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Summer Research and Creativity Grants

UK Office of Undergraduate Research

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The following abstracts were submitted by students who received Research and Creativity Awards for the summer of 2008. Many are not final reports, because the projects were still in process when the submissions were due. Rather, they are progress reports. However, these abstracts provide a clear and wonderfully diverse picture of the broad range of scholarly activities being undertaken by undergraduates at the University of Kentucky.

Effect of Endocrine Disruption on Male Reproduction in Guppies (Poecilia reticulate)
Sean Allen, Biology

Guppies (Poecilia reticulate), a tropical fish species native to Trinidad and a fish with a highly promiscuous mating system, were studied to determine what effect endocrine disrupting agrochemicals had on reproductive characteristics of males. Reproductive characteristics examined included size and intensity of carotenoid based orange spots, competitiveness for females, and attractiveness to females. Before that, preliminary experiments were conducted to understand what, if any, preference male fish had toward females with respect to size, in the presence of competition from another male, and how the presence of competition altered their behavior. Previous experiments in this lab showed males had no size-specific preference for females in the absence of competition. Next, we investigated male mate preference in the presence of competition. The data from this study showed that brighter male fish (containing more carotenoid) were dominant and consistently displayed more to females, as well as spent a larger percentage of time near the larger female. This data shows that male fish perceive larger females as more capable of producing larger, healthier broods. Once we understood the mating behaviors and preferences of these fish, we focused on studying the effects of exposure to hormone disruptors on these reproductive characteristics. Adult males exposed to hormone disruptors via diet manipulation for 6 weeks were measured for carotenoid-based color changes (if any) and behavioral changes as a result of hormone disruption. Experiments scoring competitiveness between control males and treatment males for females, as well as female preference between control and treatment males, were conducted. This study is important to understand the effects of exposure to sub-lethal doses of endocrine disrupting agrochemicals on the reproductive systems of vertebrates.

Research Progress Report for Development of a GIS-Based Model to Predict Amur Honeysuckle Presence in Mature Forests in the Bluegrass Region
Emily Bruner, Forestry

I was given a summer research grant to investigate constructing a GIS-based model to help identify target areas for eradication of Amur Honeysuckle in Mature Forest Stands in the Bluegrass Region of Kentucky. In order to help familiarize myself with Geographic Information Systems (GIS) software, I teamed up with Dr. Mary Arthur and one of her graduate students, Heather Wilson, in the Forest Ecology lab to continue research that they have already begun, investigating Amur honeysuckle presence in fifteen mature forest sites. I hope to identify statistically significant landscape variables that will help to paint a bigger picture of invasion and help land managers promote forest health. So far this summer I have gained invaluable experience getting to know the software itself and have begun to understand its limitations and possibilities. I have begun working with one particular site to import specific soil and habitat data from various GIS databases and have begun to quantify a suite of spatial parameters in order to identify invasion correlates across the landscape.

I have situated myself at a permanent work location and continue to familiarize myself with the capabilities of the software to incorporate all 15 sites into my research. Once all sites have been measured for the landscape variables identified, I will begin statistical analyses to classify which landscape indicators are applicable in diagnosing invasion of Amur Honeysuckle.

Hormonal Control of Gene Expression in Undifferentiated Cells
Amie Chan, Biology

A number of regulatory factors control the development of undifferentiated stem cells. Availability of stem cells, stem cell fate, and host rejection all must be overcome before the therapeutic potential of such undifferentiated cells can be realized. These challenges require a better understanding of the signaling pathways that control the fate of undifferentiated cells, toward an improved ability to manipulate their proliferation and differentiation. The process of differentiation is controlled by factors intrinsic
and extrinsic to the cell. Cell-permeable molecules such as steroid or terpene-based hormones have proven to be extremely useful tools for inducing differentiation of various cells into neurons, glial cells, and fibroblasts.

Our aim is to discern how extracellular molecules, such as hormones, induce the genetic programs for selective cellular differentiation. This question is being approached by elucidating, through promoter mutational analysis, what promoter DNA sequences of a model gene are necessary for hormone action in undifferentiated insect Sf9 cells. The cultured cells, into which the wild type and mutant promoter constructs are transfected, are then exposed to steroid and/or terpenoid hormones.

So far, in my research I have grown and maintained undifferentiated Sf9 cells from three different cell lines from various research supplier companies: Orbigen, Novagen, and ATCC. I performed transfections using selected DNA constructs and healthy cells from the three different cell lines. The purpose of these transfections is testing and determining which cell line would present the best promoter interaction concerning gene expression, transcriptional activity, and comparable hormone responses, based on the quantitative data collected by luminometric assay of its production of ‘reporter luciferase.’ Results have shown that Sf9 cells from Novagen’s cell line have acceptable firefly and renilla luciferase counts and normalized activity of promoter analysis. I will be using this cell line for transfections, testing specifically designed DNA wild type and mutant promoter constructs from four selected model genes.

On the basis of the results obtained thus far in the ongoing experiments, it is anticipated that specific promoter DNA sequences will be discerned that are necessary for the genetic action of these hormones that control cellular differentiation. Obtaining this new basic understanding of how hormones act to control gene expression will enable the manipulation of cellular differentiation for specific practical purposes.

**Django Reinhardt Festival 2008**

**Agatha Clixby, Music**

My knowledge of the Django Reinhardt festival before May 28, 2008 wasn’t much. The minimalist website offered a few details of the Who, What, and Where nature, but little else. Setting out to research the elusive gypsy jazz, I hopped aboard a jet plane and found myself in Paris, France, where I thought I knew exactly what lay ahead of me. In a small village named Samois-sur-Seine, a quaint, local music festival annually celebrates some of the last remaining traces of jazz manouche. As best as I could gather, there would be few people in attendance, and the acts would be solo guitarists or quintets.

Carrying on the tradition Django Reinhardt created with his Quintette du Hot Club de France. My intentions were to meet musicians who could help me understand this unique breed of music and who could help a classical violinist like myself find a way to bridge the gap from Dvorak to Django.

Feeling trapped within the confines of calculated classical music had lead me to explore the exciting world of jazz, and I was certain the Django Reinhardt festival was exactly the place to do so. Armed with daydreams of interviewing the headlining acts, I began an inspiring journey that taught me the valuable lesson of listening with my ears and my mind open.

