one might find the equation < plural > = = < singular >.

Inheritance has other uses in DATR. Languages commonly have broad classes of words that share various forms. Sheep, for instance, is not the only noun whose singular and plural are identical. Thus, DATR allows the theorist to make salient properties of a class inherit a value from a higher, abstract node, e.g., one from which sheep and deer could inherit. This property is specified by including an empty left hand path <> that tells the program where to send all paths that aren’t specified in the local node. This action is called default inheritance. For this reason, the following theorems are deduced from the theory above (a theorem is stated with only one equal sign): NODE: < path2 > = = tweetie., NODE: < value2 > = = tweetie., and NODE: < bird > = = tweetie. NODE inherits those values from NODE2.

The last tool I will mention here is the override capability of DATR. DATR allows a node to override a path inherited from any of its parent nodes. In English, we have: I drop, we drop, and he drops, but I fly, we fly, and he flies. In a DATR theory, one might describe fly as a child of the same abstract node as drop for the first person singular and plural, but for the third person singular the value can be overridden replacing the y of the stem with ie. Because of this capability, NODE can override what would be its default value at NODE2; therefore, the value of NODE: < path > is value, not value4.

After being introduced to DATR, I moved next to a training theory in classical Greek nouns. It seemed best to Dr. Hippsley that I work on a language I am familiar with while I am learning to use a programming language new to me. Even though it was conceived only as a training exercise, it has developed into an extensive theory. As far as we know, this is the first DATR theory in Ancient Greek. It has expanded to include 25 noun classes, seven abstract nodes, and two finite state transducers. This theory allows for the inclusion of lexical entries for a large portion of the nouns in classical Greek. We plan to submit it to the DATR archives (Evans et al., 1998) for publication, as well as to other possible venues.

My experience in a research environment has included other noteworthy events. I am contributing to my advisor’s efforts to acquire research funding for the Shughni project. I also participated in June when the Linguistics faculty hosted a workshop featuring Alan Timberlake, a visiting professor from Columbia University. Dr. Timberlake and others in the UK linguistics program presented papers centered around the topic of linguistic aspect. In addition, I have spent time learning PHP and other web technologies that will enable me to contribute to the Shughni verb database project.

In the second half of my project, I am taking up the Shughni DATR theory. In addition to providing a concise way of describing the verb system of Shughni, DATR has benefits for field workers as well. Because DATR supports inheritance, if a native speaker corrects the forms produced by the theory, a simple modification is often all that is needed to effect the forms of all verbs in a class. Thus, modifying the theory in the field for the Shughni team can be greatly improved by the use of a DATR theory. Continuing this valuable work will be my major contribution in the next four weeks.

Readings and Reference:


Yuen (Amie) Chan  
**Socioeconomic Challenges of Patients with Clinical Blindness in Rural Ghana**

Clinical blindness — 20/200 vision or greater in both eyes — is rampant throughout Africa. Remarkably, most of these cases are either curable or preventable. Approximately 7.1 of the world’s 38 million blind people live in sub-Saharan Africa and have a mortality rate four times higher than other areas worldwide.

Unite For Sight is a non-profit organization that empowers communities worldwide to improve eye health and eliminate preventable blindness. Unite For Sight has served over 600,000 patients and has provided 19,000 sight-restoring surgeries free of charge. I had a unique opportunity to combine volunteer work with research to contribute to this cause.

I have completed my research in rural areas of Accra, Ghana, through volunteering abroad with Unite For Sight. During this volunteer experience, I performed clinical service while assisting eye doctors in rural villages, refugee camps, and slums to provide free eye care to patients living in extreme poverty. Through interactions with patients, I conducted qualitative and quantitative research with those whose vision in both eyes is equal to or greater than 20/200. If the blind patients’ caretakers were present at the time of research, then further qualitative research was conducted through open-ended interviews.

I interviewed a total of 45 subjects, including 28 blind patients and 17 caretakers from various regions and districts throughout Ghana. I gathered data relating to the patients’ age, gender, and financial and working status before and after blindness. I also asked the patients questions regarding the effects on quality of life of their blindness. In addition, questions were asked concerning challenges to seeking proper medical services and medications. As for the caretakers, questions were asked regarding their age, gender, and financial and working status before and after caretaking. In addition, there were questions that pertained to daily challenges and problems to caretaking and how such challenges have affected their quality of life.

I have started analyzing the data collected after my trip, and I am continuing my on-going work with Dr. Glenn Blomquist, a professor in the Economics department. Data collected is grouped into categories including gender, age, and region (rural villages, refugee camps, or slums) used to analyze the different challenges faced with male versus female patients post-blindness. So far, the age group of the blind patients is mainly from ages 50 and above both males and females. The patients mostly came from the southern and mid-regions of Ghana, varying from Accra regions to Volter regions; the caretakers who accompanied the patients were also from the same regions. Further data analyses will be conducted for the blind subjects in this on-going study.

Some preliminary data summaries have been begun for the caretakers of the blind subjects. The age group of the caretakers mostly falls from mid-twenties to mid-forties. There have been specific challenges seen for females only with marriage. Data from three interviews of females with ages 20-35 has suggested that caretaking for their blind parents has caused their marriage plans to be delayed or cancelled. In contradiction to an earlier hypothesis of many expected caretakers to be teens, only a few young caretakers were seen. Further analysis of the data obtained through young caretakers will be used to show direct correlations between influences of illiteracy and lack of education due to the caretaking of blind family members. Findings from both the blind patients and their caretakers will be used to illustrate extreme poverty as a result of poor healthcare access.

James Chapman  
**United States-Iran International Relations: A Contemporary Analysis**

This paper is the product of a summer spent living and working in Washington, DC. As an intern in the State Department, I had an unprecedented opportunity to investigate and be immersed in the foreign policy of the United States. I lived just three blocks behind the Library of Congress; therefore, I had that invaluable resource at my fingertips for consultation and exploration. My personal experiences accrued through my daily, direct engagement with the decision-makers and the agency responsible for administering the diplomacy of the United States have been balanced by the traditional inquiry methods of library and archive research to result in a practical and realistic framework through
which to investigate the more contemporary aspects of United States-Iran relations. This paper briefly examines the foreign policy of Iran since the Islamic Revolution while simultaneously analyzing policy options for the future of United States-Iran relations. Furthermore, it offers an analysis of the implications of current developments, such as Iran’s recent Presidential election, the ensuing popular unrest, and the change of US Presidential administrations.

The relationship between the United States and Iran will prove to be vitally important to all countries and all people in the coming years, due to its implications in the major issues of international affairs and the ability of either country to affect world decisions. From this premise, it became possible and necessary for rigorously logical and insightful decisions to be made in the current political environment in which emotions and passions dominate, and I probed and evaluated a variety of future policy options for both countries while analyzing the implications of Iran’s growing “quiet revolution.”

I concluded that the pursuit of a grand bargain is needed to rectify the multitude of sources of tension between the two countries, but the achievement of such a bargain may be impractical currently. During its pursuit, the United States should offer Iran two distinct paths: one of confrontation and one of cooperation, with increasingly severe punishments or increasingly advantageous benefits accompanying each one. Direct diplomacy is the only way forward. Relying upon mutual respect and shared interests, the United States has the opportunity to make Iran a partner in the region, helping to pursue peace and stability and to create the opportunity for mutual advancement.

United States-Iran relations have been the subject of much analysis and research in the past, and their continued importance is self-apparent. A greater emphasis on scholarly investigations into the current state of affairs and possible future scenarios is recommended, as are rigorous studies of the recent popular, technology-driven uprising. I hope to have contributed in some small way to these goals, but more research is necessary.

Being given the opportunity to explore this subject as a formal academic inquiry, as the recipient of a summer research grant, was a stimulating and rewarding experience. I was equally fortunate to undertake this project under the guidance of Dr. John Stempel of the Patterson School, one of the most experienced and respected voices in this field. His advice, criticism, guidance, perspective, and wealth of knowledge were immeasurably important to me during my work on this scholarly pursuit. I encourage all students seeking an intellectual challenge and the opportunity to grow and mature to engage in research. I have thoroughly enjoyed it.

Sarah Cole

Differences in All-Terrain Vehicle Use on Hobby and Commercial Farms in Kentucky

The project began with a Literature Review of research related to differences and commonalities between hobby farms and other farm types in order to ascertain if these differences would affect the ATV use and risk for injury on the respective farm types. A search was done using the databases EBSCOhost, PubMed, JSTOR, and Agrico. The National Agricultural Statistics Service and the Kentucky Agricultural Statistics Service databases were also consulted.

With the help of Professor Wilson, study has begun on how to do quantitative data analysis. Using Data Analysis and Statistics for Nursing Research (Polit, 1996) as well as notes and PowerPoint presentations from the research class given in the University of Kentucky’s College of Nursing, the intricacies of data analysis are being learned.

A spreadsheet outlining all the injuries reported on the original survey has been compiled. This spreadsheet details the following information on each injury: type of Farm, position on ATV, size of ATV, use of ATV, gender of injured person, age at time of injury, whether healthcare was needed, part(s) of body affected, exposure to other farm machinery, ATV education of injured person, type of crash, and helmet use. This data will be used to analyze whether hobby farmers are at a greater risk for ATV injury than farmers on other types of farms.

The summer research will continue by gathering data from the original survey to compare hobby and all other farm types. Demographic data will first be analyzed, contrasting hobby with other farm types using the following variables: farm size, farmer’s age, education, and income, number of ATVs and ATV riders on the farm, and experience with other farm machinery. The second area of research will be centered on the prevalence and type of ATV use on a hobby farm compared to the other farm types, and types and severity of injury and safety concerns for hobby farmers compared to other farm types. This data analysis will inform the presentation and/or publication to be written from this study.


Aubrey Collier

Restaurant Locations and the Relationship with the Presence of Alcohol

Previous studies have documented the economic impacts of prohibition and currently there are articles riddled throughout newspapers in Kentucky examining a county’s decision on whether to sell alcohol or to remain dry. My research focuses on the relationship between the number of restaurants in a county in Kentucky and whether that county can sell alcohol. The regression has not yet been completed and the relationship not fully examined as of this date. My hypothesis is that there will be a
positive relationship between the number of restaurants and the presence of alcohol.

The variables that are included in this study include population size, median income, number of home owners/renters, number of persons with bachelors/associates degree, whether the area is wet or dry, number of higher education establishments, percentage of vacancies, unemployment rate, number of hotels/motels/number of beds, number of interstates/state roads within ten miles, number of doctors/physicians, number of health services/facilities (hospitals/clinics/etc), sports revenue from high school and college events, whether a historic district is present, number of railroads within ten miles, and number of events (bringing people from out of town). This list may lengthen or shorten due to the availability of viable data. Regression analysis will be completed including this data to determine if a relationship exists.

Sara Copic

The Psychology of Petersburg Urbanism in Dostoevsky’s Fiction

Russian literature has immortalized St. Petersburg as a fantastic and dichotomous city, full of contradictions in its society, and inspiring dualities within the individuals who reside there. From Pushkin’s The Bronze Horseman to Gogol’s Nevsky Prospect, Petersburg has not only been shaped in form but also in spirit; the works of these writers exposed the city as a battleground for many dualities, such as those between the clerk and the tsar or, more symbolically, the real and the surreal. Fyodor Dostoevsky was among one of these figures whose writing carved into the image of the city by showing that Petersburg and the consciousnesses of its citizens share the same dichotomies and are invariably interdependent. However, Dostoevsky’s formal treatment of the (anti)hero and setting reveal the city not as a “character” in itself, but as the vital space and medium that allows for the free development of the individual consciousness.

St. Petersburg’s history is integral to understanding its role in nineteenth-century Russian literature. Unlike most European cities, which developed organically over time, Petersburg was a planned, logical intervention onto the foreboding landscape, literally displaying humanity’s control over nature and our own irrationality. The city sprouted out of Neo-Classical ideals and forms imported by Tsar Peter the Great of Russia, and was built and sustained by means of force. Not only were all stonemasons in the Russian Empire commanded to relocate to the city on the swamp, but many noblemen were forced to build palaces there in order to relocate the capital and administrative center from Moscow to Petersburg. However, the society of this city quickly expanded beyond the upper crust to include a new kind of class, an underground.

