Complete Issue of Volume 8
**Kaleidoscope**
The *University of Kentucky Journal of Undergraduate Scholarship* is a refereed journal published annually by the eUreKa! Office of the University of Kentucky. The journal is dedicated to the advancement of knowledge through the publication of the results of the intellectual pursuits of undergraduate students. The journal accepts reports of all forms of creativity and scholarship by undergraduate students including, but not necessarily limited to, artistic and musical creations, creative writing and poetry, and reports of studies and research in the humanities, the social, natural, and medical sciences, agriculture, business, architecture, and engineering. The journal is published in a traditional print format and as a Web site. The Web site may include creative materials, such as performances and art work, that cannot be reproduced on paper.

<www.uky.edu/kaleidoscope>

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"The Talisman." Paul Serusier. 1888. Oil on wood. 26x21.5 cm.
Upcoming Undergraduate Scholarship Events and Deadlines

Kaleidoscope, Volume 8
The University of Kentucky Journal of Undergraduate Scholarship is published once each year, at the beginning of the fall semester. All contributions to the journal are refereed by a standing editorial board and guest referees and editors. Articles, reports, and other creative works may be submitted by any undergraduate student at the University of Kentucky. All submissions must be accompanied by an endorsement by a University faculty member who has agreed to attest to the scholarly quality of the work and to serve as faculty mentor for editing and final submission of the work. Detailed guidelines for submission are available at www.uky.edu/kaleidocope.

Deadlines for Volume 9, Fall, 2010:
January 11, 2010: Optional electronic letter of intent to submit, including a brief description of the nature and contents of the proposed submission sent to the editor. (rst@uky.edu)
April 22, 2010: Complete submission prepared according to the guidelines delivered electronically to the editor. (rst@uky.edu)
June, 2010: Notification of acceptance/rejection and instructions for suggested/required revisions.
July, 2010: Final, revised submission delivered electronically to the editor.

National Conference on Undergraduate Research
“The mission of the National Conferences on Undergraduate Research (NCUR®) is to promote undergraduate research scholarship and creative activity done in partnership with faculty or other mentors as a vital component of higher education. The 2010 NCUR conference will be held April 15-17, 2010, at the University of Montana. Visit the NCUR Web site at http://ncur.org/basics/index.htm for general information on NCUR; visit <http://www.uwlax.edu/ncur2010/> for details and deadlines for the conference.

Oswald Research and Creativity Awards
All current UK undergraduate students are eligible to submit a paper or other creative work to be considered for an Oswald Research and Creativity award. The competition categories in which papers and projects may be submitted include: (1) Biological Sciences; (2) Design (architecture, landscape architecture, interior design, etc.); (3) Fine Arts (film, music, painting, sculpture, videotape, etc.); (4) Humanities: Creative; (5) Humanities: Critical Research; (6) Physical and Engineering Sciences; and (7) Social Sciences. The deadline for submission is March 16, 2009. Visit the eUreKa! website at: www.uky.edu/eureka! for details, application forms, and official rules. See pages 136-38 for winning submissions from last year’s Oswald Awards program.

Office of Undergraduate Research and Creativity Awards
As a means of promoting educational experiences for students, eUreKa! offers Research and Creativity Grants during the summer term. The grants are intended to take advantage of the rich resources available through the libraries, the laboratories and, most especially, the academic personnel at the University of Kentucky. Undergraduates in all areas of intellectual inquiry are eligible, and students at many different levels of matriculation have received support. The Deadline to submit applications is February 25, 2010. For details regarding eligibility, and application forms visit the eUreKa! website at: www.uky.edu/eureka!

UK Undergraduate Research Program
The University of Kentucky Undergraduate Research Program (UKURP) creates research partnerships between first- and second-year students and faculty researchers. The program offers students the opportunity to work and learn alongside a research faculty member. Undergraduate students are given the real-life experiences of working in laboratories and other scholarly settings; developing a research abstract; presenting their projects at symposiums and professional conferences; publishing their findings; and meeting others in the international community of scholars. In other words, students are given a jump-start on their career. For more details and deadlines for applications, visit www.uky.edu/eureka!

Additional Information
Additional information regarding undergraduate scholarship and creativity programs, conferences, competitions, and opportunities is posted on the Web site of the Office of Undergraduate Research and Creative Activities, eUreKa! at www.uky.edu/eureka!

“Untitled 1.” Donald Keefe. 2009. Acrylic on canvas board. (part of “The Epistle to Pont-Aven via Thessalonica.”) 14” X 10

“Untitled 2.” Donald Keefe. 2009. Acrylic on canvas board. (part of “The Epistle to Pont-Aven via Thessalonica.”) 14”X10

Donald Keefe in front of Eiffel Tower, 2009

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Kaleidoscope, Volume 8, 2009
At the University of Kentucky, we believe that our undergraduates should all have the opportunity to work in a mentored environment with our outstanding faculty scholars, pursuing inquiries that expand the boundaries of knowledge. Such mentored scholarly inquiries are what set apart an undergraduate education at a Research I university from study at other institutions. An ever-growing number of our students are now availing themselves of this wonderful opportunity. Some of the finest of their studies come to be published in Kaleidoscope.

The articles included in this issue continue the tradition of excellence set in earlier volumes. It is wonderful to enjoy the diversity of the studies. There is a challenging study of the application of the death penalty to women juxtaposed with an inquiry into the relationship of public policy to childhood obesity; a first-person report on Cossack pride and identity next to a study in plant cell biology. Virtually every academic aspect of the University is represented. I offer the authors my sincere congratulations.

UK’s dedication to excellence in undergraduate education is clearly demonstrated by the inclusion of the reports of our Beckman Scholars, the abstracts of many of our undergraduate researchers, and the impressive listing of academic prizes, honors, and conferences at which our students have presented their work.

As I have said in previous years, the success of our students is a direct result of the dedication of their faculty mentors. It has been said that if the student does not exceed the teacher, the teacher has failed. Time and again I have found our professors to take the greatest pride and pleasure in the creative and professional achievements of their students. We are fortunate at UK to have such caring, supportive faculty members, and I salute them.

I hope you will join me in congratulating the young women and men whose scholarly works are published in this issue of Kaleidoscope. These students are but a few of the thousands of highly creative and productive undergraduate scholars who are active at UK. For example, over thirty UK undergraduates made presentations of their scholarly work at the most recent National Conference on Undergraduate Research (NCUR), and scores of others have made presentations at other professional conferences. Together they are making contributions to the enhancement of knowledge and are being recognized nationally and internationally through their performances, publications, and productions.
This is the eighth volume of Kaleidoscope. It seems almost impossible to me that what began as an idea discussed almost ten years ago by me and (then) Associate Provost for Undergraduate Education Philip Kraemer has grown into such a magnificent and scholarly publication. The quality of the scholarly contributions of our students is astounding. I am so impressed by the extraordinarily wide range and excellent merit of the student scholars’ submissions. I always find that I learn from our students’ articles. They are invariably well-researched and well-written. In many cases, if I did not know that the author was an undergraduate, I would not have believed it.

The authors are, nonetheless, undergraduates and, as such, they have worked with one or more faculty mentors. These faculty members are absolutely key to the success of the student scholars and, by extension, to this journal. I want to extend my heartfelt thanks and admiration to them. Generally, faculty mentors work closely with students because they love this form of one-on-one teaching. They do not normally receive professional “credit” for such mentoring, but they do receive untold personal rewards. For me, when one of my students comes back and thanks me for having been of support and value, that is the greatest feeling a teacher can have. I want to add my thanks to those the protégées give to their mentors. I understand and appreciate all of the effort and time you have dedicated to your students.

Kaleidoscope is a refereed journal, which means that every article submitted is reviewed by at least one faculty member (in addition to the student scholar’s mentor). The referee makes recommendations as to whether the article is of a high enough quality to be published and, if so, what changes may be required. Such reviewing takes considerable time. The referees, although they must remain anonymous, are also deserving of our considerable thanks.

Without Evie Russell, the organizer and coordinator of all of the technical aspects of this journal, and her able assistant, Kathy Logsdon, Kaleidoscope could not be completed. They work directly with each of the students and their mentors. They arrange for the peer reviews of all submissions and summarize the results. They coordinate the process of obtaining copyright permission for the use of images and other material. And, they arrange all of the business and technical details of final design and printing of the journal. Thank you Evie and Kathy.

One other person is key to Kaleidoscope: our graphic designer, Teresa Shear. Teresa has been the creative light for this journal since its inception. She has designed the beautiful covers, laid out and typeset every page, and supervised the expansion to the current extensive inclusion of color. Her enormous artistic and technical skills are deeply appreciated, as is her never-ending good humor, especially when faced with yet another correction.

I hope that all students will be impressed by this issue, and inspired to engage in their own scholarly endeavors, culminating in their own submission to our next issue. We learn best by being totally immersed in a subject, by “doing” it. It is my wish that every student at the University of Kentucky will have the opportunity to strengthen her or his education by actively engaging in mentored scholarly inquiry beyond the classroom.
I am a junior majoring in International Studies and German with a minor in Music Performance. I am a Singletary Scholar, a Chellgren Fellow, and a Gaines Fellow, as well as a student Vice President of the recently inaugurated UK chapter of Phi Kappa Phi. I serve as an executive board member for SPUR, the Society for the Promotion of Undergraduate Research. Before writing this paper on capital punishment and women, I conducted research on the death penalty and international norms, which I presented at the Showcase of Undergraduate Scholars at UK, Posters-at-the-Capitol in Frankfort, the Southern Regional Honors Conference in St. Petersburg, Florida, and at the National Conference on Undergraduate Research in La Crosse, Wisconsin. After graduating in 2010, I hope to attend law school, one reason for my interest in the death penalty. The following paper was written for Prof. Srimati Basu’s GWS 600 course on law and women. I am particularly grateful to Prof. Basu for introducing me to women’s issues and providing constant support throughout the class and the paper.

Gender and Capital Punishment: The Case of Gaile Owens

Abstract:
The United States’ use of capital punishment is a practice oft-debated in many disciplines, but the gender imbalance of the death penalty in favor of women makes feminists one group hesitant to discuss the practice. Although females account for one in ten murder arrests, they are only one percent of the criminals actually executed. This paper examines the implications of capital punishment for women, and attempts to explain why women are executed at a disproportionately low rate. Trends that emerge include institutional structures, such as aggravating or mitigating factors, which are constructed in a manner that dictates the severest punishments for male crimes. Additionally, social ideologies and stereotypes are often reinforced during trials and sentencing, when judges and juries tell us directly and implicitly that women are simply too good, fair, and delicate to commit such heinous crimes. All of these elements contribute to the low rates of capital sentences and executions for female criminals. This paper includes analysis of feminist thought on capital punishment and the state, namely the works of Elizabeth Rapaport, Renee Heberle, Wendy Brown, and Wendy Williams. Finally, these theories are applied to the case of Owens v. Guida, which illustrates how far a woman must reach outside of societal norms to be sentenced to death and executed.

Introduction:
In traditional feminist discourse, common issues include marriage, reproduction and pregnancy, equality in the workplace, and the position of such social institutions with regard to masculine
systems of law. For the great majority of these instances, the women studied are disadvantaged — held in limiting roles such as housewives, underpaid in comparison to their male counterparts, and discriminated against either directly or subtly by policies created for the societal “norm,” who is most often a man.

There are, however, a few rare instances in which women can be seen as benefitting from the stereotypical traits from which they often attempt to break free. The classic example of this is the military draft, a process that defies gender equality. What is the state saying when drafting men to war and leaving women at home? It would be hard to argue that traditional gender roles were not reinforced by the draft. Another lesser-known practice that is gender imbalanced is that of capital punishment, and the practice brings many of the same questions to the surface. What does it say about law and culture in the United States that we execute men at a much higher rate than women? The statistical disparities in capital punishment between men and women and the issues of state and societal complicity with the imbalance are not often placed within the feminist framework and, therefore, that is what I will attempt to do.

Although capital punishment is not illegal, meaning it does not exclude women totally as the draft does, courts in the United States are much less willing to sentence women to death and, through the appellate and death row processes, women are disproportionately removed from the figurative guillotine as compared to men. Victor Streib provides the following statistics in his report “The Death Penalty for Female Offenders, January 1, 1973 Through December 31, 2007:” though one in ten murder arrests are women, they comprise only one in 50 capital sentences, only one in 67 death row prisoners, and only 1 in 100 of those “actually executed in the modern era” (2008, p. 3).

In the following essay, I will examine the use of the death penalty for women in the United States in a general context as well as from a feminist viewpoint. I will examine gender discrepancies in greater depth and attempt to explain why the state does not wish to execute women in the United States. In addition to attempting to make sense of alarming statistics, I have chosen a 2008 case to analyze involving capital punishment for a woman, Owens v. Guida. The language the three judges choose to articulate their opinions in this case is just as relevant as the statistics. With this paper I hope to extend common feminist issues and questions, such as how women’s social identities carry over into the legal realm. Are women simply viewed to be too delicate to be put in the electric chair or injected with the lethal three-drug cocktail? Do we believe them incapable of acts of such violence and aggression? These are the types of questions I will try to answer.

Why Capital Punishment Is Structured in Favor of Women: The Work of Victor Streib

Not only does capital punishment for women lie outside of the usual feminist discussions, it is also something of an anomaly within mainstream death penalty discourse. One of the strongest arguments against capital punishment as a whole is the effectual discrimination that occurs. Only 57% of those executed since 1976 have been white, while 34% were black and 7% were Hispanic (Death Penalty Information Center Race, 2009). Moreover, black men who allegedly killed white victims comprise 235 of the executions in the same time period, although only 15 white defendants with black victims were executed. Within the population of women executed, the racial element is basically erased. Of the 11 women executed since 1976, only two have been black (DPIC Women, 2009). The remaining nine were white.

Perhaps somewhat due to the attention given to race, gender and capital punishment is almost ignored. Writings on the subject are largely legal, statistical, or anecdotal. There are essays on whether or not women’s support for the death penalty is different from men’s (Durham, et al., 1996; and Whitehead, et al., 2000); analyses of how men and women are victimized differently (Gartner, et al., 1990); and stories of executed women (Gillespie, 2000). There are statistical analyses such as O’Shea’s Women and the Death Penalty in the United States, 1900-1998 (1999), and regional accounts such as Streib’s The Fairer Death: Executing Women in Ohio (2006) and Reza’s “Gender Bias in North Carolina’s Death Penalty” (2005). Despite all of this, feminists have been relatively unwilling to tackle this subject. Rapaport (1991), whose analysis I will include later, says that this reluctance is due to a hesitance to campaign to kill more women. I will return to these issues later, but start now with more on the background of gender and capital punishment itself.