Roughly four days had passed since I arrived in French territory. Four days filled with unforeseen complications, overly stuffed suitcases (Why hadn’t I listened to my father?!), and, of course, inexplicable happiness to be in such a beautiful country. The glamour and frustrations of independent travel were weighing on my shoulders as I boarded the RER D in Paris, direction Melun. Unsure of what exactly awaited me at the end of the line, I prayed only that the shuttles promised by the website were in fact at the train station. I tried to keep at bay the fear of coming all this way only to be unable to find the festival. To my dismay, no one at the train station had ever heard of Samois-sur-Seine, and not a single shuttle was in sight. As I began to lose all hope, a nearby taxi driver came to my aid.

The taxi was a beautiful black Mercedes with clean leather seats cooled by the air conditioning Paris so sadly lacks. The driver was actually wearing a red and white striped shirt, and engaged me in polite French conversation the whole ride. Now, this was much closer to my daydreams of my Eurotrip.

A mere ten minute drive from the train station, he let me out as close as cars are allowed to approach the festival, and instructed me to follow the roads down toward the river, wishing me luck. The scenery was breathtaking. Not hard to imagine why a musician would find himself so inspired here. As I neared the festival, I began to hear the sound of a muted trumpet wailing in the air. It rose higher and higher as I turned the final corner and got my first glimpse of the festival. Almost unreal, the festival stage itself was on a small island, surrounded by the river Seine on all sides. The island was covered in lush trees that shaded the masses of people below, standing hip to hip, just as they do on the crowded Paris metro. Apparently I was the only one who had trouble finding this island concert! I joined the huddle of people waiting to cross the bridge, pay their admission, and find themselves in jazz nirvana.

Overcome with the happiness and relief of having found myself just where I wanted to be, I squeezed my way into the unorganized line, as festival staff carried a sign that read “COMPLET.” The festival is sold out. Shouldering my way past some mosey Frenchmen, I barely made the cut with the sign going up only inches behind my back. I made my way toward the stage where Stefano di Batista and his quartet were working the crowd into a frenzy, each member soaring through dazzling solos. However, this was not the jazz manouche I had travelled many miles to study and observe. A new fear set in — the fear that I would not find true gypsy jazz at this festival... perhaps it really was long gone? Just then, a young man around my age introduced himself as Jeroen and inquired if I were a journalist, because he had seen me taking notes. With his unkempt curly hair and backpacker’s garb, he reminded me of an old high school friend, and invited me to sit with him. He and his three brothers, all jazz fanatics and amateur musicians, had driven from Belgium to spend the weekend at the festival. We began to speak in equal parts French, English, and Flemish, discussing music and jazz and Django Reinhardt. I explained
the characteristics of jazz manouche and my concerns that I wouldn’t find much of it at this festival, after all. Jeroen suggested I take a walk through the rest of the festival grounds to see what I might find.

Around the corner was a vast array of booths, with everything from beer taps that didn’t stop flowing to on-site custom made jazz manouche picks. In between the booths, guitar circles were spontaneously forming and strumming rhythmic chord beds—individuals taking turns with their nimble fingered improvisational solos. A few lucky circles were joined by violinists who stood and moved between guitarists, latching onto harmonic progressions to dazzle onlookers with lightning fast fingers. Now this was exactly what Django and Stéphane had devised, and what I had come to observe. Relief washed over me as I studied a young violinist and caught his attention.

Once he finished his piece, Arnaud introduced himself and took a break to speak with me for awhile about playing the jazz violin. I told him that, as a classical violinist, I was extremely impressed and amazed by his ability to jump freely up and down the fingerboard with such tonal accuracy while improvising. Curious as to how someone could take what is to me a familiar instrument and create music with a freedom so unfamiliar to me in classical violin lead me to ask Arnaud how he learned to play jazz manouche. The response I got was not what I could have expected.Beginning his violin studies on his own, he had listened to recordings of Django Reinhardt and his Quintette du Hot Club de France and began to improvise along with what he heard. As he got older, he discovered something that helped him gain control of his technique and master his instrument: Kreutzer etudes—the very same etudes my violin teacher recommends. The lines between classical music and this exotic gypsy jazz were beginning to blur.

Arnaud continued to explain the importance of daily routines, such as scales and technical exercises, in order to move freely around the violin with confidence and accuracy. To watch him play, I never would have guessed that his fingers were classically trained, because the overwhelming feeling is of freedom from the rules, and the creation of something new and personal. I thanked Arnaud for his time as he sent me away with the suggestion of a jazz violinist to study, Florian Niculesu, and a completely different outlook on gypsy jazz. Barely five feet away from that guitar circle, I was already stumbling into a new one, lead by some of the most impressive violin playing I had ever heard. Standing on tiptoe to get a look at this virtuoso, my mouth fell open at the sight of a young redhead boy in baggy jeans and a white undershirt. He was absolutely wowing the growing crowd with his violin, and his hands moved with such speed yet he was having the time of his life. The group was playing a gypsy rendition of the Spiderman theme song, over and over, and each time they neared the final cadence he yelled ‘One more!’ in a British accent and spiralled into a new solo.

This was exactly what I had been searching for. Those young violinists were playing the jazz violin tunes Stéphane Grapelli had lent to the Quintette du Hot Club de France, and the guitarists strummed along to the echoes of Django himself in their ears. Ecstatic to have found true jazz manouche after all, I returned to my Belgian friends in front of the main stage to find a Portuguese woman on stage singing flamenco. The crowd appeared to have grown, despite the “sold-out” sign still posted at the bridge and, as the sun was going down, the island took on a whole new feeling. With the sultry Latin music booming from the speakers, it was becoming more and more difficult not to move along with the singer. Normally an incredibly timid dancer, I found myself laughing and joining in with Jeroen who was shaking his hips with the best of them. I told Jeroen that I had never imagined hearing flamenco at a jazz festival, and that if it weren’t for the amateur guitar circles, I never would have found jazz manouche at this festival. His answer was without a doubt the most valuable lesson I learned that day at the festival. “It is all the same esprit, spirit. Those guitarists have memorized Django’s solos, but this woman is using her voice the same way the violinists use their fingers. She is creating something new, and that is why she is on the stage with a poster behind her head that says Django Reinhardt.” He was right. I had been trying so hard to pin down jazz manouche as one specific sound from one particular instrumentation, that I had forgotten to think about what it all means.