This dualism between the underground and the crust forms one of the most prominent themes in Dostoevsky’s literature dealing with Petersburg, although many more themes accompany it — the tension between a pluralistic society and individualism, reason and irrationality, the self and the other, and the secular and spiritual realms. These shape each hero’s consciousness in Dostoevsky’s works, including The Double: A Petersburg Poem, Notes from Underground, White Nights, and a longer novel, Crime and Punishment. In these works, Dostoevsky not only analyzes human interaction in the city and with the city, but also shows that the dichotomous nature of the modern urban environment and human personality are one in the same.

Despite this fact, Dostoevsky brings out another truth about urbanism, this time not in the content but in the form of his writing. According to Bakhtin in his groundbreaking analysis, Problems of Dostoevsky’s Poetics, Dostoevsky was the inventor of the polyphonic novel, in which each voice, or character, becomes an independent consciousness; thus, in the Dostoevskian novel, the character is a subject whose object is the idea and the surrounding reality, of which the reader never gains an “objective” picture. Therefore, the setting, specifically St. Petersburg, becomes not only the medium for the interactions between these independent consciousnesses, but also the space for the development of a consciousness. Because the reader becomes aware of the reality of the urban environment only through a character’s independent consciousness, Dostoevsky forces us to grasp the relativism involved in understanding the city. I have chosen to analyze the urban environment as seen by an underground man, a socially isolated character, but one who is intensely aware of his environment.

I will continue my analysis of the urban setting through close readings of passages in the aforementioned works that focus on urban imagery. Specifically, I will analyze how Dostoevsky treats two different types of public spaces, the street and the city square, and how they impact the psychology of the character experiencing the city in different ways. The main examples of street and square I will explore are the Nevsky Prospect and the Haymarket, respectively. Although this project is mainly a literature analysis, I hope to glean an understanding of how art can inform urban design and city planning from this historical perspective.

Andrew Durig

Equine Nutrition

Equine nutrition is a rapidly growing field of research. Many problems associated with the growing horse, such as developmental orthopedic diseases (DODs), have been attributed to their diet in one way or another. For this reason, much attention has been focused on equine nutrition and associated disciplines in recent years.
A horse’s anatomy and physiology are designed for the consumption of large amounts of fibrous forages and, because horses do not possess a rumen, they must ferment any fibrous ingesta in their hindgut. The large intestine of the equine gastrointestinal tract thus harbors millions of bacteria that degrade and ferment structural polysaccharides. The physiological importance of these bacteria is evident, yet there is still very little known about these microbes that colonize the digestive tracts of horses, especially young horses. This project utilizes PCR-DGGE (denaturing gradient gel electrophoresis) to identify the bacteria that inhabit the hindgut of the equine gastrointestinal tract.

Fecal samples from five foal/dam pairs have been collected and the bacterial populations that colonize the samples will be analyzed. The foal and its dam’s microbes will be compared in an effort to identify the differences between the two over a period of twenty weeks. From this comparison, the development of the microbial flora in the foal’s gastrointestinal tract will be revealed. It will also help determine the approximate time at which the microflora in the foal’s GI tract become most similar to the microflora in its dam’s GI tract. This project will ultimately facilitate the progression of knowledge of how young horses’ GI tracts develop over time and how their ability to consume and utilize different forages is affected by this development. Knowing this information will help us formulate better diets for the growing horse and also potentially aid in the future prevention and treatment of gastrointestinal diseases.

METHODS

Fecal samples were collected from eight foal/dam pairs following defecation. This was done weekly, from birth to 20 weeks. The samples were immediately frozen and stored in airtight Ziploc bags at -80 degrees Celsius to prevent enzymatic degradation of the DNA. Subsequently, DNA was extracted from the frozen fecal samples using the Qiagen Fecal DNA Extraction Kit and the procedure provided by Qiagen. The DNA concentration was then determined spectrophotometrically.

Next, PCR was performed on the purified DNA extracted from the fecal samples using the universal 16S rRNA primers, 341F-GC and 907R. The amplification products were analyzed by electrophoresis using 1.5% (wt/vol) agarose gel. These products were then separated by denaturing gradient gel electrophoresis (DGGE). DGGE is used to separate DNA fragments that are identical in length, but differ in sequence (i.e. PCR amplicons). The gels were stained after electrophoresis using GelRed and pictures of the gels were taken using the Kodak Gel Logic 200 imaging system.

The next step of this project is to utilize DGGE fingerprint software to run a statistical analysis known as Unweighted Pair Group Method with Arithmetic Mean (UPGMA), which will produce a dendogram. The dendogram will allow us to observe and compare the similarities that exist between the different lanes in the gels (i.e., the colonic communities of different horses).

Alecia Fields

The Medicalization of Birth in United States Culture: Shifting Women from the Center

Childbirth is just one possible component of womanhood. But, for many women, childbirth is the vital component to motherhood. Historically, childbirth has taken place in women-centered settings and been attended by a female midwife. Female relatives and close acquaintances would travel far to support a laboring woman and witness the birth of a new child. Childbirth was a public event, but the audience was primarily feminine. By the end of the 18th century, customs of childbirth began to change as fertility declined and the country underwent the population shift to more urban environments. With these changes, there also entered the development of obstetrics and gynecology as a medical and more scientific alternative to midwifery. This was and continues to be a field dominated by men, built on the basis of intervention and technology.

This process of the medicalization of birth has prompted the transition away from women-centered childbirth. In my research, I propose that the medicalization of childbirth in the United States has taken the focus away from women during a process in which they ought to be actively included and involved. Medicalization limits a woman’s birth options and opportunities, and has created a disconnect between a woman and her body, thus eliminating her from the experience of her own birthing. From medicalization stems a form of social control that perpetuates gender and class disparities, as well as a capitalistic market that operates against the consumer. The cause of this oppression is the social organization of medicine as a capitalist and patriarchal force. This form of class oppression degrades a woman as the weaker sex and to the position of the consumer. The consumer, mother-to-be, must rely upon and consume capitalistic products over which she has little control, thus reinforcing her own oppression.

Today, to offset these trends and re-center women in the birthing process, there are a number of resources for expectant mothers. The process of re-centering women has even become a topic for the mainstream media. In 2008, Ricky Lake and Abby Epstein premiered their documentary film,
The Business of Being Born. The documentary focuses on birth as a rite of passage as well as its nature in big business. Lake and Epstein have most recently published, Your Best Birth: Know All Your Options, Discover the Natural Choices, and Take Back the Birth Experience. One resource the book and the documentary discuss that is rapidly gaining popularity is the role and the importance of a Doula. A birth doula is a woman who offers continuous physical, emotional, and informational support to the mother before, during, and after birth. Recent studies have shown that, when a doula attends the birth, labors are shorter and have fewer complications. Additionally, babies are generally healthier and breastfeed more easily.

During my summer research I took advantage of literary resources as well as preliminary fieldwork. In June, I traveled to Utah to become a Doula and have since been working toward my certification. This activity has been an important component to my research, because it has given me a completely new perspective on birth and an appreciation of both alternative practices as well as hospital practices. I hope to continue my research in the fall with interviews of expectant mothers and their partners about their perceptions of birth, before and after their own personal birth experiences. I am currently in the process of working with my faculty advisor to develop interview questions and gain IRB approval.

Sarah Fogarty
The Discipline of Performance Studies is on the Rise

The discipline of performance studies is on the rise in academia. It is an often overlooked field, the study of which can lead to many discoveries in each of the areas it incorporates: theatre and anthropology. Within this field, I was particularly interested in the way the Maya culture (primarily during the Classic Period) used performance and spectacle as a means of political legitimization. I have sifted through several books and articles by the foremost scholars in this area including Arthur A. Demarest, Takeshi Inomata, and Stephen D. Houston. From these articles I have gathered that my first impression of how the Maya elite garnered their power was not correct. A particular article by Demarest, “Ideology in Ancient Maya Cultural Evolution: The Dynamics of Galactic Polities,” helped me to look at this topic with a fresh perspective — that the ideologically based ceremonies and rituals were themselves the source of power for the Maya ruling class.

This concept is similar to what Clifford Geertz describes as a “theatre state” in his book Negara: The Theatre State in 19th Century Bali. This distinction is an important one to realize, and it will help me to look at my future research from a new angle. Because I have finished much of the background research for this topic, my next step is, with the help of my mentor Dr. Scott Hutson, to hone in on a particular polity during the reign of a specific ruler and study the rituals and ceremonies that occurred throughout his rule. I will be using primary resources such as murals, stelae, architectural remnants, and other archaeological artifacts for this portion of the research, thus allowing me to draw my own conclusions based on the background knowledge that I have already gathered. Through the completion of this project I hope to offer a more complete picture of Maya spectacles from an anthropological as well as a theatrical perspective. Because my background is in theatre, I feel I can offer a new look at a topic that is primarily dominated by the scholarship of anthropologists and archaeologists.

William Ford
South Elkhorn Sediment Transport Research

The South Elkhorn watershed is a mixed land use watershed containing both urbanized and agricultural areas. My area of research encompasses a comparison of the carbon flux (simplified down to the sediment organic matter) at our two sampling sites within the watershed. My question is to see how significant a difference there is between carbon flux at an area in the watershed dominated by urban land use and at an area, downstream of the urbanized section, that lies in an agricultural-based land use. In doing so, I plan on modeling seasonal carbon flux in the South Elkhorn watershed.

The first part of my research was primarily focused on lab and field methods for collection and analysis of in-stream sediment. Methods that have been implemented up to this point are described below:

1. Sediment Trap samples— Place a sediment trap in the stream to capture transported sediment during an event. Next, we collect the sample from the field and bring it back to the lab to perform isotopic analysis. This sample is mixed with sediment from all sources in the watershed.
2. ISCO Samples— Using the ISCO device we take 500mL samples every 1-2 hours in order to capture suspended sediment in the stream. We can use this information to gain the sediment flux.
3. Bed Sampling— Using our PVC tube and rebar we take a sample of sediment from the bed that would normally be transported during an event. We use this data to help determine how much of the sediment trap sample comes from the stream bed.
4. Bed Storage— Similar procedure as before except we disturb all of the sediment and perform a TSS lab test on the sample. Taking cross sections of the area we can extrapolate how much sediment is stored in the bed.
5. Bank Sampling— In this method we scrape off a quarter cup of sample from eroded banks at various points along the watershed. We then perform
analyzed for carbon loading as of yet. However, it will be quite interesting to see how it plays out in a mixed land use watershed that has not been know a lot about land use effects on stream channels. We already in-stream processes in the South Elkhorn. We already to really differentiate how different land use effects sources of carbon at the two sites. Ultimately, I hope major difference in the sources of the erosion and the carbon in the urbanized area will be high due to impervious surfaces, and carbon in the agricultural sources of carbon at the two sites. Ultimately, I hope to really differentiate how different land use effects in-stream processes in the South Elkhorn. We already know a lot about land use effects on stream channels. However, it will be quite interesting to see how it plays out in a mixed land use watershed that has not been analyzed for carbon loading as of yet.

Marc Matthew Gannon
Sweet Athens of the West

This research and creativity project for the summer of 2009 proposed an extraordinary opportunity for me. As I have viewed the campus of the University of Kentucky consistently over the past two years, I have, as an architecture major, developed my idea of how to alter the campus layout to provide better communication and interaction between students themselves, and the city of Lexington. I challenged myself to create a plan in which Kentucky students, residents, faculty, and visitors could move throughout the space provided and better inhabit the greens of the University of Kentucky.

The first part of my research focused on the historical aspect of the campus. After all, to move forward, we must look back. How did the university grow? What was here before UK? What were the goals when laying out the more recent classroom/residential structures? I conducted an interview with the Associate Vice President for Auxiliary Services, Ben Crutcher, to deduce information about the layout of the campus residence halls. The University of Kentucky, in fact has a new 20-Year plan for Student Living on campus.

To understand the change that the University has made over the last 150 years, I consulted archives of letters written by University of Kentucky First Ladies, old campus maps, and even early Student Life pamphlets that documented where the old cafeteria, bookstore, and post office were located: McVey Hall. I came to understand the direction the campus took when growing out of Lexington Pioneer Mr. John Maxwell’s original land donation of “Maxwell’s Woods.” Throughout the years, the University of Kentucky has gradually grown to become one of the most well known universities in the nation. The next step forward for my research is to propose a plan for three specified areas across campus: the Avenue of Champions/Limestone Area, the Fine Arts/ Rose Street Area, and the Woodland/Hilltop Avenue Area. I will prepare architectural drawings (plan, elevation, and section) for the new layouts of these developing areas that will better serve student life as well as create an invitation to visitors to explore the University of Kentucky in greater detail. To give UK an inviting appeal with a historical touch is my purpose for the University of Kentucky.