The aforementioned large racial disparity is but one reason to which Streib (2002) is referring in the introduction of his analysis, when he says that the “death penalty system” in America is one that “continues to carry the heavy burdens of intense political agendas” (p. 1). He argues quite rightly that the questions regarding capital punishment are not ones of justice, but “whether we can trust this hodgepodge of local, state, and federal government” methods to ensure procedural justice (p. 1).

With regard to women, Streib says that jury selection processes do not ask questions about biases in favor of women, and research has indicated that juries are slanted toward female defendants (p. 1). The death penalty arena itself is what Streib calls a “masculine sanctuary” because “typical macho posturing over the
death penalty is disrupted and confused when the murderer is a murderess” (p. 2). Capital crimes are, when viewed as norms, distinctly male norms, and Streib argues this is true of the behavior regardless of the sex of the perpetrator (p. 2).

In order to find patterns, Streib examined capital sentences from 1973 forward, the significance of the date being that it was the first time when the information about them became normalized. I gave earlier statistics on the rate of incidence, but it is interesting to look more closely at the 138 women sentenced to death from 1973 to 2001. A paltry 5% (seven women) were actually executed, while 79 sentences were commuted or reversed, leaving only 52 on death row (Streib, 2002, p. 2). Geographically, the sentences came from 23 states, with the largest numbers coming from North Carolina (16), Florida (15), California, (14), and, of course, Texas (13) (Streib, 2002, p. 3). Harries and Cheatwood (1997) note that for those actually executed, the geographical distribution for males and females is basically the same (pp. 78-93). Streib describes the historical trajectory of two states, Virginia and Ohio, which executed many female offenders until 1912 and 1954 respectively, but notes that as a whole, the pattern is unchanged and even in the Colonial period, female executions were less than 3% (2002, pp. 3, 6).

In detailing some of the executions that have taken place during the period, Streib notes in particular Karla Faye Tucker (Figure 1), the woman who is arguably the face associated with women and execution. Streib writes that even though she had a history of violent behavior and her crime was aggressive and masculine, her status as an “attractive, photogenic, articulate white woman undoubtedly contributed to both the extensive media coverage and to the reluctance of the system to carry through to the end” (2002, p. 9). Then Texas Governor George W. Bush had executed more than 130 people, but none of those subjected him to so much turmoil as the case of Tucker (2002, p. 9). The rate of executions from 1990 to 1997 had dropped to 0.5% but the Tucker case seemed to revitalize the punishment for women (2002, p. 9). Tucker’s execution in 1998 was the first of a woman in Texas since 1863 and the first in the United States since 1984. Tucker’s crime was a violation of society’s norms and expectations, due to her (born again) Christian persona, her physical beauty, and her femininity, but her execution was controversial and debated throughout the world.

More important than the statistics are what Streib identifies as institutional means of sex bias. The first of those is the crimes selected for capital punishment. Domestic homicide, for example, is considered less serious and punishments are not as harsh (2002, p. 11). One of the most common death row crimes is felony murder, meaning homicide performed during the commission of a felony such as rape, and women’s murders are less likely to be in such a category. Streib returns to domestic murder with infanticide as a further example of women’s position; women are rarely executed for killing their children (2002, p. 11). In his studied time frame, only one of seven women sentenced to die for killing her children was actually executed; Streib is particularly uncomfortable with this idea, because “the broad negative impact of infanticide upon an entire community typically is more severe than for most other homicides” (2002, p. 11).

In addition to sentencing, Streib looks at how aggravating and mitigating circumstances impact women:

This final choice between the death sentence and life in prison focuses both upon the nature and circumstances of the crime and upon the character and background of the person who committed that crime. Regardless of the seriousness of the crime, it cannot automatically result in the death penalty. The personal characteristics of the convicted murderer also must be weighed in the balance. This is where the sex of the offender can come into play, probably unintentionally, but nonetheless with important consequences. As is explained below, this sex-specific impact may either favor or disfavor female capital defendants (STREIB, 2002, pp. 11-12).

One typical aggravating circumstance is murder for hire, and women more often hire killers; Gaile Owens is one example, and I will discuss her case in more depth later (Streib, 2002, p. 12).

Another is a criminal record of violence, including violent felonies, and in this category women are less likely than men to have committed aggravating crimes. Felony murder is a third usual aggravating circumstance, and it is more likely to affect men. Mitigating circumstances have the opposite effect of aggravating and are more likely to prevent a capital sentence. They include emotional distress or domination by another, elements that judges and jurors are more likely to detect in the histories of women (Streib, 2002, p.13).

The last method of institutional inequity is jury selection, especially

Figure 1: Karla Faye Tucker, executed 2/3/98.
important because juries are normally involved
in sentencing in capital cases. Though federal
capital cases take sex bias into account, state
processes are less likely to do so, giving yet
another advantage to women (Streib, 2002, p. 14).

**Feminism, the State, and Capital Punishment: Rapaport, Heberle, Brown, and Williams**

Feminism is uncomfortable with the idea of capital punishment and, as I mentioned in the introduction, this is probably because, when viewing capital punishment as a negative consequence of behavior outside the norms of society, women are spared from this punishment as compared to men. This fact is not justification for the lack of willingness on the part of feminists to address this subject. Without advocating for a change in the rules or for the execution of more women, we should examine why the death penalty is structured to benefit women. We should also determine if these practices are discriminatory in intent and whether or not the advantageous position of women can be replicated elsewhere without undue discrimination against men. Through a feminist lens, I am seeking to discover whether institutional framework exists to say something negative or positive about women, though anyone familiar with feminism could probably guess which result is most likely.

Elizabeth Rapaport addresses this issue when she admits that discovery of the roots of gender imbalance in capital punishment could be viewed as an attempt “to exterminate a few more wretched sisters” (1991, p. 368). She takes issue with this, however, and says that the disparities in death penalty sentencing are more related to our differing societal standards of responsibility for men and women, meaning men are considered to be capable of being more responsible (1991, p. 368). Rapaport uses similar statistics to Streib to show the characteristics of male and female murderers, including the types of crimes given capital punishment and mitigating and aggravating factors (1991, pp. 369-374). She remarks almost happily that rather than “chivalrous regard for the female sex,” the disparities can be attributed to who the victims are and how background information is presented at trial (1991, p. 374). Afterwards Rapaport sets out to discover how men and women arrive at death row. One variable that she examines is “the pattern among murder suspects,” using North Carolina as her base (1991, p. 375). Twelve percent of death row males in North Carolina had killed intimates, whereas 49 percent of females had (Rapaport, 1991, p. 375). As a society, we appear to perceive women to be killing other criminals when their victims are abusive husbands or fellow inmates.

Lastly, Rapaport studies what she calls “gender interpretation of the conception of offense seriousness,” beginning with categories of murder (1991, p. 376). The three categories eligible for the death penalty include predatory murder, i.e., murder for some type of gain; murder that impedes law enforcement or other government; and murders of excessive violence. Thus, categories singled out for capital punishment do not include the aforementioned intimate murder necessarily. She says eloquently:

> But the paradigmatic domestic killing, arising out of hot anger at someone who is capable, as it were by definition, of calling out painful and sudden emotion in his or her killer, is virtually the antithesis of capital murder (1991, p. 378).

She argues along Streib’s lines that some of these crimes are the most alarming and undermine the value of the home (1991, p. 378). Her departure from Streib is when she inserts this into the feminist framework. Though she does not argue for the death penalty as a whole, she does enter the controversial territory of advocating harsher punishment for domestic crimes, i.e., female crimes. Women are more likely to kill and be killed by intimates, and familial crimes such as these, especially when a child enters the picture, are the ones for which Rapaport argues changes in policy.

One suggestion is to raise severe and routine abuse of a husband, wife, or child to felony status in order to make those perpetrators eligible for felony murder (Rapaport, 1991, p. 379). This suggestion only tangentially affects the sentencing of women, but the elevation of domestic non-capital crimes could move the capital punishment practices as well. It is at this point that Rapaport addresses three anticipated feminist criticisms. The first, that domestic violence is often “victim-precipitated” and that we should view victims as worthy of part of the blame, is discounted by Rapaport for being unable to account for the killing of a child (1991, p. 380). The second is that the planning and calculating murderer is more worthy of scorn than the passionate killer, another distinction that does not adequately prioritize responses to spousal or child abuse (1991, p. 381). Lastly, she says that the feminist viewpoint does not recognize the susceptibility of passion crimes to death penalty due to the deterrence argument (1991, p. 381). Rapaport ends by reiterating that her primary goal is “to expose the ideological biases of the status quo in which domestic homicide is treated, invidiously, as almost always less reprehensible than predatory murder” (1991, p. 381). She says, moreover, “we have no credible evidence that women are spared the death penalty in circumstances where it would be pronounced on men;” rather, it is “a

Renee Heberle agrees that it is social ideology, and she writes that it is society that “wonders whether women, as women, need to be rendered more commonly subject to the disciplinary sanctions of the state, not in the name of equality but in the name of managing the disorder engendered by unequal relations of power” (Heberle, 1999, p. 1104). She suggests that the focus should not be on the statistics but instead on gender expectations and norms (1999, p. 1104). The question she poses is whether or not, as others have asked, femininity and the traits we associate with such an abstract concept are themselves enough to protect women from harsh criminal punishment.

Heberle departs from Rapaport at the point of deciding where the significance lies in the gendering of intimate murder, arguing that the imbalance is instead between civil and domestic spheres, causing asymmetry with respect to the sexes. As an example, she says that men acting violently in the home are only acting according to societal expectations, whereas women behaving similarly have to be punished or “re-feminized” (1999, p. 1105). Thus, contrary to Rapaport, Heberle believes death row is home not to the most deserving and despicable criminals, but rather a population that is reconstructing social hierarchies. Most importantly, Heberle believes that women are the ones exempt from death row because they “have a kind of escape route in appropriately feminine behavior” (199, p. 1108). Karla Faye Tucker is mentioned again, this time as an example of someone outside feminine norms. Even though she was converted by religion, she could not overcome her former comment that she had orgasms when she hit her victims. This, Heberle observes, is a dramatic action that inverted expectations of gender.

Heberle believes that the dichotomies she explored were examples of the liberal state; Wendy Brown is one feminist who has explored theories of the state and norms that the resultant institutions have constructed. There are four specific models that she analyzes: liberal, capitalistic, prerogative, and bureaucratic. She argues that the state is a male power in subtle and overt ways. For the sake of brevity, I will limit this discussion to the liberal modality, in which I believe capital punishment and its strange relationship with women fall. Liberal thinking divides society into domestic, economic, and governmental sections. Women fall into the domestic sphere and, once there, can scarcely escape.

The private domain of the home is neither private nor safe for women (Brown, 1992, p. 18). Brown posits that rights do not really exist there, but instead the area is “governed by norms of duty, love, and custom, and until quite recently, has been largely shielded from the reach of law” (1992, p. 18). This is, in theory, the gap of which Rapaport speaks, the realm that contains both individual and privacy rights, a juxtaposition that the state has difficulty reconciling. For women, the group disproportionately affected by domestic crimes, this liberal posturing is problematic.

Another general feminist approach that could be applied is that of Wendy Williams, who critiques women’s positions with regard to the courts. In an era when women are guaranteed equal rights, the equality is equal to men, so the rights afforded to women by the government are at best male rights (1997, p. 71). Williams looks at equality issues such as the military draft, and writes on the inherent troubles with associating men with war and sex and women with whatever is opposite, namely as “[mothers] of humanity” (1997, p. 78). Much of Williams’ article is a debate between special rights and equality treatment, and she sides with equality treatment. The true issue is characterization of males and females, and she argues that gender roles should be complementary in light of all of these problems, rather than explicitly equal (1997, p. 84). With these arguments and perspectives in mind, it is time to look at how the law affected one woman.

**Owens v. Guida Background**

Of the eleven women currently on death row, six killed a boyfriend, significant other, or husband, a statistic worthy of its own research (DPIC Women, 2009). For the time being, however, we will focus on one of those women. Gaile K. Owens (Figure 2) was sentenced to death in Tennessee after hiring Sidney Porterfield to kill her husband. All of the following information and quotes are taken from the text of the appellate decision; the case was heard in the United States Court of Appeals for the 6th Circuit, which includes Kentucky, Tennessee, Ohio, and Michigan. I chose Gaile Owens’ case because of her interesting story, its relative obscurity, especially compared to the case of Karla Faye Tucker, and for its illustration of the arguments noted above. Owens’ case shows many of the unique situations that lead women to death row, and thus helps to answer the question, “What does it take for a woman to be sentenced to death?”

In 1985, Owens interviewed several hit men with the purpose of hiring one to kill Ronald Owens. Trial evidence showed that she met with the eventual hit man, Sidney Porterfield, on a minimum of three occasions. On February 17, 1985, Ronald Owens was found in the Owens’ den with his skill crushed from what the coroner determined was a minimum of 21 blows.

![Figure 2: A recent mugshot of Gaile Owens, whose lawyers were still in the appeals process in February 2010, attempting to have her sentence commuted from the death penalty to life imprisonment.](image-url)
of a tire iron. The beating was so forceful that bone chips from his skull had been lodged in his brain “and his face had been driven into the floor.” There was blood on the walls and floor, and the condition of his hands, according to pathology, suggested he had been trying to shield his face from the blows of the tire iron.

Upon the discovery of Owens’ body and the public revelation of the crime, one of the other men solicited by Gaile Owens, George James, went to the police out of anxiety that he might be suspected in the murder. He agreed to meet with Owens and wear a wire. In this meeting, she “explained that she had her husband killed because of ‘bad marital problems’ and paid James $60 to keep quiet.” Owens and Porterfield eventually confessed to their respective crimes, and Porterfield stated that Owens volunteered $17,000 for the job. He also gave more details on how he beat Mr. Owens to death, from an initial confrontation in the backyard that continued into the house. Gaile Owens said that “that she had Ronald killed because ‘we’ve just had a bad marriage over the years, and I just felt like he had been cruel to me. There was little physical violence.’”