Why had I come to this festival? To learn more about a style of violin playing that allowed innovation and encouraged break from convention. I came because I wanted to discover something new, something inspiring. But I was mistaken in believing that only the young amateurs with the impressively memorized Django solos were jazz manouche, or that the only knowledge to gain would come from the headlining acts that graced the pages of the program. Yes, those gypsy jazz musicians imitated the Quintette du Hot Club de France, but they are no more in the style of jazz manouche than Pee Wee Ellis & Fred Wesley, who played later on that night—an American big band style jazz ensemble that couldn’t sound much further from Mr. Reinhardt’s quintette. Perhaps the bereted guitarists with percussive rhythms have been replaced by pinstriped suits and amplifiers, but the spirit is still the same. Everyone gathered at Samois-sur-Seine that weekend to hear innovative music, and everyone on stage and in the audience recognizes Django Reinhardt as a founder of music that breaks boundaries and blurs lines between genres and styles. I went to the festival to learn why jazz manouche had taken a back seat, but I left understanding that it had not disappeared at all. In fact quite the opposite! My mistake was in assuming that it had to sound and look the same, because music is not a caged animal that mimics and repeats. Music is a living thing that grows and evolves, and that is how it should always be.
Synthesis and Characterization of Degradable Hydrogel Polymer Systems

Juan Carlos Cordova, Chemical and Materials Engineering

Crosslinked degradable hydrogel polymer systems are promising biodegradable materials for medical applications as well as tissue engineering. So far, my research has concerned the development of 3mm thick degradable hydrogels with an estimated starting degradation time of three weeks. After trying various polymerization techniques, I have been able to determine that for the systems that best fit my project, Thermal-Polymerization is the process that yields the best conversion of the macromer to the crosslinked hydrogel. The molecular weight of the macromers was tested through Gel Permeation Chromatography (GPC), the conversion was examined through Infrared analysis (FTIR), and degradation has been analyzed through degradation studies. Currently, I am in the process of developing highly porous hydrogels by introducing different particles into my macromer and, upon crosslinking, removing these particles to leave a porous hydrogel matrix. The degradation products and properties of these porous systems will also be analyzed and compared to the original gels developed at the beginning of my summer project.

Children in Housing Distress: Their Health and Well Being

Alecia Fields, Sociology

National research recognizes nutritional deficiencies, sleep disorders, and increased prevalence of health conditions, such as Asthma, among homeless children. However, throughout a semi-structured series of interviews with families living in homeless shelters, parents repeatedly reported that their children were in good health and had an overall good quality of life. These inconsistencies indicate a disconnect with reality that homeless parents may face when it comes to the health and well being of their children.

My mentor, Prof. Badagliacco of the Sociology Department, conducted interviews over a period of eight years from 1993 to 2001 with eighty-six families living in homeless shelters. Each of these families had at least one child and these children and their health are the focus of this research. While no children were interviewed, parents were asked questions regarding their children’s health and well being. It is the discrepancies between parental opinion and nationally reported health statistics that are being examined in relation to homeless children’s health, well being, and opportunity for success. Such disparities raise questions such as: what is the likelihood for success of homeless children if their health is compromised by distorted parental judgement? Additionally, how is the health of homeless children jeopardized by lack of parental education, resources, and security?

The potential outcomes of such differences in parental opinions versus reality could put children at risk for more serious advancing conditions. If parents cannot recognize early stages of advancing health conditions, children miss the opportunity for preventative or early intervention care. Furthermore, health factors such as sleep, nutrition, and mental well being can develop into behavior problems and problems in school. This cycle of developing conditions among homeless children puts them at a greater disadvantage for success. In proposing policy to address such disparities facing children in housing distress, interventions must include a combination of educational programs for parents and families as well as readily accessible primary care services.

Project Guignol

Sarah Fogerty, Theatre

With the 100th anniversary of theatre at the University of Kentucky growing closer, it is necessary to examine the past to fully understand the sacrifices that the founders of dramatic culture at the university made. There are endless resources that document that past in the UK archives; however, they are not organized in a way that tells the story of the rich history of dramatic arts at the University. This project’s purpose is to rediscover the Theatre Department’s roots, by searching through newspaper clippings, playbills, photos, and scrapbooks in the UK archives to tell the story of the growth of theatre on campus, and establish a greater camaraderie between those in the past and present.

As a result of my findings, I have discovered that the students at the University of Kentucky were so interested in theatre that for almost ten years there were two student groups on campus that were producing plays simultaneously. One of those groups, which began in 1910 under the title “The Strollers,” prompted the English Department to begin offering theatre related coursework. The Guignol Theatre, whose heritage we can trace directly to the current theatre department, was the first University-civic theatre to be established during the “Little Theatre” movement in early 1920s America. We have a rich history of dramatic art at the University of Kentucky; it is my intention that through uncovering, organizing, and interpreting that history we can preserve and celebrate it, and use the principles learned from the past so that we may continue in the tradition established in the last century.
Inter-Species Face Discrimination in Infancy

Whitney Gore, Psychology

Past studies have shown that infants are experts at processing faces and that, as they get older, they specialize in human faces. They become better at processing information from human faces than faces of other species. In this study, we will determine whether 9-month-olds exhibit this type of face specialization. Specifically, we are examining whether infants are sensitive to spatial relations among facial features (such as the distance between the eyes) in chimpanzee faces. This spatial information is important because infants, as well as adults, use it in part to identify faces.

Initial results suggest that 9-month-olds are also sensitive to spatial relations in chimpanzee faces. This may mean that face processing is not specialized enough in infants to prevent the 9-month-olds from processing the same information in human and chimpanzee faces. In addition, we are studying whether inverting the faces will interfere with the processing of chimpanzee faces like human faces. Preliminary results suggest that 9-month-old infants are processing the inverted chimpanzee faces differently from human faces in these conditions. Therefore, some level of specialization may be present in 9-month-olds.

Results to-date for objective 1
In the initial experiment, I sprayed 25mM, 50mM, and 75mM glycerol on soybean plants for three consecutive days. On the fourth day I extracted fatty acids and RNA from the plants and then inoculated them with the pathogen *P. sojae*. The fatty acid data indicated a decrease in levels of oleic acid in plants treated with glycerol. The extent of reduction in oleic acid levels increased with increasing concentrations of glycerol. No change was observed in water treated plants.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>18:1 levels (mol%)</th>
<th>H2O</th>
<th>25mM</th>
<th>50mM</th>
<th>75mM</th>
</tr>
</thead>
<tbody>
<tr>
<td>H2O</td>
<td>-</td>
<td>2.18</td>
<td>1.85</td>
<td>1.8</td>
<td>1.65</td>
</tr>
</tbody>
</table>

RNA analysis found increased expression of pathogenesis-related genes with increasing concentrations of glycerol, confirming that the low oleic acid-related resistance responses were induced in glycerol-treated plants. Finally, *Phytophthora* disease progression was monitored in water and glycerol-treated plants by counting the number of dead versus total number of inoculated plants six days post inoculation with *P. sojae*.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Dead/Total</th>
<th>% Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>H2O</td>
<td>4/7</td>
<td>43%</td>
</tr>
<tr>
<td>25mM</td>
<td>3/5</td>
<td>50%</td>
</tr>
<tr>
<td>50mM</td>
<td>2/4</td>
<td>50%</td>
</tr>
<tr>
<td>75mM</td>
<td>2/5</td>
<td>60%</td>
</tr>
</tbody>
</table>