Imad Jaafar
Effects of Female Density on Sexual Conflict and Female Fitness in the Western Mosquitofish, Gambusia affinis.

Introduction

According to sexual conflict theory, males have higher optimal rates of mating than do females, and the result of this asymmetry is male sexual harassment (Arnqvist and Rowe, 2005). Although such harassment has fitness costs for females (see Arnqvist and Rowe, 2005 for a review), the Sargent lab has found for the western mosquitofish that female density dependence has a much larger effect on female fitness than does male harassment of females (Smith and Sargent, 2006; Smith, 2007). In this project, we will explore the nature of this female density dependence.

The project focuses on the following hypotheses: mean harassment rate will be higher at low female density than at high female density, due to the fact that at high female density male attention is diluted over more females. Mean female offspring number will be lower at higher female density, due to the fact that past research shows that female birth rates decrease as female density increases, and that this effect is stronger than any negative effects that male harassment has on offspring number. Mean female growth rate will be lower at higher female density, due to the fact that past research shows that female growth rate decreases as female density increases, and that this effect is stronger than any negative effects that male harassment has on female growth rate. Based on Smith (2007) these effects will be larger in size than those reported by Sargent and Priddy (in prep) for varying male density, while holding female density constant.

Methods

Hundreds of Mosquito fish have been collected from Spindletop Creek on the University of Kentucky’s Spindletop Farm. This collection was done by repetitive trips through a two week time period. The extended time in
Results

Table 1: Four pools with 4 females and their mass

<table>
<thead>
<tr>
<th>FishID</th>
<th>Pool 1 Mass (g)</th>
<th>Pool 2 Mass (g)</th>
<th>Pool 3 Mass (g)</th>
<th>Pool 4 Mass (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.49</td>
<td>1.65</td>
<td>1.58</td>
<td>2.38</td>
</tr>
<tr>
<td>2</td>
<td>1.59</td>
<td>3.01</td>
<td>2.57</td>
<td>1.67</td>
</tr>
<tr>
<td>3</td>
<td>1.42</td>
<td>1.24</td>
<td>1.45</td>
<td>1.48</td>
</tr>
<tr>
<td>4</td>
<td>1.34</td>
<td>1.02</td>
<td>1.28</td>
<td>1.3</td>
</tr>
<tr>
<td>Mean</td>
<td>1.71</td>
<td>1.73</td>
<td>1.72</td>
<td>1.7075</td>
</tr>
</tbody>
</table>

Table 2: Four pools with 8 females and their mass

<table>
<thead>
<tr>
<th>FishID</th>
<th>Pool 5 Mass (g)</th>
<th>Pool 6 Mass (g)</th>
<th>Pool 7 Mass (g)</th>
<th>Pool 8 Mass (g)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>1.64</td>
<td>2.08</td>
<td>1.65</td>
</tr>
<tr>
<td>3</td>
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<td>2.34</td>
<td>2.34</td>
<td>2.13</td>
</tr>
<tr>
<td>4</td>
<td>1.4</td>
<td>1.71</td>
<td>1.56</td>
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</tr>
<tr>
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<td>1.61</td>
<td>1.15</td>
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<td>6</td>
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<td>1.46</td>
<td>1.5</td>
<td>1.75</td>
</tr>
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</tr>
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<td>2.01</td>
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<td>0.77</td>
</tr>
<tr>
<td>Mean</td>
<td>1.7175</td>
<td>1.7225</td>
<td>1.71375</td>
<td>1.70875</td>
</tr>
</tbody>
</table>

Collecting the mosquito fish was due to the need for the proper number of females and males to select from in order to perform the experiment. The two week period was also due to heavy vegetation that had built up by mid-June, making it difficult to capture the mosquito fish.

After this period of collecting the mosquito fish was completed, the males and females were separated in order to begin to prepare the experiment. The females collected were weighed and separated into 8 groups. Four of these groups contained 4 females. The other four groups contained 8 females. The females were separated into these groups by mass, giving each group a near equal mean mass while, at the same time, diversifying the range of the weights. This grouping was done by a process of trial and error in order to obtain similar means. This separation is shown in the results section.

Each group of females will be placed into their respected pool. Each pool is about 1.4m in diameter with 15cm of dechlorinated tap water. Males will be added in equal densities. Sixty-four males were separated to place 8 males in every pool. We will then gather data to test our hypotheses.

Literature Cited


Sargent and Priddy. (In prep) “Effects of Male Density and Refuge on Sexual Harassment and Female Fitness Components in the Western Mosquitofish, Gambusia affinis.”


Mary Beth Johnson

Lafora Disease

Lafora Disease (LD) is an autosomal recessive epileptic disorder that causes rapid neurological deterioration and the accumulation of insoluble carbohydrates called Lafora bodies (LBs). LD patients die within 10 years of experiencing an initial epileptic episode during their second decade of life. LD is the result of mutations in the phosphatase laforin. We previously demonstrated that laforin is the founding member of a unique class of phosphatases called glucan phosphatases that remove phosphate from carbohydrates/glucans. In the absence of laforin, glucans become hyperphosphorylated, improperly branched, insoluble, and result in a Lafora body. Currently, there is no cure or long-term treatment for the disease. Our collaborators and others are currently involved in pre-clinical treatments with mice and one clinical treatment with LD patients that have nonsense laforin mutations. However, all of these therapies lack a biomarker, which is required to validate whether the therapy is producing functional laforin. Our goal is to develop an assay that quantifies laforin function so that it can be used as a biomarker in pre-clinical and clinical treatments.

Our idea is to “pull” laforin out of tissue, via a technique called immunoprecipitation, and use the immunoprecipitated protein in biochemical assays. Currently, I am testing which α-lafortin antibody immunoprecipitates the best and also which antibody most clearly identifies laforin in Western Blot analysis. We are testing five commercial antibodies and a polyclonal antibody that we generated and purified. To perform these tests, we transfect human laforin into HEK-293 tissue culture cells and immunoprecipitate the human laforin protein with one of the above mentioned antibodies or a positive control α-FLAG. The α-FLAG antibody recognizes the FLAG epitope that we engineered at the amino terminus of the human laforin
After performing the immunoprecipitations, we probe the blots with α-FLAG to determine which antibody worked most efficiently. To date, we have found that three of the commercial antibodies (M01, M02, and GTX), and the purified α-rabbit serum antibody immunoprecipitated successfully. In addition, the same seven antibodies were tested for their ability to detect laforin by Western Blot analysis. One of the commercial antibodies (GTX) performed best at identifying laforin in a Western Blot analysis. The results of each experiment were repeated again in a second trial. Therefore, we conclude that the commercial antibody GTX is currently the most efficient to use for laforin analysis.

The next phase of our work will be to test our biomarker hypothesis on a mouse model of Lafora disease. Toward this end, we have recently tested ten additional antibodies and their ability to identify laforin in Western Blot analysis. N84/37 and the raw 140 and 139 rabbit serum performed best at identifying laforin in Western Blot analysis. Next, we tested which α-laforin antibody against human laforin most clearly identifies mouse laforin in Western Blot analysis. Five commercial antibodies (GTX, M01, M02, N84/37.1, N84/37) performed best at identifying mouse laforin.

In order to quantify the amount of laforin protein that these antibodies can recognize, we also developed a quantitative Western Blot. This analysis determines how low in concentration our “best” antibodies (M01 and M02) can detect human and mouse laforin. Our results demonstrate that the M01 and M02 commercial antibodies can detect human laforin down to 1 ng; the mouse tests are ongoing.

Our experiments testing which α-laforin antibody most clearly identifies laforin in Western Blot analysis reveal that some of our commercial antibodies may be recognizing endogenous laforin. This is an exciting and potentially very beneficial result. To date, there are no antibodies that can recognize endogenous laforin; an antibody that does so would be beneficial to us and to the research community as a whole. Therefore, we are currently testing these six possible antibodies (N84/1, N84/1.5, N84/37, and N84/37.1) against mouse and human laforin, with the empty pCNF vector serving as the control. Next, we will design an immunoprecipitation experiment with knockout and wild type mouse tissue to determine if these six antibodies are recognizing endogenous laforin.

Additionally, we will test which α-laforin antibodies against human laforin immunoprecipitate the best from transfected mouse-Laforin.

Collectively, we have made significant progress thus far in our project. We have demonstrated that our initial strategy of developing a biomarker works in tissue culture cells. We have identified antibodies that both recognize and immunoprecipitate human and mouse laforin. Lastly, we are testing if these antibodies recognize endogenous laforin. All of these results are moving us closer to developing a biomarker to test treatments for Lafora disease.

**Donald Keefe**

**Pont-Aven School of Contemporary Art**

“Vous connaissez depuis longtemps ce que j’ai voulu établir le droit de tout oser” — “You know long ago I wanted to establish the right to dare.” This phrase became the theme of the late 19th century painter Paul Gauguin during his period of experimental work in Pont-Aven, France. The work he did in this small town in Brittany, the northwest Peninsula of France, became a foundation for all subsequent art movements, and became the foundation for a transition into more free, more abstract forms of artwork. In his time, many artists traveled to Pont-Aven for its unique and exotic culture — a welcomed change from the Parisian life style in which most artists had been working. Gauguin became of sort of mentor to the many artists who were amazed at his work and traveled to Brittany to learn from him. From this arrangement arose the “Pont-Aven School.” Artists such as Paul Sérousiér, Emile Bernard, Władysław Slewinski, and Maurice Denis had their time in Pont-Aven and were part of the “Pont-Aven School.” The painting “The Talisman” that Sérusier made became an emblem for their movement, with a radical use of color, a simplifying of composition, and a bold use of line rather than modeling; all these elements became key traits of the “Pont-Aven School.”

Since that time, Pont-Aven has continued to be a haven for artists. Thanks to an Undergraduate Research Grant I received from the eUreKa! office, I was able to attend the Pont-Aven School of Contemporary Art in Pont-Aven, France. The school, started by art historian Caroline Boyle-Turner, offers artists a learning environment immersed in the themes that drove Gauguin and others to Pont-Aven — a desire to be in the exotic and unknown, a strange new culture, a place where creativity can be freed from the expectations of the city-centered art world. Though artistic movements and styles have changed since Gauguin’s day, it is these same principles that the school is based on.

My time at the school was extremely intense and focused, with classes...
Kristin Kopperud

In planta localization and interaction of Potato yellow dwarf virus proteins

The research that I am conducting this summer in the Goodin Lab is contributing to two projects funded by the National Science Foundation and The Kentucky Research and Development Center. The goals of these projects are to identify plant factors that interact with viral proteins in the course of infection leading to disease, and to characterize proteins encoded by Potato yellow dwarf virus (PYDV), respectively. These experiments require the use of transgenic Nicotiana benthamiana plants that express fluorescent markers at specific cellular loci, such as nuclei, as a means of establishing localization of the viral proteins within the host plant cell. Micrographs depicting these interactions are captured using state-of-the-art microscopy and serve as a validation of the research conducted by lab members to be used in publications. My eUreka!-funded grant is facilitating the realization of four essential objectives.

Objective 1: Maintaining transgenic plant stocks to support experiments

Protein localization is most accurately determined with the use of a reference subcellular marker in the host plant. N. benthamiana plants that transgenically express a fluorescent protein targeted to a specific locus provide such a definitive context in which to study these localizations. Specifically, transgenic plants that contain a red histone nuclear marker (RFP:H2B) are being used for viral protein localization experiments, and those containing a GFP marker targeted to the endoplasmic reticulum (GFP-ER), for studies examining the effects of viral infection on the host’s endomembrane system.

This summer, I am maintaining a continuous supply of the transgenic plants lines in the optimal size and age ranges for experiments. In order to meet the demand of the lab, I plant approximately sixty plants per week and transplant the seedlings at 21 days after germination. The optimal age of plants for use in experiments is 29 days after germination.

Objective 2: PCR amplification of viral genes to be studied

In planta protein expression is being conducted using a novel set of binary vectors that utilize recombination-mediated Gateway technology. In order to take advantage of this system, att sites are introduced into the 5’ and 3’ ends of the genes of interest. This result is most readily achieved by conducting two rounds of PCR using a high-fidelity DNA polymerase, such as Phusion. In the first PCR, gene-specific primer pairs are used, with each primer containing approximately half of the 5’ or 3’ att sites. A second round of PCR introduces the remainder of the att sites. To date, two rounds of PCR have been completed for the PYDV-N, -M, and -P genes, which encode for the nucleocapsid, matrix, and phosphoproteins, respectively.