The jury found Owens guilty of murder and murder-for-hire and “a murder that was ‘especially heinous, atrocious, or cruel.’” She and Porterfield were both sentenced to death. They appealed to the Tennessee Supreme Court and lost, and then continued appeals through various channels. The following majority and dissenting opinions illuminate the factors that Streib and Rapaport elucidated, including mitigating and aggravating factors. The technical functions of these judicial particularities often serve to shield women from capital punishment. In the case of Owens, however, she and/or her counsel did almost everything wrong if their aim was to avoid the death penalty.

**Majority Opinion**

On the first claim, that her attorneys had not properly investigated or presented mitigating evidence, the court ruled that the performance of Owens’ attorneys was not deficient. One of the bases of their argument was that her unwillingness to cooperate had complicated the mitigation process, because she would not testify or allow family or mental health examiners to do so. “A defendant cannot be permitted to manufacture a winning IAC [inadequate assistance of counsel] claim by sabotaging her own defense, or else every defendant clever enough to thwart her own attorneys would be able to overturn her sentence on appeal.” The court supported this ruling with evidence from the same circuit, using male clients.

The court wrote that the whole of her COA (Court of Appeals) claim was in essence a claim that she should have had battered-wife defense. This was refuted by the fact that her attorneys had considered both that defense and an insanity plea. The implausibility of an insanity plea was refuted by the testimony of two jail employees, who testified “that she was a model prisoner.” Another inefficiency component of Owens’s appeal was regarding the inability of her defense to surmount the prosecution’s hearsay objection to Dr. Max West’s testimony. Though West had spent an hour with Owens, he was not allowed to testify about her family history. During sentencing, Dr. Max West, a psychiatrist testified for Owens, saying that he, a psychiatrist, had seen her in 1978 for behavioral issues.

In the end, West’s only basic testimony was that Owens had “some kind of severe problem.” The appellate court found that a statute existed that could have allowed this testimony, but it was not cited by the counsel, and because this “decision was a legitimate strategic” one, the appellate court ruled it was not harmful to Owens. Owens argument was that, had West been allowed to testify:

> He would have said that Owens told him that: 1) her parents were too hard on her; 2) she was forced to care for a mentally retarded brother; 3) her parents habitually lied to each other and to the children; 4) she never felt like she was needed; and 5) she had a ‘fairly severe characterological [sic] or personality disorder.’

Her counsel argued that they were afraid that West would have testified to, among other things, the reason why she had seen him, which was that she embezzled money. Lastly, the court determined that *Brady v. Maryland*, 373 U.S. 83 (1963) was not violated in refusing to turn over cards and love notes between Ronald Owens and his lover Gala Scott. *Brady* found that “suppression by the prosecution of evidence favorable to an accused who has requested it violates due process where the evidence is material either to guilt or to punishment, irrespective of the good faith or bad faith of the prosecution.” (pp. 86-88) However, the appeals court decision argued that Mrs. Owens could have introduced other evidence about the affair, an example being that she could have subpoenaed Scott. All of these issues are ones of mitigation and illustrate the need for Owens to establish a motive and illustrate the types of problems she had faced that would have led her to kill her husband.

Also at issue was Owens’s willingness to accept the initial plea deal of life imprisonment. The condition was that she and Porterfield must both accept, and she wanted her prior cooperation to be presented in court. The appellate court upheld the Tennessee Supreme Court’s determination that a prior decision, *Lockett v. Ohio*, 438 U.S. 586 (1978), made her plea-bargaining irrelevant to her sentencing. In reference to *Lockett*, the court stated “no court, let alone the Supreme Court, has held that
failed plea negotiations may be admitted at a penalty-phase hearing." On the subject, the court wrote further that Owens’s “best argument is that the evidence is relevant to the positive character trait of ‘acceptance of responsibility.’” Even here, she is deemed a failure by the court because she did not offer an unconditional guilty plea in its place. They wrote, “Thus, she was less interested in accepting responsibility and more interested in avoiding the electric chair, a motivation that is much less persuasive as a mitigating factor.” The court determined that it was not a violation of federal law to prohibit the introduction of her willingness to accept the plea bargain.

In summation, the court wrote:

First, the entire premise of the dissent’s rhetoric is that counsel were obviously incompetent for not relying on what is called, in parts of both my state and that of the dissent, the ‘he just needed killing’ defense. While it could be true that a counsel of the dissenter’s skill could have sold a jury on that defense, there are many reasons that counsel making such a choice is the essence of a ‘strategic’ choice.

Here, the court asserted that she calculatedly interviewed hit men possibilities, and gave Porterfield the necessary information that enabled him to violently kill Ronald Owens. Thus, the majority (Chief Justice Boggs and Justice Siler) affirmed the decision of the district court to deny Owens’s habeas corpus petition.

**Dissent**

Of the three-judge panel, Judge Merritt dissented, writing that “the majority opinion slants and misconceives relevant facts and law in this case on the three major issues in order to uphold the death penalty.” He wrote that his dissent “[tries] to straighten out the case for the reader by introducing the actual facts and the correct legal principles to be applied.”

The facts about [Ronald] Owens’s cruel and sadistic behavior toward his wife now make an overwhelming case of domestic violence and psychological abuse in mitigation of the murder case against Gaile Owens. From the beginning, Mrs. Owens’ counsel knew that this was her best—indeed, her only—defense. Before trial, her counsel told the trial court that in his opinion: “This case has a meritorious defense in the battered-wife syndrome.”… The Memphis district attorneys obviously knew that this was the defense theory. But this defense was never developed or even mentioned to the jury during the trial because of the cover-up of exculpatory evidence by the Memphis prosecutor and the complete failure of defense counsel to conduct a proper investigation of [Ronald] Owens’ sadistic behavior toward his wife.

Judge Merritt wrote that Mrs. Owens asked prior to trial for the prosecutor to give her attorneys everything he had that illustrated the fact of her husband’s adulterous activities, including evidence of his many mistresses and the affairs that entailed sexual details such as fetishes or perversions. Merritt’s opinion argues that the routine and continual flaunting of these acts to Mrs. Owens was enough to contribute to her mindset. There were two specific, sexually graphic letters between Mr. Owens and Gayla Scott that were repressed, with nicknames alluding to oral sexual encounters. Merritt takes the most offense to the prosecution’s “lying to the trial court” by saying they had given all of their evidence. They went so far as to specify that they had given “any piece of paper, any notebook—anything along those lines, letters, and etc. that we have.”

Merritt accuses the majority of using the logic that Mrs. Owens could have presented this information herself, despite the fact that a murder defendant is naturally lacking in credibility and also that the ruling of the majority is contrary to *Brady v. Maryland*. “It is certainly true that the blatant prosecutorial misconduct suppressing the love letters was highly material and prejudicial at the mitigation phase of the trial,” he wrote.

Regarding ineffective assistance of counsel, Merritt argues that the majority’s opinion was biased toward the State “both as to the facts and the law.” Merritt’s basic argument is that the defense counsel failed in researching and developing a defense. Not only did it strip the defense of a better argument to abandon the battered-wife strategy, it severely weakened Owens’s motive. If it were not a battered-wife or self defense argument, the only remaining motive put forth for her crime was “insurance money.”

Merritt argues that the decision fails to comply with the Sixth Amendment and the American Bar Association Guidelines for the Appointment and Performance of Defense Counsel in Death Penalty Cases. Under those requirements, “counsel must fully investigate all mitigating circumstances, even when the defendant does not want to take the stand or is not forthcoming.” He accused the majority’s use of the *Schroiro v. Landrigan*, 127 S. Ct. 1933, 1939 case as inadequate because “[Owens] did not even refuse to cooperate, much less instruct counsel not to put on mitigating evidence.” Also, while the majority attributed counsel’s measly hours of investigation in preparation for mitigation to under-billing, Merritt argues that “counsel abandoned the investigation of the defense,” because the attorney “had no incentive to falsify his investigation.”

Merritt goes so far as to present the evidence that the “counsel would have found” had they properly investigated the background. This section is worth quoting in its entirety:

Ron Owens was abusive toward Ms. Owens. He subjected her to physical, emotional, and sexual abuse beginning with their wedding night when he was forceful and impatient, demanding sex immediately upon entering their hotel room. When Ms. Owens revealed to her new husband that she was in great pain and bleeding...
profusely, he called her frigid, and angrily left the hotel room stating that “If you won’t, I know where I can find someone who will.”

There are many further horrors. Mr. Owens inserted and broke a wine bottle inside Mrs. Owen’s vagina, and also penetrated her with a “penis-shaped marijuana pipe…which caused her pain and humiliation.” Moreover, Mr. Owens forced his wife to have sex the night before she gave birth, and the “brutal sexual intercourse” caused the placenta to “partially [detach].” An emergency C-section was required for the safety of mother and child.

Mrs. Owens endured verbal and emotional abuse as well. When their children were born, “Mr. Owens accused Ms. Owens of not taking properly her birth control pills and complained that the children would be an unbearable financial burden.” He berated her with comments such as, “she did not sweat much for a fat person.” He was not only physically unfaithful, but “also deceitful;” he lied to his wife as well as other people about volunteering for service in Vietnam, as well as being shot there [twice] and contracting Malaria. He also falsified his educational background, claiming to have a Bachelor’s degree. All of these factors led, Merritt writes, to the sentence Owens received.

Gaile Owens and Feminist Theory
Before delving too deeply into the intricacies of this case, it is interesting but probably not surprising to note that it falls along political lines. The two judges in the majority were appointed by conservative Presidents; Boggs was appointed by Ronald Reagan and Siler by George H.W. Bush. Justice Merritt, however, was nominated by Carter, and it cannot be coincidence that they wrote opinions that fit neatly with those conflicting ideologies.

As noted above, Gaile Owens managed to fit her crime into the narrow guidelines that actually execute women. She was immediately disadvantaged by the aggravating circumstance of murder-for-hire. What she was forced to argue after her conviction and sentencing, then, was that mitigating factors should have been enough to save her, and that her counsel had not researched or presented that information in an effective way. Thus, her case is really comprised of a push and pull between mitigating and aggravating factors.

Though it would be too generous to argue that Owens was unworthy of punishment, the majority’s simple characterization of every claim against her counsel as their choice of “strategy” seems a dubious path to choose when a human life is what hangs in the figuraiive balance of justice. At what point can courts agree that it is possible for bad strategy to be ineffective counsel? Rapaport’s vehemence that domestic crimes be elevated somewhat ignores the frequent and severe domestic abuse that often leads women to retaliate and seek revenge against their husbands. The majority opinion does not give credence to Owens’s claims of such violence, but I would argue that if even half of her claims were true, it would warrant the reduction from a death sentence to life without parole.

Moreover, my own personal argument is that Mrs. Owens was punished because she simply does not fit the female murderer stereotype, similar to arguments by Heberle. She is outside conceptions of traditional femininity, and instead fits the mold of the aggressive murderer. The norm is a male killer, but Owens’s unwillingness to cooperate is too stark a contrast with the societal expectations of a female killer, if they even exist — a weeping, terrified, and apologetic female who loved her husband despite the frequent beatings he gave her, and who shot him to keep him from shooting her or their children.

The majority opinion places blame on Mrs. Owens for taking control of her defense, something a woman would not usually be expected to do, and also says that she impeded her defense. While this might be true, much of Owens’s problem seems to be that she, like many other subjects of feminist theory, did not know the proper course of action with respect to the law. Her initial statement that a bad marriage was her motive was soon supplemented with the instances in which she suffered intense verbal and sexual abuse.

In a broad sense, this case is not only an implication of two individuals whose relationship had gone sour, but also the culture that allowed a situation to escalate to the point of violence and murder. For Mrs. Owens, she felt trapped by an empty marriage, but felt that the only means of escape was to kill her husband. Is it because the Owens lived in rural Tennessee that she felt divorce was not an acceptable decision? Would her husband have allowed it? Did she have a means of income if she were to be granted a divorce? What sort of person kills her husband because of a bad marriage? The majority decided that such a person is one worthy of execution, but I would argue that there could have been a more gender-equal culture that provided options for Gaile Owens before she was compelled to hire a hit man.

Conclusion
Victor Streib alluded to the fact that today, in the current tangled climate of courts and endless appeals and overworked attorneys, capital punishment is a questionable practice at best. It is likely that many of the people interested in the relationship between women and the death penalty, such as myself, are critical of the death penalty in general, and thus would avoid calls for equality that might lead to more executions. This fact
has probably kept a considerable number of feminist writers away from the subject in favor of topics on which they can speak to inspire positive social change, for example the difference in prosecution of crack versus white powder cocaine.

Nonetheless, women on death row provide, as I hope I have shown, another thread of inequality. Though many women are protected through this inequality, the assumptions that put it in place—the devaluing of domestic crime, for example—are not necessarily results of positive views of women. A long-ago acquaintance of my stepmother killed her husband after years of abuse and received only 18 months in prison. It is hard, even for feminists, to reverse this situation in their minds. It is still a persistent belief that a woman cannot abuse her husband, at least physically, and if he committed murder in self-defense, he would be laughed out of court, as well as much more likely to receive a capital sentence. It is my hope that capital punishment and gender will come more into the mainstream in the future as a key example of the difficulty in establishing and defining rights and also the struggle to develop a system of rules or a singular theory that will explain everything. If one such theory existed, more feminists would be writing about capital punishment.

Bibliography


Photo Sources

http://farm2.static.flickr.com/1251/1083942224_088248dh22_m.jpg
http://vietnameseworkersabroad.files.wordpress.com/2009/02/lady-justice.jpg
http://www.deathpenaltyinfo.org/women-and-death-penalty
James Tyler Chapman

Am a rising junior at the University of Kentucky pursuing a dual degree in Political Science and International Studies. This project is the product of my Chellgren Fellowship, and I have been selected as a Gaines Fellow for my next two years at UK. I was awarded a winter travel grant in 2008 and a summer research grant in 2009. I am a Singleter Scholar and a founding member and Executive Vice-President of the Phi Kappa Phi Honor Society. My future plans include pursuing either a law degree or a master's degree in diplomacy and international relations. This paper relates directly to my future goals because of Iran's importance to the Middle East and the future of United States diplomatic efforts around the world.