The following experiment consisted of spraying plants with a 100mM glycerol for three days. *P. sojae* inoculations were carried out on the fourth, fifth, sixth, seventh, eighth and eleventh day after glycerol treatment. This was done to test the length of glycerol efficacy in inducing plant resistance. The following results were observed:

<table>
<thead>
<tr>
<th>Days after glycerol treatment</th>
<th>Plants dead/ Total</th>
<th>% Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>3/4</td>
<td>25%</td>
</tr>
<tr>
<td>5</td>
<td>4/6</td>
<td>33%</td>
</tr>
<tr>
<td>6</td>
<td>4/5</td>
<td>20%</td>
</tr>
<tr>
<td>7</td>
<td>4/6</td>
<td>33%</td>
</tr>
<tr>
<td>8</td>
<td>4/6</td>
<td>33%</td>
</tr>
<tr>
<td>11</td>
<td>5/5</td>
<td>0%</td>
</tr>
</tbody>
</table>

Studies of Soybean Plants

Hildallcia Guerra, Plant Pathology

Glycerol mediates several vital physiological processes in prokaryotes and eukaryotes. Studies from Dr. Aardra Kachroo’s laboratory have shown that glycerol and its metabolites participate in plant defense, signaling against microbial pathogens. Soybean plants treated with glycerol exogenously induced cell death-like lesions, levels of the defense-related phytohormone salicylic acid, and pathogenesis-related (PR) gene expression. These plants also showed a reduction in the levels of the fatty acid oleic acid (18:1). Inoculation with the oomycete pathogen *Phytophthora sojae* showed that glycerol treatment enhanced to *Phytophthora* rot in soybean (Kachroo et al., 2008).

The first objective of my project was to test the efficacy of glycerol as a tool for disease management in soybeans. I treated soybean plants with varying concentrations of glycerol and then assayed the plants for their fatty acid content, PR gene induction, and response to *P. sojae*. I also treated soybean plants with glycerol for varying amounts of time and assayed the plants for all the above characteristics. In addition to *P. sojae*, I tested the efficacy of glycerol application on resistance to the fungus *Sclerotinia sclerotiorum*. 
To test similar patterns of resistance in another experiment, one pot was sprayed with 75mM glycerol for three days. Likewise, the glycerol-sprayed and control plants were inoculated on the fourth day, however, on this occasion S. sclerotiniunm was the pathogen. After several days of observation it was evident that the glycerol treated plants had undergone more extensive damage from the pathogen than the control counterparts. The results indicated increased susceptibility in the presence of glycerol, contrary to the previous findings. Experiments with S. sclerotiniunm will be repeated to confirm results.

A second objective of my project is to use yeast two-hybrid (Y2H) analysis to identify soybean proteins interacting with the soybean mosaic virus (SMV) elicitor protein, P3. Dr. A. Kachroo’s laboratory is studying soybean response to SMV. Their work has identified several components that are required for resistance to SMV. In an effort to further understand host response to SMV, Dr. Kachroo is interested in identifying host components that respond to the SMV elicitor of defense-P3 protein. A Y2H vector (pEG202) containing the SMV P3 gene was available from Dr. Kachroo’s lab. I have used this vector as a bait to screen a soybean cDNA library in the pB42AD vector (kindly provided to Dr. Kachroo by Dr. Madan Bhattacharya, Iowa State University).

**Results to-date for objective 2**

Bacterial transformation was carried out using the pEG202 vector containing SMV P3. Transformants were checked for the P3 insert, using PCR followed by gel electrophoresis. Colonies were inoculated into Luria Bertani medium and then used for plasmid DNA extraction. The extracted plasmid DNA was used to transform yeast and transformants selected on media lacking histidine (His-). Next, a soybean cDNA library was used to transform the yeast cells carrying pEG202-SMVP3 and transformants selected on media lacking histidine and tryptophane (His- Trp-). This medium would only allow yeast cells carrying both plasmids to grow. Approximately 600 yeast colonies were obtained on the non-selective medium (His- Trp-). Each colony was transferred to selective media lacking leucine (Trp- His-Leu- + 2% galactose). Twelve colonies were able to grow on the selective media. These 12 colonies will be further processed to identify soybean inserts potentially interacting with SMV P3. The subsequent step in this process is to isolate the yeast plasmids and sequence the soybean cDNAs inserts to identify the candidates and eventually confirm interaction by protein studies.

**Reference:**


**GIS and Archaeology:**

**A Marriage on Monte Palazzi**

Stephanie Houck, Archaeology

More than 2,700 years ago Greek colonists settled in Locri Epizephyrí and occupied a mountaintop in the region of Calabria, Italy, now known as Monte Palazzi. According to the earthenware found there, the site may be of some religious importance. However a mystery started to unfold when in 2005 the excavation team under the leadership of Dr. Paolo Visona unearthed a fortified wall surrounding the site. The wall seems to be too thick to be a residential structure but, in bulk and strength, is insufficient to withstand a full military siege. So, for what purpose could this strange site have existed?

The spatial distribution of artifacts as well as the layout of the site will be determined through the combination of archaeological ideas and the technology of GIS (Geographic Information Systems) and global positioning systems employed by geographers today. The research proposed here will incorporate the development of GIS maps to assist in the exploration of the Mount Palazzi archeological site in southern Italy. This information will be displayed over a never-before-produced detailed map of the local terrain, including the land slope, vegetation, soil type, and other landscape features. The goal of this study is to provide a new interpretation of the spatial usage and layout of the site, utilizing geographical methods along with new mapping technologies.

With all the information on the location and dates of each unique find — these being cluster of potsherds, ecofacts, and artifacts displayed upon a graph of the site — it was concluded that the site on Monte Palazzi probably functioned as a sanctuary and garrison for mine hands working at a newly discovered iron mine nearby. The theoretical and analytical implications of geographical tools such as GIS and GPS when combined with the tools of archaeology are immense and sure to produce a much more thorough story of the history of Monte Palazzi and of southern Italy as a whole.
E-Beam Dosed Teflon AF Waveguides

Phillip “Donnie” Keathley, Electrical Engineering

Although my original grant proposal outlined e-beam dosed Teflon AF waveguides for surface plasmon resonance (SPR) sensing, my actual work has been in slightly different directions this summer. Since the writing of that proposal, I have tied the loose ends on another work in progress (optical properties of sputtered Teflon FEP) and presented that work at the Electron Ion and Photon Beam conference on Nanotechnology (EIPBN) in Portland, Oregon. Accompanying this presentation, and with the help of Dr. Hastings, I also authored a journal article on the topic to be published in J. Vacuum Science in November, along with other conference works. It was upon returning from this trip at the early part of the summer that I realized much more potential in two other projects this summer.