Objective 3: Transformation of viral genes into plant vectors

Following amplification of the genes of interest, the PCR products are introduced into a “donor” plasmid. This insertion is done by BP Clonase-mediated in vitro recombination. The inserts are then mobilized.
from the entry vector into the destination vector in a second recombination-mediated (LR) transformation allowing for protein expression in plant cells. BP and LR transformations have been conducted for the PYDV-N, -M, and -P genes, as well.

The final step in viral protein expression in plant cells is transforming the destination vector containing the viral gene into Agrobacterium tumefaciens strain LBA4404, and plating the bacteria on selective media. When colonies start appearing after 2-3 days, they are streaked on fresh selection plates and are ready for plant transformation after further incubation for 1-2 days. Following incubation, harvested cells are resuspended in agroinfiltration buffer and incubated at room temperature for 2-3 hours.

**Objective 4: Infiltration of Agrobacterium into transgenic hosts and microscopy**

The host plant N. benthamiana is infiltrated with the vector by filling a syringe barrel with the cell suspension and appressing the tip to the abaxial surface of the leaf. By depressing the plunger while maintaining a good seal between the syringe tip and leaf, the vector enters the plant tissue through the stomata. Infiltrated plants are incubated with illumination for 48 hours. Agroinfiltrated tissues are then suitable for microscopy to determine localization of viral proteins within host plant cells. Micrographs depicting the viral proteins in the context of RFP:H2B nuclei are captured as data verifying localization.

Thus far, the PYDV-N, -M, and -P genes have been transformed into Agrobacterium and infiltrated into the host plant N. benthamiana. Data in the form of micrographs has been obtained for all three genes. The remainder of the summer will be devoted to repeating the entire process for the PYDV-p3, which encodes the putative cell-to-cell movement protein, and -G (glycoprotein) genes. In addition, I will continue to supply the lab with RFP:H2B and GFP-ER transgenic plants.

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**Christina Kuchle**

**Interactions of Bush Honeysuckle and Mycorrhizal Colonization in Native Tree Species**

**Introduction**

The focus of this project is to better understand the interactions of bush honeysuckle and mycorrhizal colonization in native tree species. Bush honeysuckle is an invasive plant species that was introduced to the United States from Asia in the 1800s and recognized as a significant threat in the 1990s. Bush honeysuckle is not uncommon. Most people don’t realize that it’s invasive and plant it in their yards to enjoy its sweet yellow flowers and red fall berries. Bush honeysuckle spreads from yards to forests and inhibits the growth of native plant species vital to Kentucky’s economy, ecosystem, and culture. What mechanism does bush honeysuckle possess that enables it to dominate the native plant biodiversity of our forests? One theory is allelopathy, a mechanism in which a plant, or in this case bush honeysuckle, will secret chemical compounds from its roots that have harmful effects on surrounding vegetation.

Mycorrhizae are a type of fungus that form a symbiotic relationship with native tree species. As a tree grows, mycorrhizal fungi infect developing roots to access sugars produced by the tree, and in return the fungi has hyphae or very fine roots that it extends into the soil that protect the tree from disease and absorb water and nutrients. This symbiotic relationship enables native trees to grow in poor soils and better survive poor growth conditions, such as drought. In this project, I am trying to find out if the allelopathic exudates from bush honeysuckle roots in the soil strata are impacting the relationship between mycorrhizae and native trees.

This summer, I have been working with my mentor Dr. Mary Arthur of the UK Forestry Department and her lab technician Millie Hamilton. Dr. Arthur has not only given me help and advice with my project but provided me with the lab resources I needed to complete this project. In addition, Dr. Arthur has advised me through difficult problems and been a wonderful source of support. Millie Hamilton gave suggestions on the project set-up, lent support, and helped maintain my project while I was away in Ecuador for two weeks this summer. I have also been working with Dr Rebecca McCulley, Dr. Norman Taylor, and Dr. Tim Phillips to obtain greenhouse space for my project.

**Getting Started**

The experimental design of my project was modeled on a similar study examining the effect of garlic mustard on the mycorrhizae of native tree species. (Stinson et al, 2006) The garlic mustard study consisted of five different experiments. I modeled my study after the first experiment investigating mycorrhizal colonization of native tree roots in four soil treatments: (1) soil with bush honeysuckle contamination, (2) soil with bush honeysuckle contamination that has been sterilized, (3) soil with no bush honeysuckle invasion, (4) soil with no bush honeysuckle invasion that has been sterilized.

Researchers in the earlier study had used tree seedlings that were sprouted in a different soil medium and then planted in the various soil treatments. I modified my experimental design to germinate my tree seeds directly in the different soil treatments to more accurately show how bush honeysuckle exudates would affect a germinating seedling. My first goal in setting up the project was to obtain mockernut hickory, shellbark hickory, and pawpaw seeds from Kentucky State Forester Kent Slusher. These tree species were chosen because they are common native species of the central Kentucky Bluegrass region and have value to Kentucky’s economy, culture, and ecosystem. Mockernut and shellbark hickory are important sources of food for wildlife, timber, and their nuts have been harvested for human and
livestock consumption. Pawpaw is an understory tree that is an important fruit bearing species for wildlife. It is also becoming more important for human consumption; Kentucky State University has an agricultural program that is trying to produce marketable pawpaw fruits.

With three tree species and four soil treatments I structured my experiment to have seven seeds of each species planted in each of the four soil treatments meaning that I would plant 84 seeds for the total project. I didn’t want to have more trees than seven per treatment because this would take up too much greenhouse space, and having seven trees per treatment would be enough to provide significant results. In late May I set out to create my four soil treatments: (1) soil with bush honeysuckle contamination, (2) soil with bush honeysuckle contamination that has been sterilized, (3) soil with no bush honeysuckle invasion, (4) soil with no bush honeysuckle invasion that has been sterilized. The sterilized soil treatments act as a control, and tree seeds germinated in these treatments are expected to have minimal mycorrhizal colonization. Both the invaded and non-invaded soil treatments were obtained in the Kentucky Central Bluegrass region. To create the sterilized treatments, half of the invaded and non-invaded soils were autoclaved at a temperature of 120 degrees Celsius. All of the soil treatments were mixed with silica sand to create a 1:1 soil medium. The purpose of this mixture was to enable water, micro-organisms, and chemical compounds to move freely in the soil strata. Soil and seeds were then planted and placed in the green house on May 27, 2009.

Maintenance

All of the pots were labeled with the soil treatment and tree seed type and randomly placed on the greenhouse benches. Pots were watered with 100ml of tap water twice a week. Once the trees germinated, the seedlings would need about four months to grow to allow for mycorrhizal colonization in the roots. It took about five weeks for my hickory seeds to start sprouting, and it took over two months before I had my first and only pawpaw germinate. I am in the third month of my project and I have had 27 trees sprout, most of them being mockernut hickory. This disappointing lack of germination is likely due to bad seed. There may also have been problems with overwatering in the greenhouse because I would come to water my project and find all of my pots were already wet. In light of these problems, most of my mockernut hickory seeds did germinate in the four soil treatments and, although I won’t be able to collect any significant data on my shellbark and pawpaw species. I should be able to see some results from my mockernut hickory seedlings.

Future Work to be Done

During the fall semester I will analyze the roots of my germinated seedlings for mycorrhizae colonization using a clear staining method. The clear staining procedure requires fine roots of tree seedlings be boiled in a ten percent KOH solution to prepare the roots to absorb a trypan blue stain. Once the roots are stained, they will be examined under a microscope for mycorrhizal infection. The total procedure could take between two days to a week depending on how the stain is absorbed by the roots. On August 20, 2009 I will be trying this procedure for the first time with Dr. Sarah Bray of Transylvania University on some sample roots, to make sure I understand the process. I won’t be able to start this procedure on my project until October because my seedlings require four months of growth to ensure there will be an adequate infection of mycorrhizae.

I am disappointed that more seeds didn’t sprout, but this has encouraged me to find out how to collect my own seeds and possibly create my own seed bank of native tree species to use in future experiments. If I could, I would like to try this project again with different tree species and seeds that I have personally collected. Although I won’t have the results I wanted from this project, I have learned how to collaborate with faculty, how to structure a project, the research involved, and how to handle failure. Conducting this project has encouraged me to continue pursuing undergraduate research and I look forward to working with Dr. Arthur, Millie Hamilton, and other faculty in the coming year to continue work on this project and brainstorm new ideas.

Work cited:

Jonathan Laurel
Sixtus IV’s Papal Library: Thoughts on Quattrocento Humanism

Four months after his election in August 1471, Pope Sixtus IV (1471-84) indicated to his chamberlain that he was interested in constructing a separate library building within the Vatican Palace complex in Rome. Apparently Sixtus’ initial plans for a new edifice were abandoned by 1475, when we learn that the 2500-book collection, created by Nicholas V (1447-55), was opened to the public. Between November 1475 and 1481, the library’s ground floor rooms in the palace’s north wing were remodeled under the direction of Bartolomeo Platina, Sixtus’ librarian.

Significant research by Jose Ruysschaert seems to show that these library rooms were formerly store rooms. However, Leonard Boyle has argued that the papal library was already located in those ground level “store rooms” before Sixtus’ election. Boyle has presented decorative evidence and a careful interpretation of Platina’s meticulous records, and thus proposed a more plausible project history. But neither researcher fully analyzed the library’s location within the palace, nor how that location could have affected Sixtus’ decision. A section through the palace reveals that the ground floor rooms were an inopportune choice for a library because of dampness and insufficient light. But book preservation and the reader’s comfort were less
Jennifer Lawlor

Forming Relationships for Success

According to a 2008 report by the Office of Institutional Research at the University of Kentucky, retention of first year students in 2006 was only 76.37 percent, which is over two percent less than the retention of students who began school at UK in 1998. Last year, Provost Subbaswamy implemented a $35 million dollar plan to increase retention and graduation rates. One of the components of this plan involves keeping records of academic and social success of each student as he or she proceeds through the freshman year.

As a resident advisor, I am a “first line of defense” in this watch-dog plan, because it is my responsibility to notice and respond to students at high risk for dropping out before they decide to leave. Each semester, through my required academic checkups, I report on residents’ social and academic progress. This is, by far, one of the most difficult parts of my job, because students usually refuse to share their experiences with me; it is this frustration that has led me to my question for a research project.

I originally intended to study the ways in which students are able to form helpful relationships with their professors. However, I have come to believe that the problem may not only be attributed to the disconnect between instructors and students. Rather, the problem may be caused by the technological methods, such as email and Facebook, that students are using to form these relationships.

I have formulated a survey that addresses these specific issues and relates them to different levels of academic success. This survey will be distributed to all exiting freshman students from the past academic year. I hope to find that a relationship exists between the amount of success that a student perceives and the way that he or she chooses to communicate with instructors throughout the year.

Due to a number of unforeseen delays, I do not have any conclusive information at this point. However, the process of working on professional research has been an exciting and educational one. If time allows, I may also choose to interview professors who primarily instruct first-year students about how they perceive their relationships with these students.

I hope that my research will give the University new insight into ways that students can be empowered through personal relationships in order to create an academically successful environment. By using the knowledge of which types of communication best foster achievement, instructors and University officials may be able to better connect with first-year students and encourage them to remain at the University of Kentucky.

Samantha Mangold

The Inhibition of LMP2 is Not Sufficient to Block the Activation of NFκB

Most diseases and chronic illnesses are characterized by inflammation. When a person gets sick, his or her tissues are inflamed and damaged. It is the body’s responsibility to respond to the inflammation and control it. The focus of my research is on the NFκB mechanism that activates inflammation and prolongs its existence. This pathway is important to the survival and strength of many cancers and autoimmune diseases.

The NFκB signaling pathway is an important sector of biology to study because it activates several genes that play a role in cancer and other diseases. Several small molecules have been designed to selectively inhibit the activation of NFκB. The activation of NFκB is followed by the transcription and encoding of over 300 genes that promote tumorigenesis and deficiencies of the human immune system. One particularly important cellular response that is encoded by the NFκB signaling pathway is the presentation of antigens that serve as markers for macrophages and other cells to recognize which cells are healthy and a part of the body opposed to those cells that could be invading it. Other important genes activated by NFκB include programmed cell death, cytokines that are used in cellular communication, and growth factors that stimulate proliferation. These genes, if over expressed and deregulated, can be detrimental to the human body.
Crohn’s disease, rheumatoid arthritis, and multiple sclerosis are just a few autoimmune diseases greatly impacted by the NF-κB signaling pathway. NF-κB is also prominent in several cancers (many metastatic) including breast, prostate, lung, colon, myeloma, and lymphoma carcinomas. Thus, there is a great demand for chemotherapeutic agents that are aimed at this pathway.