On campus, I am President of the Fraternity of Phi Gamma Delta, and I serve as the Technology Chair for DanceBlue. I have served as the Senate Parliamentarian for Student Government, and I am a member of K Crew. I participated in the Emerging Leader Institute, and I am a UK FUSION Team Leader. I participate in the University Leadership Summit, and I am a second-degree black belt in tae-kwon-do. I volunteer as a tutor at the Carnegie Center, and I participated in an Alternative Spring Break program. I love to play tennis and listen to music to relax.

The opportunity to explore this subject as a formal academic inquiry under the guidance of Dr. Stempel was a stimulating and rewarding experience. Dr. Stempel's 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 thoroughly enjoyed it.

Abstract

My research strove to further the knowledge of United States-Iran international relations through comprehensive analysis. I investigated and presented information on the internal politics of Iran, and I analyzed and commented on the organization of the government of Iran. I critically examined the historical scholarship on the affairs of state between the United States and Iran, and I investigated the current state of affairs and prospects for the future. From this understanding, 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. I concluded that direct diplomacy is needed and that the process of political engagement remains the most likely way to effectively address the areas of policy difference between the two countries, rather than utilizing the rhetoric of regime change and engaging in antagonistic saber rattling. The United States needs to use Iran as a partner in the Middle East to make progress on the issues of shared interest and to create the opportunity for mutual advancement.

Introduction

In this paper, I investigate and present information on the internal politics of Iran, analyze and comment on the organization of the government of Iran, critically examine the historical scholarship on the affairs of state between the United States and Iran,
and analyze the current state of affairs and prospects for the future. I focus on background information and the distinctive set of circumstances that lead to the establishment of an Islamic government in Iran, and I subsequently address the structure of the current government. I critically examine the historical scholarship on the affairs of state between the United States and Iran, and I propose an answer to how the theocracy's structure and divisions within Islam shape Iran's foreign policy. Finally, I examine the foreign policy implications of the Islamic Revolution and the foreign policy of Iran since the Revolution. I subsequently analyze policy options for the future of United States-Iran relations and propose possible solutions. Due to the space restrictions for publication in Kaleidoscope, however, I have not included this final section and will conduct further research in those areas during the summer.

From Monarchy to Theocracy: The Genesis of the Islamic Republic

The inexorable correlation between foreign policy and domestic conditions is in no country more apparent than the Islamic Republic of Iran (Kamrava, 1-5). Throughout its history, Iran has been ruled by absolute monarchy, with individual rulers seeking personal advancement over the national interest (Bradley, 31-40). The Constitutional Revolution (1905-1911) brought about the introduction of the concept of the limitation of powers with respect to the Shah. An event unprecedented in the Arab world, it started affecting fundamental change with respect
Minister of Iran from 1951-1953. He was passionately known leader was Mohammed Mossadeq, the Prime from foreign manipulation (Martin, 17). The most well influence within Iran as well as true independence of which advocated for the elimination of all British to the oil nationalization movement (1951), the leaders participation unthought-of during the rule of his father.

new king brought a new era of political freedom and son, Mohammed Reza Shah, assumed control. The political, social, or cultural force as his chief internal aim. He perceived to have set the elimination of Islam as a sweeping initiatives of westernization, and he was obsessed by a history of past greatness (Pollack, 3). The then Reza Khan led a coup, with the assistance of the British, and regained Tehran. After serving as Prime Minister and negotiating the withdrawal of the remaining British troops, Reza Khan was appointed King by the Majlis and began the Pahlavi dynasty.

Claiming to be against foreign imperialism in Iran, Reza Shah attracted the support of intellectuals, clergy, and the people (Ghods, 93-100). However, he quickly proved to be hostile to Islamic cultural traditions and customs, and as one example of this, he officially banned the use of the veil in 1935 to the response of a grand popular uprising and the disapproval of the clergy. His foreign policy was a grand balancing act between the great powers of the day: the United States, Germany. Using dictatorial methods, he proposed an ironically perfect example) as his illustrations.

nine years after the coup, in 1962, Mohammed Reza Shah declared that he was beginning a series of reforms in order to comply with President Kennedy’s goals for Third World nations. As was quickly revealed, the object of these reforms was the destruction of native agriculture and land redistribution, and the Shah would be encouraging now unemployed farmers to move to the cities, in effect creating a more Western culture and consumer society (Kamrava, 67-68). This set of six bills was passed by referendum (a referendum Imam Khomeini would later describe as “mendacious” and “scandalous”) under the title, “The White Revolution” (Khomeini, 178). How foreshadowing a name it was would be made apparent in due course, as the militant clergy and fundamentalist population rose to vocal and passionate opposition to these reforms, lead by Khomeini.

Khomeini would formally state in no uncertain terms his opposition to the Shah and to the imposition of Western culture on the traditional values of Iranians in a speech on June 3, 1963. He declared, “We come to the conclusion that this regime also has a more basic aim: they are fundamentally opposed to Islam itself and the existence of the religious class” (Khomeini, 177). In response to the Shah’s naming his bills the White Revolution, Khomeini stated, “The religious scholars and Islam are Black Reaction!” (179). He articulately called the people of Iran to action against the Shah, using religion and history (the Shah’s father provided Khomeini an ironically perfect example) as his illustrations.

Within hours, the state police of the Shah had contained Khomeini, and he was subsequently imprisoned. The popular uprisings that resulted from this were unprecedented, and within a year, Khomeini had been released from prison and exiled to Turkey, and then Iraq.

So began the long, slow journey toward Khomeini’s Islamic Revolution in Iran. With its foundations firmly set, and the seeds planted in the minds of the population, the Revolution was brought to fruition with the return of Imam Khomeini from fifteen years of exile, glorious in his welcome’s magnitude and implications (Stempel, 174).

**The Structure of the Islamic Republic**
The Constitution of the Islamic Republic of Iran is the governing document of the Islamic Republic, and it expresses Khomeini’s ideological vision of a practical Islamic state endeavoring toward perfection (Martin,
159-166). “Endorsed by the people of Iran on the basis of their longstanding belief in the sovereignty of truth and Qur’anic justice,” Iran’s Constitution establishes the basis of the government system and the prevailing governing philosophies (Article I). It announced the structure of the political, social, cultural, and economic relationships within society, and it was approved by referendum on March 29 and 30, 1979 “through the affirmative vote of a majority of 98.2% of eligible voters” (Article I).

The Constitution opens with the ultimate statement of sub-servitude. The people of Iran merely endorse the formation of their country, but do not participate in the formation themselves. That formation is foretold and made inevitable by the truth embodied within the Qur’an and brought to actuality by Ayatollah Khomeini. Indeed, the central principle of the United States Declaration of Independence is that government derives its just powers from the consent of the governed. Unambiguously absent is that idea from the Iranian system of government. It derives its power from Islam. As subsequent stipulations will show us, it seems overwhelmingly as if the Iranian leaders endeavored to create a self-sustaining nation with a very proud people at its base.

Article II states the belief system on which Iran’s new government was founded. The implications of the declared principles cannot be overstated. The first guiding belief of the government is that there is one God, He has “exclusive sovereignty and the right to legislate,” and it is necessary to submit to His commands. Government is the expression of the political aspirations of a nation united in faith so that the people may make progress toward Islam’s ultimate goal. The Constitution seeks to establish a framework through which the goals of Islam will flourish. Therefore, only the most devout of men should have the responsibility of administrating the government of Iran.

For Iran, the ultimate power of governance is not entrusted to the people, but to “the One God.” The Constitution establishes the idea of the Supreme Leader as God’s direct representative on Earth, acting with His authority as mediator between Him and the people. His commands and legislations are the ultimate authority, and the country is founded on “the necessity of submission” to Him. Submission is a central tenet in the opening of the Constitution. Despite this, and seemingly in opposition to this, the Constitution pledges loyalty to the “exalted dignity and value of man” and the “negation of all forms of oppression.”

The Constitution establishes that the family unit is the basis of society, and providing opportunities for the family to strengthen is a chief objective of the Islamic Republic (Article X). The Constitution provides for a religious army to pursue jihad and for the establishment of a judicial system based on Islamic justice and law (Articles CXLIV and CLVI-CLXXIV, respectively).

Iran is further founded on the belief in God’s perfect justice in His legislation. The social justice measures of the Iranian government are based on this notion of justice, as it exists inextricably simultaneously in both the government and religion. “Continuous leadership and perpetual guidance” by the religious clerics and ayatollahs is also established, claiming that those principles have a “fundamental role in the uninterrupted process of the revolution of Islam” (Article II). “The exalted dignity and value of man” is praised, and from this assumption comes the doctrine of the “negation of all forms of oppression… and of dominance” (Article II).

In accordance with these rather idealistic goals, the Constitution outlines sixteen specific duties of the government, from “the complete elimination of imperialism” to “the elimination of… all attempts to monopolize power” (Article III). One duty is particularly frightening in its implications. It gives the Iranian government the power to control and manipulate the press and media under the auspice of “raising public awareness” (Article III). Another gives the government the right to impose universal military training for the sake of safeguarding Iran’s independence and Islamic order (Article III).

When considering foreign policy, one duty is striking: “framing the foreign policy of the country on the basis of Islamic criteria, fraternal commitment to all Muslims, and unspiring support to the mustad’aftin of the world” (Article III). Articles CLII-CLV specifically address the foreign policy of the Islamic Republic of Iran. It is based upon the “rejection of all forms of domination, both the exertion of it and submission to it, the preservation of the independence of the country in all respects and its territorial integrity, the defense of the rights of all Muslims, non-alignment with respect to the hegemonic superpowers, and the maintenance of mutually peaceful relations with all non-belligerent States” (Article CLII).

This idea of a single Muslim nation with a people united behind a common religion and heritage is important, and the fact that it appears so readily stated in multiple instances in the Constitution is revealing and significant. It is also strikingly similar to the policy of the former Soviet Union, the unification of all Communist former countries and the recruitment of the working classes of all other countries. The Constitution continues to set limits on freedom in its proposition that only three non-Islamic religions are recognized by the state: Zoroastrianism, Judaism, and Christianity. All Muslims are bound to treat non-Muslims with ethical norms and principles of Islamic justice, as long as they are not engaging in conspiracy against Iran. (Article XIII).

All people of Iran enjoy equal rights, according to the Constitution, but in a slightly Orwellian
fashion: “all citizens of the country, both men and women, equally enjoy the protection of the law… in conformity with Islamic criteria” (Article XX). “The restoration of [women’s] rights” is called for in Article XXI, but a review of the history of Iran shows that progress in this area has been less than ideal.

All laws shall be based on Islamic criteria. Deliberative bodies shall be formed to comply with verses from the Qur’an. Freedom, independence, unity, and territorial integrity are inseparable. No authority has the right to infringe in the slightest way upon the political, cultural, economic, and military independence of the Iran under the pretext of exercising freedom.

The basic guarantees of the American Bill of Rights are also guaranteed in the Iranian Constitution with the all-important stipulation that the exercise of those freedoms does not conflict with the basic tenets or foundation of Islam, which may be, of course, interpreted in the manner deemed worthy by the Supreme Leader.

The economy is one of significant socialism. The Constitution states that the government of Iran will endeavor to uproot poverty and deprivation, and it will supply to all citizens “the provision of basic necessities for all citizens: housing, food, clothing, hygiene, medical treatment, education, and the necessary facilities for the establishment of a family” (Article XLIII).

The question of the actual structure of the government is answered next. Highest power is reserved for the Supreme Leader. Khomeini assumed this role first, and Ali Khameini has been the Leader since Khomeini’s death in 1989. The Leader sets the general priorities of the government and the national guiding principles of the country. He is the Commander in Chief, and he appoints the head of the Judiciary, the news agencies, half of the members of the Council of Guardians, and various other heads of agencies.

The Council of Guardians is a body of twelve, half of whom are appointed by the Leader and half of whom are appointed by the head of the Judiciary, who was previously appointed by the Leader. The Council of Guardians oversees the activities of Parliament, determines shari’a (Islamic law and Qur’anic commandments) compatibility, and qualifies candidates for parliamentary elections. It has veto power over any act of Parliament. A second advisory group is the Expediency Council, which was formed to mediate disputes between Parliament and the Council of Guardians. Its thirty-four members are conservative and usually side with the Council of Guardians. As a result, it is now effectively the advisory body to Leader, although it is subject to internal manipulation.

The second highest-ranking official in the Iranian government is the President, who is popularly elected for a four-year term, renewable once. He is responsible for the day-to-day workings of the Iranian government, but he does not set state goals or ideals. The entire executive branch is subordinate to the Supreme Leader. The legislative power is vested in the Islamic Consultative Assembly (also known as Parliament or Majlis), the body of the people’s representatives elected directly every four years. Eligibility for candidates for Parliament is determined by the Council of Guardians, which is effectively entirely appointed by the Leader. Essentially, the Supreme Leader can dictate if a person is not eligible for holding a seat in Parliament, which has dangerous ramifications for the future of a functioning government.

The final elected body is the Assembly of Experts, a group of eighty-six clerics popularly elected for terms of eight years. Candidates for a position in the Assembly are investigated and approved by the Council of Guardians. The Assembly’s main duty is to elect and confirm the Supreme Leader when the position becomes vacant. The group is similar to the Vatican’s Council of Cardinals in its duties.

The implications of this structure are numerous. Foremost is that the Supreme Leader has effective control over all levels of the government. If he does not have direct control, he has surrogate control through appointees. Lucidly explicated by Noori in his work Islamic Government and Revolution in Iran, the Constitution makes palpable the philosophy that the Islamic idea of state only claims that law is of divine origin, not the rulers or the government itself (14). Islamic government is also founded on the principles of eradicating inequality and pursuing social justice.

Noori presents six distinctive features of Islamic government that demonstrate its uniqueness in the international community. First, the Islamic state is “founded on an ideological basis in which an individual’s geographical, national, ethnic or linguistic background does not play any part.” Essentially, the Islamic state is united by a quality deeper than any superficial traits. Second, the Islamic state is dedicated to humility and “unequivocally opposed” to pompous ceremonies and lavishness. Third, Noori claims that Islamic government is “the most inexpensive form of government” since it dispenses with troublesome bureaucracy and other inconsequential institutions, although in practice, such an absence has not come to fruition. Fourth, the eminent concern of Islamic government is not economics. Fifth, the importance that Islamic government places on the spiritual and moral soundness of its leaders sets it apart from other governments. Last, the Islamic state is free of deception and deceit. The preeminent, guiding force of Islamic government is the goal of creating the perfect society, with all people united in philosophy (26-29).