The first project, on which I have spent most of my time thus far, is the deposition and patterning of SiO\(_2\) strips (30 M\(\mu\) wide) on top of a conventional dual mode SPR sensor (essentially a sandwich of a glass substrate, 400 nm thick Teflon and 50 nm thick gold). This project has been conducted with a graduate student who is pursuing her Ph.D. in the area of SPR sensing. Much of my contribution has been with sputtering and characterizing good SiO\(_2\) films. With knowledge and experience gained in past sputtering projects, it was possible to achieve very good SiO\(_2\) layers, as confirmed with spectroscopic ellipsometry. The problem thus far is the final etch step. To remedy this, we have designed a new photolithography mask, and changed our etch process.

The project I plan to spend most of my time on in the remaining half of the summer is one that just grabbed me when brainstorming with Dr. Hastings after the conference. As of now, SPR sensors require a bulky prism and complicated optical setup that is far from being portable. However, with the creation of a diffraction grating at the gold surface (at the gold-Teflon interface) it is possible to induce surface plasmons with nothing more than a light source and detector. This innovation would enable the use of quite cheap and portable sensing equipment to work with the sensors, which could apply in applications outside of a laboratory. Thus far, this has just been heavily brainstormed, and I am still gaining a solid background, but I plan to get started with some preliminary fabrication and testing within the next

Development of Transgenic Plant Lines to Support Cell Biology Research

Kristin Kopperud, Plant Pathology

The research that I am conducting this summer in the Goodin Lab is contributing to a significant project funded by the National Science Foundation. The goal of this project is to identify plant factors that interact with viral proteins in the course of infection leading to disease. 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, and will be used in publications. My eUreKa!-funded grant is related to three essential objectives.

Objective 1: Identifying the best plant lines for use in experiments

The level of fluorescence varies with the expression of the plant’s transgene, thus, all plants to be used for experimentation and microscopy must be screened for the presence and degree of fluorescence. In order to obtain the highest-quality micrographs for publication, only those plants that exhibit an intense and consistent level of fluorescence are retained for seed amplification or use in experiments. I keep diligent record of each plant tested to ensure that only the best plants are available for use by lab members.

Objective 2: Maintaining plant stocks to support experiments

In conjunction with the plant screening process, I must also maintain a continuous supply of the various 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.

The various transgenic lines in greatest demand at present are those with fluorescent subcellular markers targeted to the endoplasmic reticulum, nucleoli, and nucleus, expressing different colors or fluorescence. Each line of plants is cultivated to express one color in a specific locus and is designated by a number on a seed stock list. Transgenic plants that contain a red his-
tions, including two Oscar nominations, and some positive reviews from critics. The Nightmare Before Christmas continues to be an immensely popular cult film whose popularity has been revived in recent years, earning a three-dimensional re-release in theatres during 2007.

The Nightmare Before Christmas is a very different film, and not just in its use of stop-motion filming and clay figurines, but also in the story itself. The movie follows the citizens of Halloweentown’s attempt at hijacking the Christmas holiday, kidnapping Santa Claus, and spreading terror throughout the world. From that summary, one would think the film was a horror movie, but instead, the film is really an imaginative children’s musical. The film depicts some of the most archetypal childhood fears in a particularly adorable, and definitely not scary, manner. Creatures like the “boogie-man,” the monster under the bed, vampires, witches, skeletons, and mad scientists make up the cast of The Nightmare Before Christmas and, for all of the most certainly dark motifs that create the movie, the film remains lighthearted.

My research focuses on the peculiarity of this film and how the film itself could have affected today’s young adults and teenagers, because the intended audience of this film, young children, is now today’s high school and college-aged population. I am concerned with how people in the age group of 16-24 could have interpreted the film as children, how it affected them as they were growing up (primarily their childhood fears and imagination), and if the film inspired certain trends in fashion and ideology (inspired by the success of alternative clothing stores such as Hot Topic — which continues to sell The Nightmare Before Christmas paraphernalia), and the study of today’s counter-culture, where the film’s largest number of cult followers tend to associate themselves.

Currently, I am surveying high school students and college-age adults to find out what trends could possibly occur as a result of viewing The Nightmare Before Christmas at a very young age. Some trends have begun to emerge; some of the subjects surveyed had some of their childhood fears absolved because of the film (about half of the subjects who claimed they were afraid of the dark, of monsters under their bed, and of the “boogie-man” claimed they were no longer afraid of these things after viewing The Nightmare Before Christmas). For some of the listed fears, nearly all of the subjects who claimed that fear said they were no longer afraid after viewing the film (this occurred in subjects who claimed they were afraid of shadows and monsters in general when they were growing up; after viewing the film, 86% claimed they were no longer afraid of monsters and 67% claimed they were no longer afraid of shadows).

The statistics reported above are preliminary, because surveying is still a work in progress. Other trends are also being studied, including fashion, how dark motifs are viewed symbolically, and the relation between youth counter-culture and The Nightmare Before Christmas.

Objective 3: Amplifying seed stocks of homozygous plant lines
As a result of genetic assortment, the acquisition of a plant line that exclusively produces progeny positive for the expression of the desired transgene may take several generations. Prior to “true breeding” status, a fraction (approximately 1/3) of the progeny are negative for transgene expression and must be discarded. True breeding is achieved through the collection of seeds from those plants with the highest level of fluorescence and repeating the cultivation process until the yield of progeny positive for expression is 100%. This indicates that no segregation is occurring and the plant line is homozygous for the expression of the transgene.

Youth Culture and The Nightmare Before Christmas

Nigel Lepianka, English

In October of 1993, Touchstone Pictures released a stop-motion film, pulled from Tim Burton’s imagination, titled The Nightmare Before Christmas. The film was celebrated when it was released, garnering several award nominations, including two Oscar nominations, and some positive reviews from critics. The Nightmare Before Christmas continues to be an immensely popular cult film whose popularity has been revived in recent years, earning a three-dimensional re-release in theatres during 2007.