First, it is important to understand the exact pathway of NF-κB. There are several different proteins and modulators involved and the pathway can be activated by different sources. The NF-κB pathway is activated by the cytokine, Tumor Necrosis Factor Alpha (TNFα). TNFα was thought at one time to be involved in anti-tumor activity but was later discovered to be a tumor promoter, initiator, and directly involved in metastasis. This cytokine binds to its receptor TNFR-1 on the cell surface that is complexed to TRAF2. This complex also recruits a protein called RIP1 which plays a significant role in the pathway.

The part of the pathway I am interested in is the ubiquitination (ubiquitin is a small “tagging” molecule) of RIP1 at Lysine 63 allowing its interaction with the TAK1-TAB1-TAB2 (modulating proteins) complex. This point is where the NF-κB Essential Modulator (NEMO) interacts with ubiquitinated RIP1 and activates the IKK complex to which it belongs. IKK has two catalytic subunits that are responsible for the phosphorylation of IkB-α. IkB-α is an inhibitory protein attached to “NF-κB.” The major components of NF-κB are two proteins called p65 and p50. These proteins form a heterodimer in which they bind cooperatively to DNA and are complexed to one another by strong intermolecular forces. IkB-α is recognized, ubiquitinated, and subsequently degraded by the proteasome. This action causes the disassociation of IkB-α from p50 and p65. The dimer of p50 and p65 is then detached and becomes activated. Thus, the dimer is translocated into the nucleus where it binds to its respective transcription factors, activating genes that regulate critical cellular activities.

My mentor, Dr. Kyung-Bo Kim, is one of the few people studying the chemical genetic approach using proteasome inhibitors. A former student of the lab successfully designed and synthesized a drug called UK-101 that specifically inhibits one of the Catalytic β-subunits, LMP2, of the immunoproteasome. The immunoproteasome degrades misfolded proteins within the cell. I use the MDA-MD-231 breast cancer cell line for my experiments, because it expresses large amounts of the immunoproteasome. The goal of my research is to test the effects of the inhibitor, UK-101, and to better understand the NF-κB pathway.

I have recently made a lot of progress in my research. Previous to this summer, I carried out experiments testing the efficacy of UK-101 in relation to the activation of NF-κB. I have looked at the time-dependent phosphorylation of IkB-α and have seen irregular patterns with the treatment of UK-101. Based on the data collected, we can say that there is a delay in the rate at which IkB-α is being phosphorylated. There is also a delay in which p50 and p65 form a dimer (two proteins complexed to one another) and are translocated to the nucleus.

In the past two weeks I have acquired data that show us how p105 is processed upon treatment with UK-101 and TNF-α. We propose that the amount of p105 should decrease when cells are treated with UK-101 and the amount of p50 should increase. This variance is because p50 is cleaved from p105 and joins p65 to form the heterodimer of NF-κB. The graph indicates that there is a similar pattern of p105 and p50 until 30 minutes, when the amount of p105 decreases and the amount of p50 begins to increase. This result is showing us that at this time p50 is cleaved and the NF-κB is resuming its normal progression.

New data also shows the amount of IKK-α and IKK-β present when cells were treated with UK-101 and TNF-α is maintained at a constant level. Because there is no change in the amount of these proteins in the IKK complex, I have concluded that UK-101 is selectively inhibiting LMP2 of the proteasome and is not responsible for any off-target effects on other proteins that I suggested before I began my research this summer.

The experiments clearly show that, although the delay exists, NF-κB is still activated after treatment with UK-101. I feel that if we can develop drugs that can slow down the progression of cancer or other autoimmune diseases, there is a hopeful future to find a class of drugs to cure these diseases. I hope the research I have done on UK-101 only strengthens its journey in moving into mice studies and maybe even a clinical trial. One day, if successful as a drug, it could be combined with
other drugs or radiation therapy to make an effective treatment for cancer.

Emily Davidson McMahan

Factors Associated with Smoking During Pregnancy

Tobacco use during pregnancy is a significant problem in the state of Kentucky. Kentucky ranks second in the nation for pregnant smokers. The prevalence of pregnant smokers in Kentucky is 26.7%, versus 12.4% throughout the nation. Smoking during pregnancy has been associated with low infant birth weight, increased number of preterm births, and an increase in perinatal deaths. Little is known about how intimate partner support and everyday stressors affect smoking cessation during pregnancy. It is proposed that by increasing partner support and decreasing everyday stressors, individuals will be better equipped to complete successful smoking cessation. I am conducting a secondary data analysis in order to examine both intimate partner relationships and everyday stressors and their relationship to smoking status throughout the course of pregnancy. This secondary data analysis explores whether smoking status is altered due to positive partner support and reduction of everyday stressors during the first and third trimesters of pregnancy.

Data on 44 pregnant women in their first trimester — before 14 weeks gestation — from the CCOST (Collection of CVF, oral secretions, serum across trimesters) perterm birth database were used to examine the association between smoking status, everyday stressors, and social/partner support. The majority of the women were Caucasian, in their mid-twenties, having had some college or vocational education, and were married or living with their significant partner.

I have been assisting in the collection of quantitative surveys and urine nicotine markers of study participants during the first, second, and third trimesters, as well as postpartum. Data Analysis Software (SPSS) is being used to compare smoking status, everyday stressors, and intimate partner support between the first and third trimesters of pregnancy. Everyday stressors are being measured by the Everyday Stressors Index and partner support is measured using the Autonomy and Relatedness Inventory. The goal of this research is to understand the relationship between smoking during pregnancy, social support, and everyday stressors. If there is a link between these variables, further research could focus on the implementation of smoking cessation strategies that address the social and stress barriers throughout pregnancy.

Aaron Meacham

Graphene Nanoribbon Formation, Isolation, and Measurement

Graphene is a hexagonal sheet of sp²-bonded carbon atoms. This 2D material, with its unique structure, is a promising endeavor for nanoscale devices requiring great precision. (Geim and Novoselov, 2007) Research in the field, therefore, is progressing at a rapid pace, including recent work on graphene nanoribbon formation. (Datta et al., 2008; Campos et al., 2009) The objective of this report is to explain the processes and methods behind graphene production and nanoribbon formation from metallic catalyst particle etching. In addition, it will discuss methods of isolation, measurement, and analysis using atomic force and scanning electron microscopy (AFM and SEM, respectively).

Beginning with mechanical exfoliation of bulk graphite onto 300nm thick layered SiO₂ substrate, optical microscopy was used to identify isolated sheets of few-layer graphene (FLG) and potential single-layer graphene (SLG). Once data are recorded from these samples they are prepared for the etching process — one that is continuously being optimized. A number of samples at this step were annealed in a Lindberg Blue-M furnace at 500 degrees Celsius under a gas flow ratio of Argon to Hydrogen of 600:400 sccm. This step was thought to clean the samples of any organic substances that might contribute to unwanted contamination. (Campos et al., 2009) Samples were analyzed with AFM to determine any changes that may have occurred over that step in the process. No noticeable advantages were observed with this step.

At this point, prepared graphene samples are submerged in solution of Fe(NO), and isopropanol as a control. Some samples are coated, instead, in a solution of NiCl₂ and water. Both sets of samples are placed in a furnace for 30 minutes at a range of temperatures from 900 to 1000 degrees Celsius, with a set point added midway through the furnace ramp at 500 degrees (Ar:H₂ flow rates of 850:150). The midway set point (held for 20 minutes) is thought to encourage nanoparticle formation, which, if accurate, would produce better and more frequent nanotrenches. Iron nitrate particles (and nickel chloride) have been observed to etch tracks through FLG and even SLG along zig-zag or armchair paths under such processes. (Datta et al., 2008)

Figure 1

SEM and AFM, respectively, of Fe(NO) etched graphene (many-layered, approximately 5 mm thick). Nanotubes, in addition to etchtracks, are also present on the sample as a result of the chemical vapor deposition processing.
Concentrations of NiCl2 particles seem to produce more etching through SLG on average (see Fig. 2).

Work has also been done on nanolithography, or nanomanipulation, of FLG and SLG in an attempt to isolate thin nanoribbons or other nanostructures for transistors. Figure 3 shows a sequence of AFM images that demonstrate contact mode lithography. The AFM tip was used to plow into a graphene sheet in a direction orthogonal to the edge. The last image shows a one-step process that produced a clean fold of the same edge. Such methods will be used to isolate thin (10 nm) graphene nanoribbons from neighboring materials for the fabrication of potential electronic devices.

**Works cited**

**In American Politics Today**

The election of our first African-American President raises countless questions about what racial barriers still exist in American politics today. How much racial hostility did Barack Obama face during his 2008 presidential campaign? Did a significant number of voters reject Obama because of racial prejudices, and if so, who were they?

The research I conducted this summer sought to lay the groundwork for investigating the relationship between race and voting behavior in the 2008 election. We are interested in whether or not Barack Obama’s African-American race effected the way in which people voted, and if it did, how so? What type of people were more or less inclined to vote for him because he is black? Were they minorities? Did they live in urban or rural areas? Did southern voters display racially hostile voting patterns similar to what we saw in the 1968 presidential election when George Wallace ran as a pro-segregation candidate? These are just a few examples of the type of questions we want to answer.

In order to answer such questions, though, a complete account of how Americans voted in every part of the country is necessary. Working to create such an account was the primary goal of my summer research. Before this summer, I had done a study analyzing election returns and corresponding demographic data at the county level. This model, although giving us a general idea about what we might expect as far as racially motivated voting patterns, was insufficient to make precise predictions about how individuals actually voted. Counties are large, diverse, communities and, therefore, using aggregate data about how a county voted and what demographic breakdowns exist in that county do not allow for an accurate assessment about how individuals voted. Because of this, our effort focused on compiling precinct-level results from each state.

Each state organizes and makes available its election data in a different manner. Creating such a database, then, required soliciting data on a state-by-state basis or even on a county-by-county level, and then converting the data we received into a uniform dataset.

A little more than halfway through the summer we were contacted by Stephen Ansolabehere and his research assistant Anthony Fowler at Harvard University, who were also working on creating a database of precinct-level election returns for the 2008 election. Although their goal was primarily the database itself, and not the research into racial voting behavior that we are interested in, we decided to collaborate efforts so as to ease the burden of collecting some of the more difficult-to-obtain data.

Our task at this point became collecting the precinct-level election results from West Virginia, Kentucky,
and Indiana. Our summer ran short of time while still in the process of collecting and organizing these results, with West Virginia and Kentucky both almost complete.

As stated before, the research work done this summer is the groundwork for a larger research goal of answering questions about racially motivated voting behavior in the 2008 election. Collecting the precinct-level election results from each state is the most time-consuming component of the research, but is necessary in order to provide precise and accurate results. The goal now is to finish the work we have done over the summer and use it to start addressing the questions we’ve raised about the 2008 presidential election.

Jake Oxnard

Alternative Fuel Technologies: Exploring The Use Of Waste Vegetable Oil To Fire Ceramics Kilns

Introduction

My research project to construct a kiln and develop a burner system that is fueled by waste vegetable oil (WVO) has been an exciting and extremely educational experience full of hard work, frustration, and rewards. The scope of the project grew considerably and it has become evident that more research and experimentation are needed. I will break this report into two parts for clarity. The first part is the kiln, its design, and what I’ve learned about building it; and the other part is the burner system, or the method by which the kiln is fired.

The Kiln

After researching numerous kiln designs, I decided to focus my attention on a downdraft method. The Kiln Book by Fredrick Oslen suggested designing a kiln from pre-existing kiln designs that work well. I looked at two of the four kilns we have here at the Art Department, and drew up several designs before I arrived at a final design, which I then drew to scale.

The kiln was designed in accordance with standard hard brick dimensions. This restriction helps to limit the number of bricks needing to be cut. I built the kiln on a steel palette so I can transport it with a forklift. Once the bricks were laid, a steel frame was constructed to enclose the exterior of the kiln and ensure that the bricks would move as little as possible during the firing and cooling of the kiln. This frame also will help to prevent any unnecessary shifting of the bricks during transport. After the completion of this stage, research on the right castable material began.

I discovered that castable refractories’ success depends upon the alumina to silica ratio. This ratio is especially important in atmospheric kilns in which the introduction of caustic ingredients, such as salt or soda, cause deterioration to the interior of the kilns. The alumina creates the greatest barrier from this reaction, though it has very little structural integrity. Thus, the addition of other ingredients was essential to maintain a castable that could withstand a temperature of 2300 degrees as well as the corrosive nature of salt and soda.