As Buchta notes, the Shi’a clergy have increasingly consolidated their political power and their control
over all levels of the government (xi). Substantial informal power structures exist within the Iranian government as well. For a substantial and compelling treatment of the relationships between officials within the Iranian government, see Buchta’s Who Rules Iran?: The Structure of Power in the Islamic Republic.

According to Amuzegar, the Finance Minister and Economic Ambassador in Iran’s pre-1979 government, “Khomeini’s promise of a just and free Islamic society has proven a sham. After nearly a quarter-century of theocratic rule, Iran is now by all accounts politically repressed, economically troubled, and socially restless. And the ruling clerical oligarchy lacks any effective solutions for these ills” (1). His observation is insightful and revealing of the true accomplishments of the Islamic Republic. Khomeini’s grand promises of an ideal, peaceful Islamic society have not come to fruition in what Mafinezam and Mehrabi call “a legacy of unsustained achievements” (3).

The bewildering ideology of the Islamic Revolution in Iran, which sought to move society back to the seventh century and the era of the Prophet Mohammed in an atmosphere of complete religious control, contrasts heavily with the ideology of other revolutions that sought to usher in eras of freedom and new ideas (Bozeman, 388). Present in the Constitution and the methods of governance are a multitude of contradictions and incongruities, but also the foundations of a crudely unrefined, but functioning, government.

The Evolving Relationship between the United States and Iran

Formal diplomatic relations were established between Iran and the United States in 1883. Much of the early contact between Iranians and Americans, however, came in the form of American missionary action. The majority of these missions aimed to convert Iranians to Christianity. The American Presbyterian Mission founded the first missionary school in Iran in 1835, forty-eight years before the two nations established official relations (Heravi, 10-12). In the earliest years of the two countries’ diplomatic efforts, general ignorance on the part of the American people and the American government of Iran dominated the exchange of ideas, and a vague, idealistic idea of Iran was pervasive throughout the United States government.

In 1856, the United States and Iran signed the Treaty of Friendship and Commerce mutually declaring the principles of friendship and commerce between the two nations and pledging to sustain “a sincere and constant good understanding” of each other (Alexander & Nanes, 3). In spite of President Buchanan’s advice and due to the American Civil War, a legation was not established in Tehran until twenty-seven years after the signing of the treaty. The formal establishment of the American legation in Tehran occurred on June 11, 1883, with the presentation to the Shah of Minister Benjamin’s credentials. By 1888, the Iranian diplomatic party had arrived in Washington and had received its first audience with President Cleveland.

By 1896, a movement had begun in Iran calling for a constitution and a legislative body. After the movement formally stated its set of principles, the American minister in Tehran, Richmond Pearson, relayed a pessimistic message to the U.S. State Department, stating his observations and beliefs:

1. The great body of the Shah’s subjects have no idea of the meaning of constitutional government.
2. The majority of the people are illiterate.
3. There is no middle class, whose interests could form the basis and the guarantee of constitutional government.
4. Iran is still largely a feudal state.
5. The concept of autocracy is more accepted than democracy.
6. It is generally believed that the Mujtahids, who sided with the reformers or revolutionists in the recent agitation and whose influence gained the victory for that party, will soon return to their traditional support of autocratic ideas (Herlavi 18-19).

To complicate matters, in 1904, the Reverend Benjamin Labaree was murdered in northwestern Iran. This event was “the one important event in Persian-American relations up to that time” (Yeselson, 82). The Labaree affair brought about an analysis of the existing diplomatic relations between the United States and Iran, and it revealed the dangers of missionary work in Iran. While the final settlement between the two governments favored the American standard of justice, the Labaree affair also forced the United States to become unduly involved in the course of Persian justice.

After the slight crisis of the Labaree affair, a Constitution was successfully constructed and implemented. Muzaffaru-Din Shah, who had granted the Constitution legitimacy, died, and his successor, Mohammed Ali, “immediately tried to undermine the Constitution” (Herlavi 20). Ali’s desire to rule as an absolute monarch resulted in the Constitutional Crisis of 1907-1909, during which the “American attitude was one of non-intervention” (Herlavi 20). After Ali’s abdication in 1909, the United States again pledged full support for his successor, the twelve-year-old Crown Prince Ahmad, who would rule under the regency of Azed Al Molk. The Labaree affair and the change from absolute monarchy to constitutional monarchy fundamentally changed American-Iranian relations.
In what James Goode called “the diplomacy of neglect,” the United States pursued a course of non-intervention in Iranian affairs. For example, the United States did not come to Iran’s help when the Iranians felt a sense of danger because of the Anglo-Russian Convention, which they interpreted as an attempt to partition Iran into one British and one Russian zone of influence. Consistently, the Iranians sought America’s help to lessen the perceived European influence in their country, but despite its willingness to help, the United States was reluctant to provide assistance. As Yeselson stated, “America’s more positive role in world affairs in the twentieth century did not include the translation of such pro-democratic sentiments into an official policy of encouragement for revolutionary movements overseas” (88).

In 1911, under President Taft’s order, the United States sent W. Morgan Shuster to head an American financial mission in Iran to help mend the Iranian economy. There was one caveat, however. The mission was, by order of the State Department, in no way representative of the United States government. The men were simply private citizens being employed by a foreign government. Shuster’s mission did nothing to alter Washington’s policy toward Iran, but it did help increase the positive public support of Iranian issues (Heravi 30-34). Yeselson has called the Shuster mission “the high point of America’s prestige [in Iran]” (228).

At the outbreak of World War I, Iran quickly informed the United States of its neutrality, although its neutrality was routinely violated by Russia, England, the Ottoman Empire, and Germany. As previous years of relations would indicate, the period of war did not see much interaction between the Iranian and American governments. Iran subsequently asked for “assistance of the United States Government in securing for [Iran] representation in the peace conference which will convene at the termination” of the war (Heravi 36). At Britain’s insistence, however, Iran was not offered a voice. The world was enlightened quickly thereafter of the secret negotiations happening between Iran and Britain. On August 10, 1919, a secret treaty between Britain and Iran was made public, and the response from the United States was highly unfavorable. In the treaty, Britain promised to take a much more proactive role in Iranian affairs than the United States had done in the past, but Britain still denied that Iran would become a protectorate or a quasi-colony. Britain would maintain this position of preeminence in Iranian affairs until 1921, when the newly established leadership of Reza Pahlavi nullified the treaty and effectively showed Britain that foreign countries would not be allowed influence under Iran’s new nationalism.

In 1925, after being crowned Shah, Pahlavi began to modernize Iran, fusing nationalism and westernization. After witnessing the failure of British leadership, the debacle of Russian influence, and the perceived neglect given by the United States, Reza Shah set the goal of Iran becoming independent of foreign influence. During this same time, Iran was requesting various American advisors for the Ministries of Finance, Commerce, Agriculture, Public Works, and other similar governmental agencies. With limited involvement in the internal affairs of Iran, the United States maintained a relatively consistent state of relations with Iran until the outbreak of the Second World War (Heravi 58).

“Prior to World War II, indifference and ignorance characterized the American attitude toward Iran” (Hamilton 2). By the early 1940s, however, after a sequence of diplomatic missions, many Americans were aware of Iran. In fact, in 1942, during the war, Iran asked for yet another American financial minister in Tehran. This final mission ended in 1945 after the Iranian Parliament voted to repeal the minister’s financial powers after a series of unpopular decisions.

By 1946, after two world wars, American–Iranian relations had undergone a transformation. By engaging in World War II, the United States had clarified its stance on world affairs and altered its policy of isolationism. The United States had pledged full support for Iran. Following Iran’s 1943 declaration of war against Germany in hopes of gaining membership in the United Nations, the governments of Iran and the United States reached an agreement in 1944 to elevate the United States Legation in Tehran to an Embassy, corresponding with the regard given to both countries’ diplomatic missions. Accordingly, President Roosevelt announced, “Iran and America have every reason to be close friends” (Heravi 102). Nevertheless, the American-Iranian partnership remained, as Alexander and Nanes deemed it, “a peripheral relationship” (1).

Over the years, the Department of State provided aid to support Iran’s independence, territorial integrity, political and economic progress, and overall sovereignty. The United States became a mediator in the English-Russian power struggle in the region. In due time, the United States had, of self-interested necessity, replaced Great Britain as the major Western influence in the Middle East in the post-war period. Finally, the stage was set for the United States to feel justified in defending Iran against possible aggression from Soviet aims.

U.S. involvement was secondary to the interests of Great Britain and Russia until its help as a neutral state in the conflict became necessary, in the eyes of the Iranians, to “fend off incursions on [Iran’s] independence” (Stempel, 59). The level of participation by the United States steadily increased during the post-war and Cold War period until the dramatic events
of the Islamic Revolution. The United States’ policy of Soviet containment was logically extended into the Persian region, and the Soviet Union’s military presence in Iran was eliminated after the arrival of the Americans. While the United States helped improve Iran economically and politically, it also provided a promising and demanding market for Iranian oil. Although Gasiorowski claims that the United States was attempting to construct “a client state” in Iran, the U.S. was truly more interested in ensuring that Iranian oil and other resources made it to the market. While the United States certainly had self-interest in mind in its dealings with Iran, its own advancement was not its sole concern. With increased involvement and a growing interest in the well-being of the United States’ strongest ally in the Middle East, the United States increasingly became interested in supporting the actions of the Shah, and it did not recognize or foresee the fermenting problems resulting from Western impositions on the traditional lifestyles of Arab Muslims.

Iran’s call for a neutral third party to counter the Anglo-Russian conflict within Iran led directly to the end of the hesitanty shown in the formative years of the United States–Iran partnership. Responding to that call, slowly at first, the United States gradually became more involved in both the internal and external affairs of Iran. America did, however, eventually become more concerned with Iran’s strength as an ally than America’s ability to help Iran’s political and economic well-being. Through the various American missions to Iran, relations strengthened, and America’s growth as a world power paralleled Iran’s growing sense of nationalism and desire for independence.

The Interplay of Structure and Islam in Iran’s Foreign Policy

The Constitution of the Islamic Republic of Iran establishes a government based on “the complete elimination of imperialism and the prevention of foreign influence” (Article III). This rejection of foreign manipulation is a logical consequence of the establishment of a society based on absolute submission to the ultimate authority, the laws of the Islamic faith. Article III also states the chief organizational principle of Iranian foreign policy: the government is responsible for “framing the foreign policy of the country on the basis of Islamic criteria, fraternal commitment to all Muslims, and unsparing support to the mustad’afin of the world.” Even Article XLIII, an article concerning the economic organization of Iran, states that the “prevention of foreign economic domination over the country’s economy” will be a guiding force behind the establishment of the economy.

As an apparent insult to and rejection of previous policy, Article LXXII simply states that “the employment of foreign experts is forbidden, except in cases of necessity and with the approval of the Islamic Consultative Assembly.” Previous Iranian policy had supported the hiring of American experts to aid the Iranian ministers in different policy areas, and the new Islamic constitution is purposefully breaking with this tradition from the past.

Articles CLII-CLV specifically are dedicated to the foreign policy of Iran, and they explicate a clear and consistent vision. Their brevity accentuates their stark message. Article CLII states the Iranian vision clearly:

The foreign policy of the Islamic Republic of Iran is based upon the rejection of all forms of domination, both the exertion of it and submission to it, the preservation of the independence of the country in all respects and its territorial integrity, the defense of the rights of all Muslims, non-alignment with respect to the hegemonist [sic] superpowers, and the maintenance of mutually peaceful relations with all non-belligerent States.

Article CLIV states with similar clarity a second crucial foundational principle of Iranian foreign policy:

The Islamic Republic of Iran… considers the attainment of independence, freedom, and rule of justice and truth to be the right of all people of the world. Accordingly, while scrupulously refraining from all forms of interference in the internal affairs of other nations, it supports the just struggles of the mustad’afun against the mustakbirun in every corner of the globe.

Apart from the establishment of certain principles in the Constitution, the power structure of the government of Iran comments on the country’s attitude toward international affairs. The ultimate authority of the Supreme Leader, God’s representative on Earth, and his ability to arbitrarily set governmental policy is indicative of the country’s willingness to allow decisions to be made without deliberation or an open and honest discussion of the varying policy avenues available. The Supreme Leader is also declared, in Article CX of the Constitution, to have “supreme command of the armed forces” and to have control over the “declaration of war and peace, and the mobilization of the armed forces.”

The ultimate power of the Supreme Leader in the realm of international relations parallels his ultimate
authority in all areas of Iranian life. The entire system of Islamic governance is based on his power as the one official representative of Islam, but internal conflicts between members of the bureaucracy also have helped shape the functioning of the Islamic government.

Similarly, Iran’s championing of “independence, freedom, and rule of justice and truth” in one of the Constitution’s statements establishing the principles of foreign policy appears slightly hypocritical in light of a dispassionate examination of Iran’s record. Thus, both the organization of Iran’s government and the powers of the Supreme Leader contribute to the formation of Iranian foreign policy.

Shia Islam is the official religion of Iran, and this fact is important in the creation of Iranian foreign relations. Shi’ism holds that the only legitimate successors to the Prophet Mohammed are linear descendants in his bloodline. From the time of the death of Mohammed, however, Sunni Islam has been dominant, holding that the member of the Islamic community best qualified to lead to the community should assume leadership and power. Not until the establishment of the Islamic Republic did Shi’ism dominate a country’s religious atmosphere or did the leaders of a country profess belief in Shi’ism. Sunni Muslims historically have been the politically dominant force in countries with large Muslim populations. Even in Iraq under the reign of Saddam Hussein, where the majority of the population is Shia, the Sunnis controlled the government. Shi’ism’s rise in Iran emboldened Shi’ites worldwide, and Iraq was especially impacted by these invigorating revolutionary feelings.

With the establishment of the Islamic Republic of Iran, however, Shi’ites controlled the actions of a country. Shi’ism is based on a more pessimistic view of human nature; it assumes, in opposition to Sunnism, that humans can neither find salvation nor manage their own affairs without divine guidance. Shia religious leaders presume a certain amount of political power because of their more prophetic and messianic roles.