The Nightmare Before Christmas is a very different film, and not just in its use of stop-motion filming and clay figurines, but also in the story itself. The movie
Research Concerning Pediatric Sedation and Complications

Madison Allen, Pediatric Critical Care

The education of medical practitioners is based on didactic lectures and clinical “hands on” experience. In recent years, the sedation of children for painful and diagnostic procedures is increasingly being performed by non-anesthesiologists such as pediatric intensivists, emergency department physicians, and pediatric hospitalists. Although these specialists have extensive training in their fields, which includes airway skills training and resuscitation training, training specifically in procedural sedation is not often a part of the structured educational program. Although the ability to respond to complications or events is not questioned for these practitioners, the ability to avoid complications and events is unknown. Several studies have shown that increased patient volumes in hospitals leads to better outcomes. We hypothesize that with increasing experience, non-anesthesiologist pediatric sedation practitioners (pediatric intensivist) will report fewer complications/events during pediatric procedural sedation.

At the University of Kentucky, Kentucky Children’s Hospital pediatric patients who require diagnostic or invasive procedures may be referred to the Pediatric Sedation Service for sedation and analgesia. The Pediatric Sedation Service has performed procedural sedation for diagnostic or painful procedures for children since 1999. Since that time, this service has performed approximately 9000 procedural sedations. This service is staffed by a pediatric intensivist and pediatric nurses. The physicians are credentialed and privileged to provide moderate and deep sedation to children. They conform to the requirements as outlined in the hospital sedation policy for assessment, documentation and monitoring.

All records of children who presented for sedation within the eight-year period will be retrospectively evaluated for the physician performing the sedation and the complications/events related to sedation that occurred. For each physician, the first quartile number of sedations will be examined for the frequency of complications or events and compared to the most recent quartile of sedation complications.

For each sedation performed, we will record what number of procedural sedation it is for the practitioner performing the sedation since the start of his or her practice at UK (i.e., first, second, third, ……100th, 101st, etc.) Each practitioner will be identified by a unique number and, when data is collected, only the unique number will be written on the data collection sheet. Analysis will group the first 25 sedations of all practitioners and compare in 25 sedation increments up through numbers 250-300. Therefore, there will be 12 groups of sedations over time to compare events based on numbers of sedations performed. If six practitioners consent to participate, each group of 25 sedations per practitioner will have 150 sedations total.

The number of “expected” events or complications has not been described for this group before (pediatric intensivists performing deep sedation), therefore it is not known the number of sedations that will need to be evaluated to achieve significance. With the small number of potential participants, this study will likely serve as a preliminary tool for future research studies in this area. The one large study to describe complications and events that occur during pediatric procedural sedation is from the Pediatric Sedation Research Consortium (Dr. Cheri Landers is the PI for the UK site of this multi-center study: IRB protocol #06-0764-P1G).

Selective Melting and Evaporation of Gold Nanoparticles

Robert Martin, Mechanical Engineering

We are developing a new concept, based on atomic force microscopy (AFM), to pattern and assemble metallic nanoparticles on a substrate. We take advantage of the unique thermal and optical properties at the nanoscale to pattern the particles. Initially we have been able to melt and evaporate 50 and 100nm particles using a pulsed laser beam with a 532 nm wavelength of light and a Silicon AFM tip brought in proximity to the particle. Extensive computer modeling has been done using multi-physics software to show the particle’s enhanced energy absorption in the presence of the probe. After certain energy thresholds, the particles will either be melted together or evaporated entirely. This method is unique compared to other patterning methods, because it is flexible and requires less energy.
The Relationship Between BART Scores and Low Anxiety

Amanda Metze, Psychology

Under Dr. Milich’s supervision, my summer research project has progressed nicely. On a weekly basis I meet with Dr. Milich to discuss studies that have already been conducted, to build a foundation for what will become my Senior Honors thesis. Thus far, I have been immersed in the literature investigating the links between psychopathy, impulsivity, anxiety, and the use of behavioral tasks that are used to measure these characteristics. One such behavioral task, the Balloon Analog Risk Task (BART) has been my main focus as of late. The BART is a computer task in which a participant is instructed to pump the balloon to collect money per pump. If the balloon pops, the participant loses the money, but if he or she banks the money before the balloon pops he or she gets to keep the money. This task has been used to predict impulsive behavior and is, consequently, being used in research investigating psychopaths who seem to suffer from chronically unstable behaviors such as impulsivity.

I have also had the opportunity to begin analyzing some previously collected BART data. For this task I added the total number of balloon pumps and then subtracted the balloon pumps in which the balloon actually popped. These adjusted values are preferred in the analysis of BART data because they eliminate the inclusion of trials in which the participant was forced to stop pumping due to an explosion.

Because my ultimate goal in starting research this summer is to lay a firm ground work to be able to continue this research into the fall, I have begun drafting an introduction for my Senior Honors thesis project. I am currently compiling research for this endeavor. As the summer continues, I hope to do more analysis and will continue to research psychopathy, anxiety, and impulsivity to ensure that I get the most I can out of this opportunity.

Sunscreen: The Reason for the Segregation of the Sexes?

Jonathan Moore, Biology

As anyone who has spent a little too much time at the beach in the sun can attest, high sunlight levels can damage living tissue. Unlike humans, plants do not have the luxury of simply moving out the sun to a shady spot or slathering on a sunscreen lotion. Plants use the physiological method of producing sunscreen pigments (carotenoids and anthocyanins among others) to deal with excess solar radiation. For plants that are exposed to higher amounts of solar radiation, it is important to maintain a higher ratio of sunscreen pigments to major energy gathering pigments (chlorophylls) than plants exposed to lower amounts of radiation, in order to dissipate excess absorbed energy. This phenomenon has not only been observed in seed plants but also the nonvascular plants (e.g., mosses and liverworts).

The study species for this project is the liverwort, Marchantia inflexa, which consists of a flat horizontally growing photosynthetic thallus and vertical sexually reproductive (and photosynthetic) structures. Males of Marchantia are more likely to be found in high light environments than are females. Thus, the goal of this study is to test the hypothesis that males will produce more sunscreen pigments than females.

To test the hypothesis, I traveled to Trinidad, where Marchantia is indigenous, with my mentor, Dr. Nicholas McLetchie. At four field sites, pairs of males and females not more than half a meter apart were located and sampled. Because of their close proximity, each pair was considered to be in the same light environment. From each male or female, a sex structure, the thallus that produced the structure, and a thallus not producing a sex structure but connected to the sex expressing thallus were collected. These samples were dried and brought back to the University of Kentucky and assayed for sunscreen pigment content. Pigment content was correlated with light environment (% open sky and light level), which was estimated using hemispheric canopy photographs. Average light intensity over the previous three months was used as light level.