Once the development of a recipe for this purpose was finished, I constructed an arch form that spanned the distance of the two walls of the kiln. This form was built with MDF (mass density fibers) and masonite. The refractory was mixed in a cement mixer, poured, and rammed upon this form. I allowed a couple of days to pass before removing the form. After finishing that task, the door of the kiln was constructed in a similar way. I fabricated a steel frame, built a form around it, and rammed the
high alumina refractory in it. The steel frame had hinges welded to it that slide over a hinge that is welded to the frame around the kiln itself. The chimney was the next aspect of the kiln to address.

Because most of the caustic elements will be contained within the actual kiln chamber, the chimney refractory was a different, less expensive mix. The design for the chimney consisted of three sections that can be disassembled for easy transport. I constructed these sections by using an 8-inch diameter galvanized pipe and a 6-inch diameter cardboard tube cut into three parts. I poured the castable in the two-inch spaces of these three separate sections then allowed for setup time and burned the cardboard tube out with a small wood fire. These sections had metal tabs to allow them to be bolted together, along with being bolted to the kiln.

The Burner

At the same time as I was working out the construction of the kiln, I was researching and gathering materials for the burner design. For the burner, I wanted to develop a homemade fuel injector that would atomize and spray a fine mist of vegetable oil, with the hope that this mist could be lit with a simple flame. I proposed to create a duel nozzle/blower system first. After further consideration, I decided to build a less complex burner system. This portion of the research and development is an ongoing study.

Instead of the duel action proposition, I went with a single nozzle and a single air source. These were assembled with pipefitting where the waste vegetable oil (WVO) source and the air source meet at a half-inch T valve. The idea was that the air would blast the WVO through a tiny nozzle to atomize the oil. However, the nozzle was too small or the blower/air source was not great enough. Based on the ratios in The Kiln Book by Fredrick Olsen, I had expected it would work, even though this was a homemade fuel injector and lacked the proficient technology of a real fuel injector pump. Thus began the fun in variable limitation, and trial and error.

Going with the initial set up, having the oil pumped down to the T valve and the air being blown from the back of the T valve, I began to change the variables. First, I made my own orifice or nozzle by drilling a 32nd of inch hole into the cap of a half inch pipe and assembled that to the T valve. We got a mist that was too strong, too narrow, and hard to control. I added an extender nipple that was three inches long and an inch in interior diameter, to try to create a larger space for the oil and air to mix before it left the end of the burner. This modification seemed to help some, but not enough. I tried the original idea again and took the nozzle off its adaptor, which was tapered down in size to a ½ inch nipple that had to fit into the ½ inch T valve. This change, surprisingly, created a very full and fine mist. With this discovery I felt well on the way!

After attempting to light this mist with a propane torch, I accepted the notion that the kiln would need to be pre-heated with an alternative heat source. I hooked up a propane forge burner and positioned it into one of the burner ports of the kiln. I lit the propane and let it fire for about 5 minutes till I got too eager and introduced the WVO mist in a different port positioned directly in front of the propane forge burner. This brought immediate results! The flame grew to twice to three times it original size. After allowing the propane to help feed the oil for about 15 minutes, I shut the forge burner off and the WVO flame fed itself. This result was good, although there was too much flame and heat and not enough control. The actual combustion of the WVO and the ratio of fuel to oxygen is the area of my project that needs more experimentation.

The ongoing study of this project will involve developing the burner to efficiently dispense the oil to allow for more control. After running the setup previously described, I found that the amount of oil being allowed to pass down to the air source is too much. To solve this problem, I am going to taper the oil to a ¼ inch tube and install a needle valve, which is more precise than the ball valve. I will also put a rheostat on the pump for the oil, which may not be needed after adjusting the amount of oil intake. There are also some ideas about changing parts of the blower that I am considering.

Conclusion

This project has been immensely educational. The knowledge gained will always be with me and may hopefully lead to further developing methods of using waste vegetable oil as an alternative fuel for such purposes as forging or heating steel, a larger kiln, or a furnace for melting and casting various metals. I am grateful for the opportunity that I have been given and have learned several important lessons along with a new body of knowledge.

Susan K. Perry

Analysis of Learning in Children Participating in Community Safety Sessions

Approximately 104 children die each year from farm work related injuries on American farms (Rivara, 1997). In addition, another 32,000 children are injured on farms as a result of just being present (Myers and Hendricks, 2001). Farm Safety Days are popular one-day community events that teach children about farm hazards and provide safety and health education during short sessions, usually about 10-15 minutes. In the course of a day, children might attend 8-10 sessions. These events reach about 60,000 children every year. The Refinement and Enhancement of Agricultural Curriculum for Children (REACCH) study, (NIOSH/CDC R01 OH 009 197), directed by Dr. Deborah Reed of the University of Kentucky College of Nursing, has developed three new curriculum guides for use at safety days: animal safety, chemical safety, and water safety. REACCH is now testing the curricula.

Video data of these sessions at three intervention sites and two control sites were analyzed for this summer project. Data included 678 4th or 5th grade children. The findings show children who attended safety days that...
used the new curriculum demonstrated more overall attentiveness and participation during the safety session and a higher eagerness to learn. The use of interactive safety activities proved efficient in promoting learning for this age group. The implications for future practice are that a standard curriculum and instructor training for safety days may be more effective and also provide a better learning atmosphere for children. Further testing of the curricula is being conducted.

**Background**

The Progressive Agriculture Foundation’s (PAF) Safety Days® is one of the nation’s largest initiatives for child injury prevention. Most farm safety education for children occurs in community settings and is delivered by community volunteers. Last year, over 380 PAF safety days were held in 38 U.S. states, six Canadian provinces, the U.S. Virgin Islands, and American Samoa. This marked the 14th year of farm safety days in the U.S. and the 7th in Canada (Progressive Agricultural Foundation, 2009).

In an effort to decrease the number of injuries to children on farms, the National Institute for Occupational Safety and Health (NIOSH) launched a research initiative for injury prevention interventions for children. Dr. Deborah Reed of the University Of Kentucky College of Nursing is conducting a community efficacy trial, funded by NIOSH, that tests alternative curricula and instructional methods for the Farm Safety Days®. The Refinement and Enhancement of Agricultural Curriculum for Children (REACCH) examined the type of curricula previously delivered to children at farm safety days and investigated where improvements could be made. The research found safety day volunteers often presented their own safety information based on their own knowledge and past experience. This approach proved problematic, because children were not getting the same messages and some curricula were not developmentally appropriate for that age group. After developing new curricula, based on cognitive theories in childhood development and focus group results from PAF Safety Day organizers and other community members, attention was placed on three areas of injury prevention: animal safety, chemical safety, and water safety.

Children between the ages of six and adolescence try to conquer the psychosocial stage of development known as industry vs. inferiority (Hockenberry, 2007). According to Erikson, “the goal of this stage is to achieve a sense of personal and interpersonal competence through the acquisition of technologic and social skills” (Hockenberry, 2007). Another theory used is Piaget’s cognitive development theory. This stage, known as concrete operations, is described as when “children are able to use their thought processes to experience events and actions” (Hockenberry, 2007). The use of these theories helps in analyzing children’s responses during a safety day event. The new safety day curriculum incorporated these developmental concepts.

**Methods**

The project approval for human subjects was obtained prior to data collection (IRB # 07-0453-P3H). For the video analysis, a qualitative approach was used. Intervention and control sites were selected across the nation by geographic pods. The new curricula and training was provided to intervention site instructors; control sites followed their usual activities. After obtaining informed consent, safety day sessions on the three topics were video recorded and analyzed. The analysis of child learning and instructor fidelity was performed by collecting all raw video data and then organizing the data into watchable videos. Two sessions for each safety lesson were reviewed at five different sites (three intervention sites and two control sites). Each session lasted approximately 20 minutes, yielding approximately 600 minutes of data. Six hundred and seventy-eight children were involved in the recorded sessions; 367 at the three intervention sites and 311 at the two control sites.

Two views of the safety day were used: the perspective of the instructor and the view of the students. The two views were reviewed simultaneously, but independently, by two reviewers. The lead reviewer of this analysis portion was Dr. Nancye McCrary, associate professor in the University of Kentucky College of Education. The other researcher was me, Susan Perry, an undergraduate student and research intern in the UK College of Nursing. An eight-page review sheet guided the analysis of instructor methods, curriculum, content, developmental appropriateness, and children’s responses.

This report focuses on children’s responses — in particular child attentiveness, eagerness to learn, and participation. Inter-rater reliability was calculated and data was reviewed until agreement between the reviewers reached 95%. After analysis, overall themes and trends were discussed. For the larger research project, further processing of the video analysis will occur.

**Results**

Overall, child attentiveness, eagerness to learn, and participation were higher at intervention sites than control sites (Table 1). Children who received the new curricula often asked questions, many raised hands to participate, and almost all of the children in the intervention sessions remained interested throughout the twenty minute session. The use of activities to enhance the message promoted child involvement in the sessions. Children at intervention sites sang songs, read poems aloud, participated in hands-on activities, and discussed scenarios with their instructor.

For control sites, the overall affect of the group of children seemed blunted and disengaged with the instructor and material being presented. Whereas intervention sites promoted involvement through multiple activities, the control sites typically had a lecture style presentation and provided children with less opportunity to raise hands and participate. Children at control and intervention sites demonstrated eagerness to learn by raising hands, asking questions, and sharing stories. Children present for intervention curricula showed a higher intensity of involvement than those at control sites. Although the typical time allotted for safety sessions was twenty minutes, control site safety sessions lasted from 9:05-24:00 minutes in length. Intervention sites analyzed lasted from 13:00-21:49 minutes.

One confounding factor in the analysis was the atmosphere in which
the safety lesson was taking place. Areas that had high noise and traffic seemed to be more distracting to children regardless of intervention or control site. Also, the use of live animals for props or demonstration seemed to captivate children’s attention more than the message being presented. In these instances, attention was focused on animals or props and children had difficulty focusing on the session.

**Discussion**

Children at intervention sites demonstrated a higher level of participation, attentiveness, and an eagerness to learn. Much of this is due to the more interactive approach the curricula used. More active involvement by the child is useful for engagement and learning, as supported by Erikson’s theory of Industry versus Inferiority (Hockenberry, 2007). The children at intervention sites performed tasks and then interpreted the meanings of those tasks, thus giving them a sense of industry, or accomplishment. According to Erikson, children at this age place a high value on peer involvement and interaction. They also enjoy acquiring technical skills that help them to complete tasks (Hockenberry, 2007). Using activities during safety day lessons enhanced student involvement and participation because the students were able to accomplish a task and it involved their peers. For example, during the water safety session, students are taught how to throw a homemade flotation device to a bucket simulating a drowning victim. Children performing this activity became highly involved and many wanted to repeat the activity several times.

The cognitive development of the school age child was also taken into account, especially at intervention sites. According to Piaget, children in their school years begin to “acquire the ability to relate a series of events and actions to mental representations that can be expressed both verbally and symbolically” (Hockenberry, 2007). This stage is described as concrete operations. This developmental level helps children understand more in-depth ideas, events, and the relationship between them. It also allows school-agers to make judgments not just on what they see but what they reason. Children involved with the new curricula showed a more intense eagerness to learn, because the presentation of the information allowed them to rationalize options and understand concepts. For example, children who participated in the animal safety session discussed different animal safety scenarios with their instructor and decided if the scenario was safe or unsafe and what the next best action would be. Children responded eagerly to this type of instruction, because it allowed them the ability to accomplish a task and to carry out conceptual thinking.

**Limitations**

Community-based research brings with it substantial limitations. In this study, the control sites were left to their own resources when presenting their sessions. Time allotted for the sessions varied even at the intervention sites. Environmental factors (noise, weather, seating arrangements) may have influenced the children’s abilities to focus on the session. However, the environmental competition seemed consistent across intervention and control sites.

**Implications**

Even short sessions based on principles of child development have the potential to impact children’s responses to safety messages. By understanding the results of this overall project, further expansion is warranted to other areas of education for this age group. Although these types of curricula are proving to be effective for safety instruction, other types of instruction similar to these enhanced curricula may also prove effective. Also, after testing, other types of curricula for this age group will likely prove more effective if a highly interactive approach is used.