The implications of Shi’ites in the seats of power are numerous. Shia as a ruling philosophy has many ramifications. Iran, as a Shi’ite country, seeks to hasten the day of the advent of perfect divine justice brought about by the second coming of the Twelfth Imam. Advocating and participating in jihad is one of the clearest ways to further the Twelfth Imam’s vision of a worldwide Islamic community, and to accelerate his return. Shi’ites are also, generally, more favorable toward violent, revolutionary action to further their political goals. There is a fundamental difference of temperament between Shia and Sunni Muslims.

Shia Islam also fully embraced nationalism within Iran and in other countries throughout the Middle East, as it capitalized on the discontent many Shi’ites felt at being constantly referred to as “lesser Arabs.” Their desire to change their perception led to some of the more extreme actions observed by the world by Shia Muslims.

The idea of the Supreme Leader, who is absolutely influential in matters of foreign policy, is directly a consequence of Shia Islam. Khomeini saw himself as representative of the proper successor to Mohammed and, like Plato’s philosopher-kings, perfect for creating and maintaining an ideal government and society. Throughout the history of Shi’ism, martyrs were glorified and exalted, from the original death of Imam Husayn, the fighter against Sunni tyranny, who was killed at the Battle of Karbala and whose day of death marks the Muslim holiday of Ashura. Invoking feelings of religious pride, and evoking messianic images and ideas, Khomeini rose to absolute power in the Islamic Republic.

The leftist, socialist tendencies of the Islamic Republic are a direct consequence of radical nature of Shi’ism and the time period in which the country was conceived. Clearly, both the structure of the Islamic Republic and the core beliefs of Shia Islam influence the foreign policy of Iran. An explanation of such would be incomplete without consideration of both characteristics.

Works Cited
Alexander, Yonah and Allan Nanes (Eds.). The United States and Iran: A Documentary History. Frederick, Maryland: University Publications of America, 1980.


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In a double-degree program here at UK, I'll graduate in December, 2009, with a BA in English (with a minor in French) and one in Art Studio, having completed honors in Honors and four years as an Otis A. Singletary Scholar. In addition, during the 2007/2008 school year, I was the recipient of the Université de Caen/Deauville Jumelage award, which allowed me to study abroad for a year in Caen, France. Though I was there to learn the language, I also took the opportunity to find a job as an English teacher at private school — an experience that continues to be rewarding almost a year later.

When I graduate, I will be serving in the Peace Corps, but upon my return to the United States, I plan to apply to graduate schools for a PhD in English so that I can go on to become an English professor at the university level. I am extremely interested in how art and literature relate to and/or can be made to relate to each other, which is why investigating the history of artistic issues in a literary context was so intriguing to me.

Throughout this paper, I was helped immeasurably by Dr. Peters, who pushed me further and harder than any other teacher ever had. Her influence was not only felt in her support of my own abilities, but also in the time she took to read and comment, in minute detail, on all aspects of this project. As I come to the end of my college career, I am only now realizing just what a rare and valuable trait it is in a professor to care deeply about the success of his or her individual students, and I am also aware that without her help, this paper would not have been even remotely as comprehensive as it ended up.

Artemisia Gentileschi has been the object of scholarly attention ever since the 1970s, when feminists began to reconstruct the contribution of women to the history of art. Gentileschi’s vigorous, gruesome depictions of Judith decapitating Holofernes have become a standard inclusion in the art historical canon. Using the example of Gentileschi’s 1635 self-portrait, La Pittura, Virginia Conn successfully contributes to current scholarship and debate by strengthening the argument that Gentileschi consciously manipulated and undermined not only 17th Century gender expectations, but also assumptions stemming from her personal history as the victim of rape. She shows how Artemisia took advantage of a unique point in history — from both sociological and symbolic perspectives — to manipulate her self-portrait. Virginia supports her contention that in La Pittura Gentileschi, by the ingenuity of her visual choices, forcefully asserts herself as a professional artist and equal in a male-dominated profession and society.

Artemisia Gentileschi’s painting La Pittura [1635 (fig. 1)], a depiction of the allegory of painting, almost universally recognized as a self-portrait, is unique in the canon of baroque self-portraiture — not because it was created by a woman, though that in itself rarefies the work considerably, but because the artist’s gender allowed her to produce an allegorical reference unavailable to her male contemporaries. (Garrard, 1989) In a society in which abstract ideas were generally represented by the female form, any male painter wanting to depict himself as art personified encountered a stumbling block that, due to her unique position, Gentileschi bypassed completely.

The success of Gentileschi’s self-portrait as an abstract representation, however, is secondary to its success as a personal statement. Gentileschi (1597—c.1651) is best-known to modern audiences (and, by all accounts, to the public of her day as well) not for her art, but for her widely-publicized and notorious rape trial (1611-1612). Many art historians have ascribed her appeal to being more closely linked to her persona as a public figure and victim than to any inherent enduring quality in her art, but when we bypass these prejudiced judgments, we find the type of creation in which the social circumstances of the artist are inextricably bound up with that of the art. To a certain extent, this is true of every artist and his or her oeuvre (see Picasso’s blue period paintings or the homoerotic imagery of Robert Mapplethorpe), but it is especially important to the aims of Gentileschi. Although she was certainly talented enough to have portrayed herself in any position or costume, she did not. eschewing the idea of overtly misrepresenting herself through the assumption of an imagined identity and superficial trappings.
in favor of a self-portrait that combined both her literal profession and the allegorical idea of personification.

Nevertheless, the idea of manipulating the way in which one appears and is, therefore, perceived is integral to a full understanding of Gentileschi’s work, as Jean-François Maillard (1973, p. 18) states. For example, why would a Baroque artist living in Italy — which at the time afforded its artists more agency, power, and respect than any other European nation — have cast herself as a painter, when she could have used her art to rise above her station? Her male counterparts certainly had no compunctions in doing so; self-portraits of this time by male artists frequently presented the subject in the costume of a nobleman. Meanwhile, if we look elsewhere in Europe, we notice other female artists also creating self-portraits as working artists, driven by necessity to establish themselves in a profession that society already recognized their male contemporaries as practicing. Gentileschi, however, incorporates and goes beyond simple gender dichotomies to produce a work that, while it shows her as realistically engaged in artistic practice, also subverts traditional power structures and establishes the artist as the very embodiment of creation in a way that no other painter was able—or dared—to do.

Initially, La Pittura seems to be a beautiful image that, nonetheless, contains little substance. Like a single bold stroke in a contemporary painting, it showcases the quietly determined form of the artist at work, the curve of her body a sweepingly elegant c-shape, her arm holding the paintbrush strong and sure above her head. Though the viewer faces her directly, she is turned in profile, engrossed in the hidden canvas before her in the same way that we, the viewers, are drawn in by her understated assuredness.

La Pittura is an action shot, positioned as if the viewer were invisibly observing Gentileschi up close, which adds to our impression that we are viewing her in her “natural” state. We see her from the waist up only; there is no indication that she’s aware of our gaze, either in her demeanor or dress, which creates an intimate setting in which we can almost smell the dense oiliness of her paints or sense the heat coming from her body. In the actual process of artistic creation, she is tilted to the side, considering something in front of her before making her next stroke. Her hair, frizzled, is messily pulled away from her face — the hasty solution of one without time for niceties. Additionally, she wears no makeup, though she does make several concessions to femininity, notably in her dress, which features ruffles and a low-cut bodice. Her undeniably female form fills the page;
the only other objects within are the tools of her trade. These tools — a brush in her raised right hand, a palette in her lowered left — begin to emerge from the Caravaggio-esque shadows surrounding her, although her tenebrism in this painting is not as heavily worked. Because of this, her arm becomes gradually lighter as our eyes move from the upper left corner in which she applies paint, following the line of her body down to the palette held at the bottom. The brightest point is her upturned face, lit from a source that could be merely another of her tools or could stand in for the light of inspiration. The rust-colored background is the same hue she holds on her palette, and sets off the shifting green, blues, and browns of her dress. Around her neck, one can’t help but notice the glinting gold of a finely-worked chain, at the end of which dangles a heavy pendant depicting a mask.

The majority of the elements in her painting would have been immediately recognizable to her contemporaries, artistic or otherwise. Though they may be lost on a modern-day audience, the details are drawn largely from a text, extremely influential to artists of the 17th and 18th centuries (particularly in Italy), by Cesare Ripa, titled *Iconologia overo Descrittione Dell’imaginari Universali cavate dall’Antichità et da altri luoghi*, or more simply, the *Iconologia*. Written in 1593, it was an emblem book containing information about how to physically depict abstract ideas and virtues such as wisdom, night, eternity, or — most importantly to Gentileschi — art and painting.

According to the *Iconologia*, the elements that were to be included in a depiction of the allegory of painting (fig. 2) included: a pendant mask on a gold chain (to show the artist’s capability for imitation of what he or she sees in life), a green dress that shifted hues (to demonstrate the painter’s control of color), unruly hair (depicting “the divine frenzy of the artistic temperament,” as well as emotion and inspiration), the tools of a painter, a piece of cloth binding the mouth, meant to symbolize the non-verbal means of expression to which the artist was limited, and that the form — like other allegories of abstract ideas — be a woman. (Ripa, 1987) In *La Pittura*, Gentileschi has followed each guideline except for one: the gag. Nevertheless, while seemingly conforming to the proscribed guidelines, this self-portrait takes another artistic liberty besides not binding the mouth. Following the guidelines of the *Iconologia*, in most allegories depicting the artist, the tools — a brush and palette — are shown near the figure, but not in use. By showcasing herself as the artist at work, however, Gentileschi demonstrates that she is more than simply a figurehead for the concept of “art.” At a time when women were banned from the high art academies and rarely accepted as artists in their own right, this was an incredibly bold declaration that today’s viewers, disarmed by the intimacy of their proximity to the subject, are perhaps too quick to overlook. What could have been her reason for these alterations to a deeply-embedded artistic tradition?

The answer may lie in an observation by the leading scholar of Artemisia Gentileschi, Mary Garrard, who wrote “biographical experience and metaphoric expression are historically and specifically — not universally or deterministically — conjoined in Artemisia’s art [...].” (Garrard, 2001, XIX) meaning that Gentileschi’s personal experiences would have had a direct bearing on her artistic output. In Foucaultian theory, which argues for the effacement of the author in deference to the work, such a reading of Gentileschi’s output has traditionally been dismissed, despite the efforts of feminist revisionist historians to consider the very real effects of institutionalized victimization on women when carving space for the individual artist within the overarching social and artistic canons. Between these two competing ideologies, Gentileschi’s art has tended to become lost or, at best, marginalized as “female” art, outside of the dominant artistic canon. And, despite the fact that this marginalization was an active phenomenon during her lifetime, it has become more visible in our contemporary culture with the rise of feminist interpretation.
This new way of looking at art history has created two camps with relatively current views toward Gentileschi with, on one side of the argument for the worth of her art, the above-mentioned revisionist historians, and on the other, anti-feminist art historians who claim that though she has a compelling personal history, her art is worthless. Foremost among the latter is the art historian Francis Haskell, who is characterized by fellow art historian Anita Silvers as arguing that “Artemisia’s gender or other personal characteristics or history are not relevant [...]. That Artemisia’s rape caused her anguish is an admissible hypothesis about her, [...], but it is not thereby a fact about her art. The story of the artist is not the story of the artist’s art.” (Silvers, 1990, 365) He discounts the idea that circumstances outside of the art itself could in any way contribute to how it is produced and the genius inherent in it — a “purist” interpretation that theoretically effaces the creator in favor of the creation.

Haskell, however, goes on to demonstrate the double standards of which he is accused by Silvers by the way in which he refers to a male contemporary of Gentileschi’s, whose cause of death is uncertain, but is generally thought to have been suicide, due to his melancholic nature. He writes: “[...] Pietro Testa emerges as having possessed just those elements of originality, complexity, capacity for expressing personal suffering, and (almost) genius that, despite her great talent, were beyond the reach — or perhaps beyond the ambitions — of Gentileschi,” (Haskell, 1989, 38) thereby employing the same logical assumption with a male artist — that his personal suffering influenced and enriched his artistic life — that he denies to Gentileschi. In contrast, Silvers contends that the life of the artist is integral to his or her output, because it influences the way that the artist sees, interprets, and reproduces the world around him or her, thereby admitting Gentileschi’s personal history should be a valid point of reference when critiquing her oeuvre.

Although only her scholars are around to refute such gender biases today, in the seventeenth century, when she was living and working in the overwhelmingly male-dominated art world of baroque Italy, Gentileschi had similar double standards with which to contend. Due to her notorious rape, R. Ward Bissell states, “The conception of Artemisia Gentileschi as a woman of dubious rectitude, first provoked above all by the events of 1611-1612 [her rape and subsequent trial], was to have an effect on the nature of the commissions she was awarded and upon how her pictures were to be received.” (Bissell, 1999, 18) Branded thusly as a woman of sexual inclinations, with whom physicality was already associated, Gentileschi was to become valued not so much for her work as for her reputation and appearance.

“Another gender-distorted assumption traceable to Artemisia’s own time is that the artist and her art, as exempla of feminine beauty, constitute a seamless whole. Renaissance connoisseurs sometimes claimed to admire self-portraits by women as “double marvels,” of the painter’s art and her own beauty.” (Garrard, 2001, 7) Garrard’s comments here aptly sum up the situation in which Gentileschi worked and by which she was restrained, but that, also, she was able to masterfully exploit. As Bissell notes, “It was when writers acclaimed Artemisia Gentileschi’s physical attributes that they ran a special risk of doing her a disservice by

Figure 3. Drawing of the Hand of Artemisia Gentileschi with Paintbrush, Pierre Dumonstier le Neveu, 1625. British Museum, London.
emphasizing that aspect of her person at the expense of her mind (indeed by implying that she owed her art to her beauty) and by opening the way to those who associated female good looks with lasciviousness and a host of related negative qualities.” (Bissell, 1999, 40)

As I have argued, however, gender-based assumptions were the framework upon which Gentileschi built her reputation, by breaking them as often as she acquiesced to societal pressure for non-threatening, beautiful images of submissive women. The idea of beauty and skill in the person of Gentileschi can be seen in Pierre Dumonstier le Neveu’s drawing of Gentileschi’s hand (fig. 3), which is headed in archaic French by the inscription: “The hands of Aurora (goddess of the dawn) are lauded for their rare beauty. But these hands must be a million times more so, for knowing how to create such marvels, which ravish discriminating eyes.” 2 The objectification of Gentileschi’s hand as a beautiful object, linked with its ability to itself create beautiful works, represents for Le Neveu the “double marvel” that was a female painter working within male-imposed confines and using them to her own advantage.