The data is still under analysis, but some preliminary patterns have emerged. In all three tissue types, the ratio of carotenoids to chlorophyll increases with light level, supporting the expectation that the relative amount of carotenoids would increase with light intensity. There seems to be essentially no difference between males and females with respect to the pigment content of the two types of thalli. However, females actually produce relatively more carotenoids in their sex structures than males, which is unexpected and contrary to the hypothesis.

The relative elevated levels of carotenoids in female sex structures compared to males may relate to protection not only of the female gametes but also the subsequent diploid sporophytes and the spores they produce. Males need only to protect their gametes and may be doing so with other pigments such as anthocyanins, which we were unable to extract. These possibilities bear investigation in the future.
Black Bear Foods and Family Dissolution in South Central Florida

Sean Murphy, Forestry

The black bear (Ursus americanus floridanus) is a threatened species in Florida (Maehr and Wooding, 1992). The small population in Highlands County, Florida, is comprised of fewer than 100 individuals (Bentzien, 1998) and exists in a fragmented landscape (Maehr, 2007). To obtain data on black bear family dissolution and food selection in this population, I have captured two adult females (F3 and F5) using a culvert trap and an Aldrich spring-activated snare (Seibert et al., 1997). Both females were fitted with Lotek (Lotek Wireless, Inc., Newmarket, Ontario, Canada) GSM (Groupe Spécial Mobile) GPS (Global Positioning System) collars in May, 2008, to enable tracking. A maximum of 96 locations per day will be acquired from F3 and F5’s individual collars. These locations will be entered into ArcMap 9.2 (ESRI, Inc., 2006) and plotted on aerial photographs to show each family’s movements. Food selection has been monitored opportunistically. Multiple scats have been collected and visual confirmation has been acquired as well. Combined, they will give insights into spring and summer choices of food.

These two females, F3 and F5, were chosen as study subjects because they have offspring in two different age classes. Bear F3 has two yearlings (bears between 1 and 2 years-of-age); whereas bear F5 has two cubs (bears less than 1 year-of-age). Because bear F3’s yearlings are close to the dispersal age of 1.5 years-of-age, and the family will soon disband, I hypothesize that F3’s family will have much wider-ranging movements in comparison to F5’s family. Due to bear F5 having two young cubs, I hypothesize that her family will have relatively small movements, because her cubs may not be able to make long trips.

References:
Realizing Text Signals
Whitney, O’Rourke, Psychology

Signals are writing devices that emphasize the organization or specific content in a text. Signals include headings, overviews, outlines, highlighting, boldfacing, and other typographical variation, summaries, and other devices. Although signals take a wide variety of forms, a recent theory has analyzed all signals as having a common underlying form of representation, called “metasentences.” A metasentence is a statement by the author directed at the text (as opposed to a statement concerning the subject matter of the text). For example, a sentence such as “The next topic to be discussed is firefighting” is a metasentence. The theory further claims that any signal communicates one or more of only six types of information, which are termed “information functions.” The present study tests two hypotheses derived from the theory. (1) Participants editing a text containing metasentences will be more likely than participants editing the same text with metasentences omitted to (a) insert headings and to (b) preserve the information functions of the original metasentences. (2) Participants editing a text containing metasentences that communicate information about text organization will be more likely to correctly insert paragraph breaks between subtopics.

Sixty students in psychology courses were asked to edit a text that contained no formatting beyond conventional sentence punctuation. The students were asked to add formatting to make the edited text “look like a chapter in a textbook.” Across the 60 participants, there were two versions of each of two texts on different topics. One version of a text contained metasentences that communicated information about text organization and the other version omitted the metasentences. Edited texts will be scored with respect to (1) the number and types of headings that are included in the revised text; (2) the correspondence between the information functions communicated in the metasentences and the information functions served by the inserted headings; and (3) the placement of paragraph boundaries in the edited text, by comparing the number of paragraph breaks inserted in the correct positions within the text by the participants with metasentences to the participants without metasentences.

Archaeological Fieldschool Educational Outreach
Jessica Schmitt, Anthropology

For my eUreKal! grant project, I coordinated community outreach in conjunction with the University of Kentucky Department of Anthropology’s Archaeology Fieldschool in Lee County, Virginia. Along with other UK students, I assisted in the excavations of the Carter Robinson mound site, a late prehistoric (A.D. 1300-1500) Native American mound and village site.

My time at the site was split between learning archaeology field methods and actively doing community outreach. The community outreach had three goals. First, I coordinated site visits from interested groups such as local camps and elementary school teachers. Approximately 35 visitors, including schoolchildren, visited the site over the course of the excavations. Visitors learned about archaeology field methods, Native Americans of Lee County, and the dangers of looting archaeological sites. Second, I worked with local teachers to create posters for distribution to local schools, which will highlight Lee County archaeology, the Carter Robinson site, and the damaging effects of looting on archaeology sites. This work is ongoing throughout the summer, and posters will be delivered to schools in Fall, 2008. Third, I worked with the Wilderness Road State Park, located adjacent to our site, to organize a Community Archaeology Outreach Day. This activity included coordinating with park officials to use their facilities, creating fliers about the event, and advertising the event widely in the community.

Held on July 4th, the Outreach Day was a great success. Approximately 200 people attended over a 4-hour period. We had tables with basic information about archaeology, a display of artifacts from the site, information about the dangers of looting, and a kids’ activity table where children could create clay coiled pottery, bead necklaces, and play Native American games. Additional tables included a display of archaeological field tools and information about Native American history. The most popular table was the artifact identification table, where local residents brought their private collections to be dated and identified. The park’s chief ranger is now interested in making this outreach day an annual event for the community. Overall, this grant project enabled me to make information about the region’s rich archaeological heritage available to the community in a variety of forums.
We Have to Go Everywhere, and We Will, We Will: Baseball in China as Part of America’s New Manifest Destiny

Mark Smith, History/Spanish

Earlier this year, in March, Major League Baseball (MLB) played its first games ever in China — two Spring Training games between the San Diego Padres and the Los Angeles Dodgers. When asked where else the MLB would go, Commissioner Bud Selig stated, “We have to go everywhere. And we will; we will” (Schlegel, 2008), which indicates that the MLB will not stop with China. Although those in the sports industry glorify this move as one of inevitable globalization, one has to wonder if that is true. Is it globalization or Manifest Destiny? With Latin America as evidence, one questions whether this is simply a benevolent gesture of generosity or simply an American business looking to exploit China.