**Works cited**


David Riegel

**Potential Effects of Golf Course Design**
and Management on Stream Habitat Conditions

Introduction
For this study, we are conducting field research at ten golf courses in western North Carolina, all of which are located within the southern Appalachian Mountain region. The purpose of this research is to observe any potential effects that golf course design and/or management may have on stream habitat conditions. I am assisting Mark Mackey, a graduate student attending the University of Missouri, with this project. Mr. Mackey is working toward earning his doctorate in biology, with a specialization in herpetology. The field research is primarily focused on the presence and health of salamander populations that live in and around streams in the southern Appalachian Mountain region.

I am also in the process of conducting a contingent valuation study that aims to capture golfers' environmental values, which should allow me to draw some general correlations between environmental awareness and golfers' “willingness to pay” (WTP) to protect water and wildlife resources in the region. Thus far, one golf course community has granted me the permission to distribute a questionnaire to its members. The questionnaire was sent out via email to 400 households, and I am currently waiting for completed questionnaires to be submitted. Depending on the response rate for this questionnaire, I may send out questionnaires to other communities of comparable demographics in the area.

Summary of Work
Over the past several decades, the sport of golf has become increasingly popular in the United States and overseas. Throughout this time period, particularly in the United States, the golf course industry’s environmental perspectives and management techniques have changed in many ways. For example, different pesticides and different application techniques are utilized today compared to those used in the 1970s and 1980s. In general, there may be a tendency for the public to feel that golf courses cannot be environmentally friendly, due to the use of inorganic fertilizers and pesticides. In reality, the natural habitat alteration that occurs when courses are constructed and the amount of water used for irrigation are probably the most significant issues that the golf course industry is dealing with currently.

In our field work, we are studying the effects that golf course development and ongoing operation can have on headwater stream ecosystems in the southern Appalachians.

Salamanders have extremely permeable skin, which allows for the passage of water and gases. They are what ecologists sometimes call an “indicator” species, because they are quite susceptible to pollutants and other environmental hazards. Therefore, if the salamander populations in a stream are healthy, it can be inferred that the stream is most likely healthy as well, and vice versa. On each of our ten courses, we have six 25-meter “stream transects.” On each course, we have two transects that are upstream of the course’s management area (streams that should be unaffected by the golf course), two transects that flow through the course (usually flow through fairways and have little to no tree canopy cover), and two transects that are located downstream of the course (the water in the stream has flowed through the golf course’s land.) Mr. Mackey and another field technician are doing most of the salamander sampling; I am taking physical and chemical measurements in the streams.

The purpose of my contingent valuation survey is to estimate the potential benefits of maintaining healthy salamander populations and higher levels of water quality. There are three main parts to the survey: (1) background information on the environmental good (i.e., education on salamanders and their relationship to water quality), (2) a section eliciting value (I created a hypothetical scenario in which environmental degradation is occurring from fertilizer application and I ask golfers if they would be willing to pay various amounts of money annually in order to reduce this pollution), and (3) a section asking background information on the respondent. The questionnaire is primarily dichotomous choice (“yes” or “no”) response. If my response rate for this first survey is acceptable, we may try to send out a survey to another comparable golf course and leave out the educational section of the questionnaire, to see if this lack of information produces statistically significant differences in demand for healthy salamander populations and water quality.

Possible Conclusions
If golf courses’ layouts and/or management techniques are indeed affecting salamander populations and, therefore, stream habitats in the region, it should be expected that the number of salamanders found in the through-course and down-course transects will differ significantly from our up-course transects. It is still unclear whether there are any statistical differences in the number we are finding. I currently tested water from all 60 of our transects for nitrate. Every one had a nitrate concentration lower than the Environmental Protection Agency’s drinking water standard of 10 ppm (parts per million). In fact, all concentrations were most likely much lower than 7.5 ppm (the lowest observable test value range was 0 – 7.5 ppm).

In the case of environmental degradation, contingent valuation methods can reveal the stated preferences of people in society who are directly affected by, or are affecting, the environment. For my survey, the group of people who have “standing” are the golfers who live in a community directly on or near to the golf course. Eliciting values with regard to salamanders and water quality, can assist golf course superintendents and policymakers alike in knowing how people feel about the environment. Knowing how people feel could help to guide management decisions that could correct environmental damage, if it were indeed occurring. In general, I would expect that peoples’ valuation responses would generally form a demand curve (i.e., many people supporting low bid prices and few supporting high bid prices). Also, I would assume that people who are familiar with salamanders and who also visit the local streams for recreation would be
willing to pay more to ensure the conservation of these resources. Once my responses begin arriving, I will begin analyzing them.

Eric Schmidt

**Determining the Molecular Mechanisms that Underlie the hERG K+ Channel Transport Process**

**Brief Background**

The human ether-a-go-go related gene (hERG) encodes the voltage-gated K+(Kv) channel α-subunit 11.1 (Kv11.1) that tetramerizes to form the pore of the rapidly activating delayed rectifier K+ current in the heart (Sanguinetti et al., 1995). Mutations resulting in a loss of hERG function correlate with Type 2 Long QT Syndrome (LQT2), a disease that can result in ventricular arrhythmia and is potentially fatal (Sanguinetti et al., 1996). Approximately 90 percent of LQT2-linked missense mutations (mutations of a single amino acid) fail to undergo intracellular transport (trafficking) to the cell surface membrane (plasmalemma) and decrease hERG K+ current (I_{hERG}) (Anderson et al., 2006).

In order to develop a therapeutic strategy to potentially correct the trafficking of these LQT2-linked mutations, the mechanism that regulates hERG transport through the cell’s organelles must be understood. The currently accepted model for hERG trafficking involves transport from the Endoplasmic Reticulum (ER) to the Golgi complex (Golgi), where the channel is complexly glycosylated and specific sugars are added, before ultimately traveling to the plasmalemma. This trafficking process is regulated by a significant number of small GTPases (enzymes associated with hydrolysis of the energy molecule GTP), each of which controls a certain step. Therefore, it is important to identify which GTPases regulate the trafficking of hERG. The GTPases of interest in this study are Rab GTPases, enzymes that are responsible for directing the vesicle carrying the cargo protein to the appropriate membrane.

**Methodology**

Dominant Negative (DN) mutations are engineered within a protein in order to cause loss of function of the Wild Type (WT) protein, thereby allowing data to be collected regarding its function. These mutations typically alter a single amino acid within the primary structure of the protein. I engineered DN mutations into different copy DNA (cDNA) that encode different Rab GTPases. The mutations were introduced through site-directed mutagenesis, and their presence was confirmed through DNA sequencing technology.

During the initial period of my project I have engineered several different DN mutations in Rab7, Rab9, and Rab10: Rab 7-Threonine to Asparagine at amino acid 22 (Rab7-T22N), Rab7-Q67L, Rab7-N125I, Rab9-S21N, Rab9-Q66L, Rab9-N124I, Rab10-T23N, Rab10-Q68L, and Rab10-N122I. These mutations were chosen because there has been research indicating that they are analogous to DN mutations for many other Rab GTPases (Tidssdale et al., 1992). I am currently transfecting these DN Rab GTPases with WT hERG cDNA in Human Embryonic Kidney 293 (HEK293) cells to determine their role in the protein trafficking of hERG.

**Future Objectives**

Western Blot will be utilized to determine the regulatory role of the Rab GTPases of interest. The Western Blot technique utilizes gel electrophoresis to separate proteins of different molecular weights. hERG channels that have not yet traveled to the Golgi are only core-glycosylated and, therefore, weigh less than those that have traveled through the Golgi and are complexly glycosylated, thereby weighing more (Zhou et al., 1998). Analysis of the results from the Western Blot will allow us to determine if the Rab GTPases control the trafficking of hERG to the Golgi. In addition, confocal imaging and immunocytochemistry will also be utilized to determine if the subcellular localization of hERG is altered by the DN GTPases. Collecting these data will allow us to better understand the role of the Rab GTPases within the trafficking process of hERG, which could ultimately aid the development of effective therapies for patients suffering from LQT2.

**Works Cited**


Joseph K Stieha
**Summary**

We investigated how time, temperature, and the concentration of iron particles affect the outcome of the graphene when placed in a furnace. This technique showed that the iron particles clustered at the edge of the layer before the iron etched the graphene to make nanoribbons. We also utilized atomic force microscopy (AFM) and scanning electron microscopy to observe how the concentration influenced graphene on the nanometer scale.

Graphene is a popular research material because of its honeycomb lattice structure (Geim and Novoselov, 2007) which causes it to be one of a few stable two-dimensional structures under ambient conditions (Novoselov et. al., 2005), and its electronic properties (Datta et al., 2008), which are desirable for use in electronic devices. Recent studies have shown that when metallic particles are placed on the graphene, with the correct reaction and high temperatures, crystallographic etching of the graphene lattice can occur. (Datta et al., 2008) This etching can create nanoribbons which in turn can potentially be fabricated into field-effect transistors.

To fabricate graphene nanoribbons, we started off by depositing bulk graphite onto silicon substrates. The silicon substrates were cut using a diamond tipped pen into small (about .5 cm by .5 cm) squares. We then placed graphene on the silicon substrate using the standard mechanical exfoliation technique. (Novoselov et al., 2004) The process is done in this way: we took a small piece of highly-oriented pyrolytic graphite (HOPG) and placed it onto scotch tape. We then repeatedly folded over the tape until we had the graphite spread out over this piece of tape. We then placed this on the table, graphite side up, and took another piece of tape and repeated the same process between the new and previous piece of tape. As the graphite spread out, the layers of graphite decreased and this became graphene — a single layer of graphite. (Katsnelson, 2007)

We then applied the iron salt to the graphene. This iron salt was used in a previous experiment, where the etching trenches occurred in parallel at a width around 35nm, a nanoribbon was etched. After placing the graphene onto the silicon substrates, we then used an analog scale to measure out a small piece (less than 10 mg) of iron(III) nitrate nonahydrate. We then dissolved the iron(III) nitrate nonahydrate in Isopropyl Alcohol (IPA). In this step we were able to change the concentration of the iron(III) nitrate nonahydrate with the IPA. In the first experiment we had a .1 mg/ml. The first experiment had too many particles, as shown in Figure 1. We then changed the concentration to .02 mg/ml and .01 mg/ml; these had fewer particles, so the surface of the graphene was visible in the Atomic Force Microscope.

The sample was then placed in the furnace. The schematic of the furnace and the flow of gases is shown in Figure 2. The furnace extended a distance of 14 and 1/8 inches; therefore, we were able to place the samples in multiple spots within the length of the furnace. We placed the sample around the front (about 3-4 inches), in the middle (around 7 inches), and then toward the back (around 9-10 inches). The measurements of the placement were taken from the front of the furnace.

**Figure 1.** Image is taken from the AFM. The darker side is the silicon substrate while the lighter side is the graphene. The rough morphology structures are the dense particles.

**Figure 2.** This is the schematic of the CVD Chamber. Before heating the system, the sample is placed inside the tube and gases are then able to go through the system as you heat the furnace up and then cool it down. Through multiple runs, the placement of the samples did not change anything that was truly noticeable during this time. In the furnace we
ran argon and hydrogen gas (600sccm/400sccm, respectively; using Mass Flo Controllers) at 900°C for a time. The time at a temperature of 900°C was another variable that we tested; the times being one minute and 45 minutes. During the experiment, on the samples that were at 900°C for one minute, the particles collected at the edge of the layers of the few-layer graphene but few had actually etched (this is noted in Figure 3). Whereas, the samples that were in the furnace for 45 minutes at 900°C, had more etch tracks. It is believed the etching of the few-layer graphene by the metallic nanoparticles likely occurs by a hydrogenation mechanism in which the reaction is catalyzed by the Fe nanoparticles.3

In the 45 minute run, the sample was in the furnace allowing this reaction to proceed for a longer time, causing there to be more etching. The samples were then looked at under an optical microscope to locate the graphene. The graphene was then identified on the AFM.

After doing these experiments, we started increasing the temperature to see if the fewer-layered graphene would etch. Previously at 900°C, thicker pieces of graphene would be etched, which was seen by scanning electron microscopy. As we increased temperature from 900°C to 1000°C, these nanotubes started developing on the surface of the graphene. We then increased the concentration to cut down on these nanotubes. (Campos et al., 2009) After running the test at 1000°C, using SEM, the graphene layers were covered in nanotubes. Later, we changed the ratio of the gases to 150 sccm of Hydrogen and 850 sccm of Argon. (Campos et al., 2009) This ratio decreased the number of nanotubes that were produced, because there was less methane produced in the experiment (shown in Figure 4). This allowed us to see more of the etching through scanning electron microscopy. There was still no etching on the single-layers.