Gentileschi, then, must have garnered a certain degree of acclamation above and beyond that of her notorious violation, at least in her own time, by realizing that “identity [is] a ‘manipulative, artful process.’” (Pearson, 2008, 4) She would use this knowledge in that “identity [is] a ‘manipulative, artful process.’” Notorious violation, at least in her own time, by realizing the degree of acclamation above and beyond that of her imposed confines and using them to her own advantage.

Gentileschi, then, must have garnered a certain degree of acclamation above and beyond that of her notorious violation, at least in her own time, by realizing that “identity [is] a ‘manipulative, artful process.’” (Pearson, 2008, 4) She would use this knowledge in creating La Pittura, which strengthens its revolutionary message by grounding itself in a deceptively traditional visual language: the Iconologia. By using an allegorical reference that was widely understood, she was able to describe herself visually as a personification of painting, while rejecting the implications of female beauty that went along with it, effectively taking a stand against the classifications others imposed on her. Picking and choosing from the Iconologia, Gentileschi used what elements she needed to convey her message, but it is nevertheless telling that she does not apply what elements she needed to convey her message, but it is nevertheless telling that she does not apply a single element that makes up “beauty.” We can see in Ripa’s description of how this beauty is to be presented (fig. 4) how much La Pittura deviates from, rather than conforms to, gendered expectations.

This description, too, could be an explanation for the missing gag typically associated with the allegory of art; Gentileschi is taking her stand as an artist, refusing to be silenced and put “in her place.” She is known to have held what, today, would be labeled (anachronistically; certainly Gentileschi did not use the term) feminist convictions, which, although they did not necessarily translate into action or power, were evident both in what Garrard describes as her subversively dominant female images (Garrard, 1989) and her personal statements to friends and patrons. These statements include the claims: “You will find the spirit of Caesar in this soul of a woman” and “I will show Your Most Illustrious Lordship what a woman can do.” Her security in her personal artistic prowess is quite evident in the calm assurance and competency felt by the viewer of La Pittura, in which her person is anything other than surrounded by splendor, as the Iconologia proposes for the idea of allegorical beauty. Instead, her self-representation draws upon centuries of earlier allegory related to intellectual skill and competence, rather than the fleeting attributes of loveliness.

In the artistic allegorical tradition, however, the allegories of painting (Pittura), architecture (Architettura) and sculpture (Scultura), were relative latecomers, not appearing until the first half of the sixteenth century. Before that, during the Middle Ages, accepted female allegorical representations were limited to the canonical seven liberal arts of the Trivium (dialectic, rhetoric, and grammar) and the Quadrivium (arithmetic, geometry, music, and astrology), while painting, architecture, and sculpture represented the mechanical arts, or crafts. In the fifteenth century, poetry, philosophy, and theology were added to the list of liberal arts, but painting was still excluded. It was only when “the art of painting was understood to involve inspiration and to result in a higher order of creation than the craftsman’s product did it become appropriate to symbolize the art with an allegorical figure.” (Garrard, 1980, 101)

The reasons for this figure being represented as female are generally accepted to be twofold: first, as a matter of practicality, in Latin and the five romance languages these liberal arts concepts are feminine (la pittura [Italian], la peinture [French], la pintura [Spanish], a pintura [Portuguese], picture [Romanian]), thus, a feminine personification. Second, and more abstractly, as women were traditionally far removed from such pursuits, which involved higher learning and which were therefore almost exclusively the domain of educated men, a female figure represented the fact that these ideas were removed from the individual (the norm against which all was measured being, of course, masculine) and the manual labor involved in its production, rendering it an intellectual and aloof concept, rather than a base craft.

This female image, of course, created problems
for male painters, because it meant the depiction of themselves as the artist must necessarily remain separate from that of the personification of art. Many ingenious solutions were proposed in response to this, such as Poussin’s 1650 Self-Portrait, in which he alludes to pittura in a painting in the background, yet he and “art” are still necessarily separate. That female allegory was incompatible with male self-representation is obvious, but it also led to “[...] ambiguities which exist between the representation of women and women as representation in seventeenth-century culture.” (Johnson, 1993, 449)

That Gentileschi was able to harness this ambiguity to serve her own ends — and recognizably associate herself with the idea of art as concept in addition to the artist as practitioner — is evident in the fact that there exist a spate of paintings, both before and after the celebrated La Pittura, which depict her as this very allegory. Earlier examples, such as Jérôme David’s engraving (fig. 5), undoubtedly gave Gentileschi the basic idea for her own work because it presented her as a “famosissima pictrice,” a professional practitioner of her art. But Gentileschi alone was able to take her self-portrait and include both professional and allegorical elements in a single cohesive whole. That it was adopted and replicated by other artists is a testament to its validity as a visual language that contemporaries were unable to produce for themselves.

Therein lies the genius of La Pittura: an allegorical self-representation by a woman, who deliberately manipulated traditional methods of symbolism to convey a revolutionary message. Unlike her male contemporaries, so concerned with gaining status as nobles and men of intellect, Gentileschi first had to establish herself as capable of producing the very art that they were occupied with rising above. Although the eternal conflict between theory and practice would later be further developed by other artists (notably Velasquez and Vermeer), in the existing theoretical framework, Artemisia Gentileschi continues to stand, literally and metaphorically, in the foreground.

1 “Ces fêtes et ces déguisements, si bien décrits par J. Rousset, sont bien autre chose que de vulgaires mascarades: ils signifient à la fois une attitude existentielle, celle que l’on vient d’esquisser, et s’érigent parallèlement en mythologie politique. Ces fêtes et tout leur attirail nous introduisent au cœur même de ce que l’homme baroque face à lui-même et face à la société voudrait être, croit être ou plus exactement voudrait paraître.”

2 “Les mains de l’Aurore sont louées pour leur rare beauté. Mais celle cy plus digne le doit estre mille fois plus, pour scavorir faire des merveilles, qui ravissent les yeux del plus judicieux.”

Works Cited
Figure 5. Portrait of Artemisia Gentileschi as Pittura, unknown artist, c1630. Galleria Nazionale d’Arte Antica, Palazzo Barberini, Rome. www.artemisiagentileschi.com
Abstract

Industrialized agricultural systems have given America a convenient and affordable means to supply a surplus of food products to its citizens. Transgenic technology, synthesized fertilizers, advanced pesticides, concentrated animal feeding operations (CAFOs), and the use of farm machinery have all contributed to humanity’s ability to feed the world’s rapidly growing population. However, the energy-intensive food operation of today may not be as ideal as we assume. Fossil fuels are burned to meet the energy requirements for the continual production of large quantities of fertilizer and to keep farm machines operational. Fertilizer and pesticide runoff from farmland ultimately drains into rivers that empty into estuaries and the oceans, where they contribute to hypoxia and weakening of competitive ability in aquatic animals. Indeed, there is some debate as to the necessity of industrial agricultural practices in light of the risks that have become associated with them after greater scrutiny. This article presents and analyzes information related to the consequences of agriculture on the long-term well-being of the global ecosystem, and addresses the sharp duality that has developed over this issue.
Introduction

Swift spikes in 2008 gas prices sparked a revitalized interest in the accessibility, efficiency, and stability of human energy sources. In order to move toward the utilization of more economical and environmentally friendly methods, we must take notice of discrepancies in all required large-scale, industrial operations — perhaps most importantly in agriculture, the activity that keeps everyone fed. Food is something that humanity in the developed world has come to take for granted. It is available, tasty, and generally nutritionally sound. No great amount of thought is generally attributed to the origin of our food, how it was grown and processed, or the amount of energy that was required for its transition to a commercial product and later transportation to easily accessible markets.

Great progress has been made in the United States in producing a surplus of food to feed the country. In the year 2000, the U.S. generated enough food to sustain every person in the country with 3,800 calories per day (Agriculture Factbook, 2008). The rate of food production in the U.S. has continued to rise as a result of improvements in transgenic crops, pesticide effectiveness, fertilizer use, farm machinery, limited agricultural species variety, and land management. However, this system comes at a cost. Processing and transporting food requires energy. This demand, achieved through the burning of fossil fuel resources, represents a large portion of energy use in the United States. Furthermore, the pesticides and fertilizers which we depend on to optimize every crop harvest, wash off of fields and into streams and rivers and ultimately the oceans, where they can put ecosystems and human health at risk.

I will address the environmental costs of modern, industrialized agriculture due to greenhouse gas emissions and the application of both fertilizers and pesticides. I shall also compare this information with Dennis T. Avery’s Saving the Planet with Pesticides and Plastics, which argues in favor of pesticide use, transgenic organisms, artificial fertilizers, fossil fuel energy, and free trade programs, and criticizes the positions of environmentalists and organic food activists. Saving the Planet with Pesticides, is an example of contemporary views in the defense of today’s industrialized agricultural systems. In his book, Avery lays out multiple reasons why he believes that energy-intensive crop and livestock production will lead humanity to a more favorable future than the alternatives, which he sees as organic farming and innovative energy sources. His method of presentation consists of beginning each chapter with a series of statements from environmentalists and organic food activists, which he labels as a “mythmakers say” section. He then refutes these statements and ideas using outside data that he refers to as “reality says,” as well as his own thoughts and opinions. As I will illustrate, Avery’s sharp contrast of industrial vs. sustainable agriculture is biased and flawed in that it does not incorporate the latest scientific research and intentionally misrepresents sustainable agriculture.

Greenhouse Gas Emissions

The EPA (Environmental Protection Agency) has determined that the agricultural sector contributed approximately 6% of the total greenhouse gas emissions in the United States in 2007 (or roughly 413 million metric tons of CO₂ equivalents). This figure does not take into account the production of fertilizers and pesticides and the transportation of food goods, all of which require fossil fuels. Most agricultural greenhouse gas emissions are linked to meat production, in which energy is required to grow feed crops for the animals, transport feed and meat, manage the waste materials, and process the final product. Meat production accounts for 18% of all greenhouse gas emissions worldwide, according to data from the United Nations (Rosenthal, 2008). Although agriculture represents a small portion of the total greenhouse emissions of the United States, it is still an issue that must be addressed if the country is to reduce its total emissions. Standardizing the capture of methane (each molecule of which has approximately 25 times the heat trapping ability of a CO₂ molecule) from CAFOs and applying renewable energy sources to agriculture could decrease agriculture’s impact on greenhouse gas emissions.

The most cited result of increased atmospheric greenhouse gas concentrations is an overall warming of the Earth. According to the predictions of the Intergovernmental Panel on Climate Change (IPCC), CO₂ concentrations in the atmosphere will reach 540-940ppm, with an associated temperature rise of 1.4-5.8°C by the year 2100 (IPCC, 1994). A global increase in temperatures of 2°C would hasten the melting of land-ice that has unexpectedly increased in the past few years. This unpredicted ice-loss is believed by some to be a result of the lubrication of the surface between the ice and the land beneath it with melt-water. Melting of land-ice in Greenland and Western Antarctica would produce a 0.34 meter rise in sea level; melting of sea-based ice could leave the world without a northern ice cap within 1-5 decades, which would represent loss of a barrier between nations in the northern hemisphere, the elimination of an arctic habitat, and a reduction in the Earth’s albedo. This loss would further promote the warming of the planet (a synergistic warming trend known as the ice albedo positive feedback). The rise in sea level in response to the melting of land-ice could flood coastal regions, resulting in calamity for homes.
and infrastructure nearby. Despite the rise in sea level, associated with increased CO₂ concentrations, some still argue that global warming should not be a major concern.

In one particular chapter of Saving the Planet with Pesticides and Plastics, (“New Excuses for Bad Regulations”), Avery cites one of his articles from American Outlook to make the argument that we should not be concerned with global warming and have no reason to feel guilty regarding the continual consumption of fossil fuels as our primary energy source. In this article he claims that global warming would be a beneficial change for humanity because it might produce a climate similar to that of the Earth during the Medieval Climate Optimum, a period between 1000 and 1350 A.D. that experienced temperatures comparable to today’s climate. That time period was particularly more habitable compared with the Little Ice Age that followed it (a period between 1400 and 1860 A.D. that experienced a 0.5°C global cooling) (Paleoclimatology, 2004).

Avery foresees a future in which a 1.6°C warmer climate and carbon dioxide concentrations of up to 550ppm spur plant growth and boost crop yields across the globe by 52%. Furthermore, Avery claims that alternative energy sources are harmful because they compete with traditional methods and increase energy prices, resulting in less money available for necessities (in particular, he mentions tractor fuel and the purchase of fertilizers). According to this information, humanity can benefit from a warmer, CO₂ saturated world, and should embrace this future rather than attempt to escape it through expensive, though novel, alternative sources of energy. However, increased atmospheric carbon dioxide concentrations will do more than simply warm the planet and raise sea levels.

Carbon dioxide in the atmosphere is taken up by the world’s oceans in the form of bicarbonates that increase the overall acidity of the ocean. Ocean acidification poses a risk to many shellfish, coral, and plankton species that depend upon the ability to produce scleritized, calcium carbonate exoskeletons. The production of calcium carbonate is inhibited for some species under acidic environments, though studies have shown that a few species of coccolithophores display increased calcification under acidic conditions (Fabry, 2008). These species form the very foundation of the marine ecosystem food web and, thus, the loss of any one of these species would have a major impact upon the entire ocean environment. Dr. Michael Oppenheimer has stated that the impact of a 2°C warming by the end of the century would include extinction for up to 30% of all known species that are incapable of adapting fast enough to the environmental changes (Oppenheimer, 2008). I believe that humanity cannot risk the extinction of such a large number of organisms (especially when humanity is making such great accomplishments in the field of biotechnology, which depends upon the use of DNA from various organisms as a tool).

Another assertion of Avery’s, which neglects to account for the price of biodiversity, is that wild-growth forests should not be preserved as refuges, but replaced with agriculturally controlled forest monocultures. He believes that these agriculturally monitored forests would improve management of lumber harvests, prevent unpredictable forest fires, and provide adequate habitation for a great variety of fauna and flora. Groups of old-growth trees would be cleared periodically to create habitation for organisms that require open areas, while at the same time removing dead wood, a potential source of forest fires. Some ancient trees would have to be kept however, in order to provide habitation to the organisms that use dead and dying trees. The creation of a systematic forest of only a desired tree species may extend the control of mankind further into the realm of nature and improve our ability to harvest resources. However, it should be noted that a forest of a single tree species may suffer a lack of biodiversity due to the fact that some wildlife depend on certain species of trees (or a variety of tree species) for survival.