Since 1864, when Nemesio Guilló claimed to have brought baseball to Cuba, baseball has become a key part of the culture of Latin America. At first, MLB took only lighter-skinned Latinos, who could be passed off in the states as white; later, after Jackie Robinson broke the color barrier in 1947, darker-skinned Latinos were brought as well. However, the largest jump in the number of players brought to the United States occurred after free-agency was introduced in the mid-1970s, because Latinos suddenly became much cheaper than American players. Now, there are baseball academies throughout Latin America, especially in the Caribbean in the Dominican Republic, where scouts for different organizations analyze players, bring them in for try-outs, give them a bed for a month while they see if the player has a future, and then, maybe, send them to a minor league team. However, they fail in teaching these Latinos more about American culture and the language, which are so vital when they come (Klein, 1991).

Even though March’s Spring Training games were the first professional baseball games in China, they were not the first the country had seen of baseball. Brought by Henry William Boone in 1863, baseball flourished into the mid-twentieth century, until the Cultural Revolution purged itself of everything of the West (“Baseball Has Deep Roots in China,” 2008). Now, baseball is back in China, and they are looking for money and players. Major League Baseball experienced a spike in revenue with the addition of just a few Japanese players (“MLB a Success in Japan,” 2008), so one can only imagine, with the massive population and blossoming wealth of China, how much MLB stands to garner if baseball becomes a success there. Also, with more and more Latin players hiring agents to advertise their talent and negotiate contracts, Latinos have become more expensive. Moving into China, MLB could find a new wealth of cheap talent to steady soaring salaries.

Major League Baseball revels in its expansion into China, but my question becomes should the Chinese be excited to see MLB arrive. In Latin America, baseball has already created a false hope of rising above the poverty of the region while carelessly bringing more players to the United States who have very little chance of making it to the Majors. I fear that China will endure the same path. Is the United States a benevolent leader attempting to welcome a new, more capitalist China or is the United States a more experienced, economic adversary awaiting its prey? In order to prove my point, I will use the historical perspective of MLB in Latin America to explain how MLB might use China. I will document how this has affected Latin America socially, politically, and economically.

Work Cited


Analysis of Stable Gene Expression Across Different Tissues

Marlène Tremblay, Animal Sciences

This study is the analysis of the annotation characteristics of genes that display stable expression, as well as a search for endogenous control genes (i.e., housekeeping genes) for use in normalizing quantitative polymerase chain reaction (qPCR) data, using two independent technology platforms.

The first platform is a technique called Whole mRNA Resequencing, with which the entire transcriptome of six equine tissue samples were determined. The millions of 32-base sequencing reads that were generated from total RNA of each sample were assembled on the predicted gene structure of the equine genome to provide both a quantitative and qualitative assessment of all mRNA transcripts expressed in that sample. The six samples analyzed were: 1) normal articular cartilage, 2) articular cartilage from an inflamed joint, 3) brain, 4) testes, 5) placenta and 6) embryo. Data generated and the subsequent analysis will be used both to annotate the expressed gene structure of the equine genome and to generate gene expression data. In addition, the MacLeod laboratory has completed transcriptional profiling experiments using an equine-specific 9,367 element...
cDNA microarray. More than 300 microarray slides have been hybridized over the past two years generating transcriptional expression data from a wide variety of equine tissues and cell culture samples.

These two independent technology platforms, mRNA resequencing and microarray based hybridizations, were used with the original objective of identify differential gene expression across a diverse set of equine tissues. The analysis can also be used to identify genes with stable levels of steady state mRNA across these samples. We hypothesized that genes with stable expression would cluster in functional pathways that define fundamental cellular processes in all tissues.

A technique called “quantile regression” was applied to microarray results to identify genes having a stable pattern of expression across the 11 tissues compared. The tissues were cerebellum, bladder, spleen, muscle, placenta, lymph node, liver, testis, kidney, lung, and articular cartilage. The determination of specific gene ontology (GO) categories over-represented in the stable expressed gene list compared to all the genes analyzed by microarray was performed using the Expression Analysis Systematic Explorer (EASE) software application. We selected GO categories that had an EASE score < 0.05 and found a majority were involved in transcription. This finding indicates that transcription is a fundamental cellular process that requires a steady level of activity independent of the tissue type.

Our current priority in this research includes analyzing Whole mRNA Resequencing data to again identify genes having stable levels of expression. With the assessment on a genomic level, major patterns should be more apparent and we will be able to answer how many genes in the mammalian genome have a stable expression pattern at the transcriptional level. Once the experiments generate a list of genes with stable levels of steady state mRNA across a diverse set of equine tissue and cell culture samples, these can be evaluated as potential endogenous control genes that are needed to normalize cDNA levels between samples and as an exogenous control between experiments.

Does Alcohol Abuse Increase HIV-related Brain Damage?

Kelly Wehle, Psychology

Recent clinical findings indicate that individuals who abuse alcohol and are HIV seropositive are at risk for developing significant neurological abnormalities, including cognitive and psychomotor deficits. Separate lines of investigation suggest that the alcohol withdrawal syndrome and brain injury related to HIV infection may involve excessive activation of N-methyl-D-aspartate (NMDA) type receptors for the neurotransmitter glutamate. Thus, the current studies in Dr. Prendergast’s laboratory are designed to examine the hypothesis that alcohol exposure enhances the neurotoxic effects of exposure to HIV proteins known to activate NMDA receptors.

Studies on alcohol abuse indicate an increase in the expression of NMDA glutamate receptors in the brain. NMDA receptors are ionotropic receptors that are thought to play a critical role in synaptic plasticity, which is a cellular mechanism for learning and memory. Excess activation of these receptors is known to contribute to the development of cytotoxicity in the brain. This study looks to determine if one of the viral proteins, Tat, produced by HIV-1 may contribute to the development of HIV-associated dementia (HAD) in patients who are known to abuse alcohol. HAD is seen in HIV patients on medication for the virus because the medication has difficulty penetrating the blood brain barrier, thereby allowing the virus to replicate and infect neurons uncontrollably in the brain. The primary hypothesis of this work is that by abusing alcohol, which causes the proliferation of these NMDA receptors in the brain, a person with HIV-1 has more targets for some HIV-1 proteins to excite and cause brain injury.

These studies will use a cellular model to examine the effects of exposure to binge-like doses of alcohol on the excitatory and toxic effects of the HIV-1 protein Tat on neurons in the hippocampus, a brain region involved in learning and memory. All studies will involve the use of fluorescent dyes to measure: (1) the amount of calcium that accumulates inside neurons during and after exposure to alcohol and Tat; (2) damage to the nuclei of these neurons; and (3) expression of NMDA receptors on these neurons.

Changes in cell function are monitored using high-powered fluorescent microscopy. The research taking place this summer is a continuation of the ongoing research and is funded by the National Institute on Alcohol Abuse and Alcoholism. The goal of this work is to identify NMDA receptors as therapeutic targets in the treatment of HAD in alcohol dependent HIV-1 patients.