We have demonstrated how time affected the etching process, and how the metallic particles collected at the edge of the layers of graphene and concentration affected the density of the particles of iron on the graphene, allowing you to see the graphene when there was less concentration. The technique we used was effective in making the nanoribbons, but there is not enough control at this time. Therefore, this technique used in the experiment has potential to making the nanoribbons in a controlled way. The limitations depend on the tip used in the AFM and controlling the direction the iron particles will etch.

Works Cited

Georgianne F. Tiu
Investigating Heat Shock Protein
Expression Levels with the Interaction of Ceria Nanoparticles in the Cerebral Cortex: Insights into Alzheimer's Disease

Heat shock proteins, or molecular chaperones, can be found in the simplest life-forms, such as bacteria, or in some of the most complex life-forms — us, humans. They are also known as “stress response proteins,” because their presence is induced by stress factors such as increases in temperatures, injury, or other environmental factors. Chaperones are known as “helper proteins,” because they are a family of proteins that have evolved for a specific purpose: to help unfolded or misfolded proteins achieve their proper three dimensional conformation. (Karp, 2005, p. 69.) Chaperones selectively recognize and bind to short stretches of hydrophobic amino acids that tend to be exposed in nonnative proteins but buried in proteins having a native conformation. (ibid.) In other words, these special proteins help other proteins to form normally in a structural sense in order for their function to be normal.

Dr. Butterfield’s lab focuses on the effects of oxidative stress in Alzheimer’s disease. Ceria, which is also known as CeO$_2$ was studied “to characterize biodistribution from blood and its effects on oxidative stress endpoints because it 1) is an insoluble metal oxide that can be readily observed in situ by electron microscopy, making it a useful in vivo tracer, and 2) is redox reactive” (Zhang et al., 2004). These are only two of many reasons of why ceria is a preferred nanoparticle. “Ceria was also considered to be a good candidate for these studies because it has been reported to have both pro-oxidant and anti-oxidant properties” (Sultana et al., 2008)

Results Thus Far

So far this summer, I have almost completed my Heat Shock Protein Project that involved the hippocampus of control and MCI brain. I have successfully completed HSP 27 and Thioredoxin, proteins that are reportedly either up- or down-regulated in Alzheimer’s disease brain. The last HSP that I need to complete is HSP 32, for which we are awaiting the arrival of the antibody. I found that there is a significant increase in HSP 27 protein levels, while there was a significant decrease in Thioredoxin levels. These findings correspond to earlier studies in the AD hippocampus.

This new project, tentatively entitled “Investigating Heat Shock Protein Expression Levels with the Interaction of Ceria Nanoparticles in the Cerebral Cortex: Insights into Alzheimer’s Disease,” uses the same methods that I have used for the past year (Western blotting analysis). I have been working with graduate student, Sarita Hardas, on this new project that entails the joint efforts from Dr. Peng and Dr. Yokel from the College of Pharmacy. I run Western blotting analysis on the brains of rat models that have been infused with Ceria nanoparticles for one hour and 20 hours. Although the original purpose was for me to investigate heat shock protein levels in the cerebral cortex of the rat brains, my project has a turned a new direction with the use of different antibodies. Sarita will give me the antibodies after I run Western blotting analysis on all three groups. The sample number, n, for this project is 38. I have helped Sarita make samples, as well as run Western blots on Group 1. We must use chemifluorescence detection, and currently we are waiting for the chemifluorescence reagents to arrive.

HSP 27 and Thioredoxin

According to Renkawek, K. et al, their findings “show a strongly induced expression of Hsp27 in AD cortex and hippocampus, mostly in proliferating and degenerating astrocytes.” (Renkawek et al., 1994) Because of this finding, I hypothesized that there would be an increase in Hsp27 expression levels in the hippocampus of mild cognitive impairment brain samples because, according to prior research done by me in Dr. Butterfield’s lab, oxidative stress already affects the brain at this early stage of dementia by altering protein expression levels. HSP 27 is evidently increased in the MCI brain in an attempt to counteract the oxidative stress that the brain is already undergoing at this stage of dementia.

Figure 1. Heat Shock Protein 27 (HSP 27) Blot from Hippocampus from brain from Control and MCI Subjects

There is a significant increase in HSP 27 protein levels.

Thioredoxin (Trx) is a redox modulation enzyme and is essential in
maintaining the homeostatic state of the cells and the main substrate of Trx substrate. Lovell et al. demonstrated this: “Analysis of Trx protein levels in 10 AD and 10 control subjects demonstrated a general decrease in all AD brain regions studied, with statistically significant decreases in the amygdala (p < .05), hippocampus/parahippocampal gyrus (p < .05), and marginally significant (p < .10) depletions in the superior and middle temporal gyrus.” (Lovell et al., 2000) Therefore, it is seen that there are decreased levels of Trx in AD brain, and my hypothesis is that there will be decreased levels of Trx in the MCI hippocampus as well.

**Figure 2. Thioredoxin Blot from Hippocampus from brain from Control and MCI Subjects**

There is a marked decrease in Thioredoxin levels in comparison of

**Expectations**

I expect to see either increases or decreases in the antibodies with which I will be probing the cerebral cortex blots. Western blotting is only 1D, or one-dimensional, meaning that only increases or decreases of protein levels will be visually shown on the blot. Because there are currently no prior studies of the effects of ceria nanoparticles on the brain, the results that we find will be first of their kind.

**Works Cited**


**Jessalyn Ubellacker**

*Medical Tourism and its Effects on Primary Health Care of the Providing Country, Argentina: A Case Study*

Although a significant number of medical tourists from the United States (middle- and upper-class citizens who travel across international borders to receive cheaper medical treatment procedures) seek treatment in the far East in Thailand or India, Latin America continues to serve as a primary location for medical care. The President of the Medical Tourism Association (MTA), Jonathan Edelheit, recently predicted that in the year 2017, “Americans could be traveling overseas spending up to $79.5 billion per year [on medical tourism treatments] and over 50% of that business could be headed to Latin America.” (Vequist, 2009, p. 40).

Within Latin America, Brazil provides the most treatments to foreigners, with Argentina serving the second most significant number of surgical treatments. In 2006, Argentina treated over 4.1 million foreigners and the number of medical tourists to Argentina has increased by up to 10% each year since 2003 (Balch, 2006). Buenos Aires has become an increasingly popular location for medical tourism because of its location, expertise of physicians, economic environment conducive to international attention, and cooperation with medical insurance companies.

However, Argentina is facing healthcare access issues and speculators argue this could potentially be caused, in part, by medical tourism. Little research on this subject has been completed, although much information exists on healthcare access in Argentina. From a survey conducted in 2008, it was estimated 31.0 percent of the population holds no medical insurance coverage (Insua, 2004). By stratifying the results into four different income levels, the survey revealed that, of the Argentineans without insurance coverage: “15.1 percent were in the highest-income stratum to 23.0 percent in the middle-income stratum, 31.9 percent in the lower-middle income stratum, and 45.9 percent in the low-income stratum” (Argentina, 2002). This distribution of data is clear evidence of the health access inequalities present in Argentina.

Through my research in Buenos Aires this summer, I surveyed over 50 local Argentinean patients in five different hospitals, conducted interviews with ministry
of health workers, hospital administrators, and medical tourism program coordinators, to develop a complete perspective on how the citizens of Argentina perceive this industry may affect the ability of the country to provide sufficient medical treatment for the impoverished citizens. Questions such as “Does serving foreigners detract resources and treatments from Argentina’s poor?” and “Do you believe medical tourism has a positive or negative effect on healthcare access issues in Buenos Aires and Argentina?” were explored in this study.

From the information collected in this case study, and from previously existing studies, it was possible to develop an inclusive exploration of how medical tourism was perceived to impact health care access of the impoverished citizens of Buenos Aires, Argentina. The responses I received on this topic covered a wide range of opinions, but an interesting pattern emerged between the public and private sector. The citizens and physicians of Argentina from private hospitals, along with the coordinators of medical tourism, believed the influx of foreigners had little or no impact on the access to healthcare by impoverished citizens. Many of them even believed medical tourism was only beneficial to Argentina, because of the increased economic exchange through the industry. On the other hand, citizens and physicians from the public hospitals generally believed the negative impacts of medical tourism outweighed these benefits. Many of these citizens voiced the opinion that foreigners coming to Argentina for treatments reduced the medical care and attention for Argentineans.

My article on this dichotomy of opinions explores the differences between these two views of the perceived effects of medical tourism in Argentina. This article will be one of several chapters for my senior thesis, through which I will explore factual evidence. To draw a conclusion on the actual impact medical tourism has on access to healthcare. The thesis will include a comparison of perceived impact versus actual impact and an analysis of how medical tourism affects the healthcare system of the country from which the medical tourists are leaving.

Brett Wolff

The Writing on the Stall: Graffiti, Vandalism, and Social Expression

The focus of my research is why people make graffiti. Why do students or university employees write on the walls and stalls of bathrooms? What is the social meaning of this behavior?

In reviewing the literature, I have found diverse opinions on both how to approach such behavior and what motivates it in the first place, but there are two main schools of thought dividing the debate. The first group summarily decries any such activity as vandalism and advocates intervention to prevent defacement in the future. A second group posits that graffiti is a socially relevant and artistically expressive movement. According to these latter authors, street art varies from intense social protest to purely aesthetic pieces with a wide spectrum between. In the mainstream culture, graffiti are often associated with marking gang territory and offensive bathroom wall words. I have found several examples that do not fit easily into that model:

- In Argentina, volunteers use stencils and spray paint to mass-produce socially aware graffiti. In a recent graffiti campaign, Argentines tagged messages encouraging the use of condoms to prevent the spread of HIV/AIDS.
- In a radically innovative approach to “street art,” some individuals have begun cleaning selective parts of dirty surfaces to leave a sort of relief image. The pollution and dirt-based discoloration of the wall provides the outlines to the images. Some have called this “reverse graffiti.”

There are other examples of this different sort of graffiti that defies the traditional classification, but a few suffice here.

However, some graffiti are not hard hitting political commentary or a citywide health campaigns. It might be someone’s name or what is on his or her mind at that moment. These writings represent various cultural and social messages and perspectives. In addition, a good number of graffiti works are executed on private or state-owned property. How does one approach this graffiti?

An interesting middle ground I have found in the argument is one borrowed from archaeology: cultural property. The most basic explanation of the concept is that it is the collection of objects, ideas, and practices that belongs to a particular culture. However, these cultures are multifarious and simultaneously present. That is, there is a dominant culture or line of thinking that assumes primacy, but often such dominance includes destruction of other pieces of coexistent cultural property. When considered in this way, graffiti is an example of an oft-abused dissonant form of cultural
property. At the same time, graffiti itself destroys part of the property of the dominant culture. Most of what I have read so far calls for a dialogue between the two cultures to allow for some sort of mutual understanding, but neither side seems willing to listen. Perhaps part of the reason people resort to graffiti is that they do not have a forum for expression of their views.

A different and somewhat radical approach I have considered is a form of dialogue or critique between graffiti makers. If someone finds something offensive or incorrect, he or she can respond to it in the same medium: on the wall. This extends to the bathroom stall as well: painting over the message simply ends any dialogue that might occur. Allowing the graffiti to happen provides a space for discussing issues that might otherwise go unspoken.

This analysis brings the project back to its original question: why do people make graffiti? More importantly, what does it express? On both sides of the vandalism argument, some say that it springs from social isolation. In countries where oppression is overtly military and political, graffiti rises up as a voice of dissent. In postmodern societies where people feel isolated, apathetic, and bored, bathroom wall writings break some of the monotony and foster some level of communication (“someone has to come in here and read this eventually”). The racist, sexist, and sexual nature of much bathroom stall graffiti may suggest that the writers are seeking out a forum to voice opinions held taboo in the mainstream.

For the remainder of my research, I plan to continue reading relevant literature to further expand my knowledge of the current attitudes toward graffiti (on both sides of the argument) and develop a theoretical perspective, which I will apply to graffiti on University bathroom walls. I recently ordered a book called From the Stall that includes a good number of bathroom wall graffiti photos to reference in my research. In addition, I plan to visit restrooms around the University of Kentucky and the University of Louisville campuses to photograph interesting examples of bathroom graffiti. As with most research projects such as this one, my goal is not a solution to the debate; I just hope to shed some more light on the social meaning of what people do — even if it is writing on a bathroom wall.