Runoff Pollution

The application of fertilizers and pesticides on crop fields allows farmers to increase plant yields faster, and with less damage from pest species. However, excess pesticide and fertilizer residue is often washed into nearby surface and groundwater during rainfall, which transforms aquatic ecosystems — both freshwater and marine — into harmful environments. Pesticides can be toxic for a variety of organisms in waterways, but are especially harmful to arthropod life, which many pesticides are designed to target. Fertilizer runoff, on the other hand, promotes algal blooms in estuaries, where rivers meet the ocean, resulting in “dead zones.”

Dead zones are oxygen-deficient areas that appear in the oceans, often close to the shores or near estuaries. These hypoxic zones occur when increased algae populations cause a greater amount of organic matter to be deposited into the oceans. This excess organic material is thus made available for decomposition through processes that consume oxygen, ultimately leaving the surrounding waters without sufficient oxygen to sustain fish and crustacean life. Hypoxia in the Chesapeake Bay has been much more severe in the past four decades than for the past 500-2,500 years (Phillips, 2007). The cause of algal blooms along the coasts of many countries is an increase in the amount of plant nutrients being carried by rivers into the oceans, which is ultimately a result of the addition of an excess of nitrogen and phosphorous fertilizers to croplands.
where they later wash away into water systems. The algal blooms themselves may actually be beneficial in their ability to sequester atmospheric carbon dioxide, but they also cause the dead zones that have become an ever-growing problem facing the world’s already strained fishing markets (EarthSave News, 2008). One solution to this problem is to encourage the use of the minimum amount of fertilizer required to achieve needed planet growth, because many modern farms apply an excess of fertilizer in order to ensure the desired yields.

Pesticides are another cause for concern among farm runoff components. Most pesticides are designed to protect crops from insect infestation and damage. These insecticides perform a much needed task in reducing crop losses due to insect damage, but they also kill aquatic arthropods, such as daphnia, when introduced into rivers or streams through runoff (Pereira, 2007). These small crustacean-like organisms are a vital source of food for the lower end of the aquatic food web; a decrease in their populations would result in a decline for many aquatic species. Other beneficial, predacious arthropods, such as dragonflies and damselflies, are also killed during their aquatic stages by insecticide runoff. Furthermore, modern pesticides are not readily degraded by many microorganisms, and thus have a particularly long lifespan in groundwater supplies and wells. Pesticides also contribute to a significant number of fish kills; an estimated 6-14 million out of 141 million total fish kills, between 1977 and 1987, have been attributed to pesticide contamination (Pimentel, 1992). Endocrine disrupting insecticides are of particular concern, due to their ability to alter the behavior of fish, and possibly human, populations directly.

Many organochloride compounds hinder the functionality of the endocrine system in target organisms. According to Sean Allen, a junior in Biology and Entomology at the University of Kentucky, research into the effects of endocrine disruptors, such as endosulfan and atrazine, upon aquatic ecosystems has shown that guppies and other fish may experience weakened competitiveness when exposed to such chemicals (Allen, 2008). This weakening decreases their chances of surviving and mating, thus producing a dampening effect on the population. Even small quantities of endosulfan can cause serious organ damage to humans if ingested, and is also able to be absorbed through the skin (Kucuker, 2009). There have been other studies that link endocrine disruptor exposure to pregnant women (from water supplies or other sources) with increased rates of autism in children (although these studies suggest that more research be done into the sensitivity of different gestation periods before a definite conclusion can be drawn) (Roberts, 2007). Animal testing, run by The Endocrine Society, has shown that there may also be a connection between endocrine disrupting chemical exposure and diabetes, and that it is reasonable to assume that these connections may also apply to humans, although, again, more research is required to be completely certain of the information. The Endocrine Society also noted that the mutations caused by endocrine disrupting compounds could occur in germline cells, which would then pass on mutations to any future offspring of the exposed individual (Diamanti-Kandarakis E. et al., 2009).

Avery defends the use of all pesticides, including endocrine disruptors and DDT, for keeping crops free of parasites and disease. He states that early studies of these pesticides could not find significant evidence of deleterious responses in exposed groups of wildlife or humans, and that studies relying on information from rat tests cannot be trusted for medical information. Avery criticizes the credibility of rat tests by bringing up the fact that the tests usually use extremely high doses, at which just about any chemical becomes toxic. Furthermore, the biological responses of rats to pesticides and other chemicals is not guaranteed to be the same as, or even similar to, a human response to the same stimuli.

Avery also points out the advancements that pesticides have made over the years. Farmers in industrialize countries now use machinery to apply pesticides safely as they move through the field, thus keeping themselves out of the way of the applied product. Some pesticides now come in a pelleted variety that is less prone to washing away (although the pellets may prove a hazard for birds that mistake them for seeds). Hence it can be said that the risk posed by pesticides toward humans directly is somewhat overstated due to flaws in the commonly used high-dose rat test and improvements that have been made in the delivery methods of modern pesticides.

Despite the advancements that we have made in applying pesticides, cases of water contamination and accidental poisonings have continued to be found in humans, as well as in natural ecosystems. It is estimated that 67,000 nonfatal poisonings, in the U.S. alone, are attributable to pesticides each year (Pimentel, 1992). It should be noted that endosulfan, an endocrine disruptor used as a broad-range insecticide, remains in use in the U.S. as an agricultural pesticide (although it is banned from other uses) to be applied on crops to prevent insect damage. I do not believe that we can continue to apply such chemicals so liberally when we know that they may be affecting not only the natural environment, through their attack upon organisms close to the base of the food chain, but also human lives.

**Conclusion**

Avery’s Saving the Planet with Pesticides and Plastics
is an intentional defense of modern agriculture that rationalizes the use of industrial farming techniques against alternative, sustainable agriculture techniques. However, Avery’s arguments focus too strongly on denying any value in alternative farming techniques, to the point of making a number of claims that lack any scientific basis. Such an approach purposefully blinds both author and reader to truths that can be found only in seeking out and studying the enormous amount of trustworthy research that has been conducted and published in recent years. Threats to the sustained and greatly varied life of the planet must be taken seriously and assessed responsibly if we are to ensure that we do not create an unredeemable, catastrophic, global situation. The field of agriculture can help spearhead this movement by reducing its own impact upon the environment.

Acknowledgements

I would like to give my greatest gratitude to Dr. David Atwood, of the Chemistry Department, who provided me with a wealth of knowledge on the subject of climate change, and who encouraged me to write this report on an important issue. I would also like to thank Dr. Paul Kalisz, of the Forestry Department, for his encouragement and suggestions for the article.

Works Cited


I graduated from UK College of Fine Arts in 2004 with a double major in Art History and Arts Administration. Upon graduation, I worked at the UK Art Museum for three years as Curatorial Assistant. While I loved working with art, I felt a deepening desire to return to my childhood dream of becoming a scientist. In the fall of 2007, I chose to return to UK to pursue a Bachelor of Science in Agricultural Biotechnology. I am fortunate to have had the opportunity to work in the Goodin lab, where my art background ties in nicely with Dr. Goodin’s focus on obtaining the highest quality micrographs to accompany publications.

The past two summers, I have been awarded a eUreKa! Summer Research & Creativity Grant to support my research in the lab. A portion of the research conducted last summer is currently in press to appear in The Plant Journal, a leading plant research journal (of 145 plant science journals, The Plant Journal has the sixth highest cumulative impact factor [www.journal-ranking.com]).

I plan to continue my education in a biology-related field after graduation. My dream is to study in the Graduate Program at the Florida Institute of Technology in Melbourne, FL, where I may continue to conduct research. Having access to marine ecosystems, I could apply my studies in biotechnology to the field of marine biology. At FIT, I would have the opportunity to work with some of the leading researchers in the field.

Faculty Mentor: Dr. Michael M. Goodin

Department of Plant Pathology

Ms. Kopperud has worked in my lab since January, 2008. During this time she has assisted in the development of several transgenic plant lines that are essential to the success of a federally-funded research project aimed at identifying plant factors that interact with viral proteins. Construction of protein interaction maps for Sonchus yellow net virus and Potato yellow dwarf virus (PYDV) are essential for the long-term goal of understanding how host and viral factors function in concert at the molecular level leading to disease. Additionally, Ms. Kopperud is accelerating the characterization of proteins encoded by the genome of PYDV, which needs to be included in the aforementioned interaction maps. The genomic sequence of PYDV has only recently been determined and now it is time to characterize the encoded proteins using fluorescence microscopy techniques to determine their protein localization and interaction. Dedication to her research project has resulted in inclusion of her contributions as second author in a major paper accepted in the Plant Journal, one of the highest impact factor journals in plant biology. This and continued experiences are essential to developing this talented scientist who is preparing to go to graduate school next year.

Abstract

Viruses pose a threat to humans in a variety of ways — from direct infection to imposing devastating effects on the agriculture industry. Prevention of such infection requires knowledge of the mechanisms of viral infection, both in animal- and plant-infecting species. The goal of this project was to identify plant factors that interact with viral proteins in the course of infection leading to disease. Sonchus yellow net virus (SYNV) and Potato yellow dwarf virus (PYDV) were used to test the hypothesis that the viruses utilize different subsets of host factors in order to infect Nicotiana benthamiana, despite both being members of the genus Nucleorhabdovirus. Protein:protein interactions were validated with the use of bimolecular fluorescence complementation (BiFC). In addition, these experiments required the use of transgenic Nicotiana benthamiana plants that express fluorescent markers targeted to histone H2B as an aid to establishing localization of the viral proteins within the host plant cell. Taken together, BiFC experiments conducted in “blue nuclei” transgenic plants that express CFP-H2B significantly improve image quality and information content of the experiments, providing simultaneous localization and interaction data. The utility of novel techniques and the transgenic plants developed in the Goodin lab provided the necessary tools required to fulfill the objectives of a major NSF-funded research project.

I. Introduction and Significance

Viruses threaten human health and welfare in a variety of ways. In addition to diseases caused by pathogens that are human-infecting, such as HIV, hepatitis, and influenza, diseases caused by plant viruses are equally detrimental. Infection of crop plants affects food quality and yield and, in
turn, may have devastating economic, social, political, or historical consequences (Strange and Scott, 2005). The development of novel anti-viral strategies for application in agriculture requires insight into how viruses interact with their host cells to cause disease. In order to replicate or to be transported into host cells, viruses must manipulate the host’s cellular functions to their advantage while avoiding the defense responses it implements. The proteins encoded by the genomes of host cells associate physically with viral proteins. In many cases, these host proteins are recruited away from their normal sites of accumulation to subcellular loci where viral processes such as replication occur. Taken together, viral infection in host cells results from the combination of altered gene expression, protein:protein interactions, and changes in protein localization. In order to integrate these processes into systems biology toward the development of novel anti-viral strategies, a comprehensive view of host: virus protein interaction and localization is required.

Specifically, although the plant-infecting viruses to be studied, Sonchus yellow net virus (SYNV) and Potato yellow dwarf virus (PYDV), are both members of the genus Nucleorhabdovirus, they elicit dramatically different effects from the host, both at the phenotypic and cellular levels (Fig 1). Infection of the host by SYNV (Fig 1A-D) induces an accumulation of green fluorescent protein (GFP) (targeted to the endoplasmic reticulum (ER) lumen of the host) within the nucleus. PYDV infection, on the other hand (Fig 1E-H), stimulates GFP accumulation around the periphery of the nucleus (Jackson et al., 2005). Therefore, in the current research, SYNV and PYDV were used to test the hypothesis that the viruses utilize different host factors in order to infect Nicotiana benthamiana. Validation of protein interaction for SYNV and PYDV are essential for the long-term goal of understanding how host and viral factors integrate at the molecular level.

The research reported herein will contribute to a significant project funded by the National Science Foundation, entitled A Host Protein Interaction and Localization Map for a Plant Rhabdovirus. The goal of that 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 have been captured using state-of-the-art confocal microscopy. Given that both SYNV and PYDV replicate in plant nuclei, the host proteins predicted to interact with viral proteins are those that mediate nuclear transport. One such protein is importin-a, a host protein that functions to aid in the nuclear import of proteins containing nuclear localization signals, such as the one found in SYNV-N (Ghosh et al., 2008).

**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 used for experimentation and microscopy were screened for the presence and degree of fluorescence. In order to obtain the highest-quality micrographs for publication, only those plants that exhibited an intense and consistent level of fluorescence were retained for seed amplification or use in experiments. Diligent records of each plant tested were kept, to ensure that only the best plants were available for use by lab members.

**Objective 2: 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 1/4) 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 result indicates that no segregation is occurring and the plant line is
that express red fluorescent markers targeted to the nucleus or the endoplasmic reticulum (ER). These plants were utilized in experiments conducted in the context of probing plant:virus interactions to gain insight into the membrane and protein dynamics that take place in virus-infected cells (Chakrabarty et al., 2007; Goodin et al., 2007).

B. Agroinfiltration of transgenic \textit{N. benthamiana} 

\textit{Agrobacterium tumefaciens} transformed with expression vector is streaked onto LB plates with the appropriate antibiotics and incubated at 28°C. Following incubation, cells are harvested and resuspended in agroinfiltration buffer, and the cell suspension is adjusted to an O.D.\textsubscript{600} of 0.6-1.0. Acetosyringone is added and the cells are further incubated at room temperature for 2-3 hours.

To inoculate \textit{N. benthamiana} plants expressing CFP-H2B with the \textit{Agrobacterium} culture, a 1 mL syringe barrel is filled with the cell suspension and appressed to the tip of the leaf. The leaf is infiltrated by gently depressing the plunger while maintaining a seal between the syringe tip and leaf. Following incubation with illumination, agroinfiltrated tissues are suitable for microscopy or biochemical analyses.

C. Bimolecular Fluorescence Complementation (BiFC)

Bimolecular Fluorescence Complementation (BiFC) is a powerful new technique that permits simultaneous determination of protein:protein interaction and localization (Ohad et al., 2007). In this technique,
plants that expressed CFP fused to histone 2B (CFP-H2B; Fig 4I-Q). Consistent with previous reports (Deng et al., 2007; Goodin et al., 2001), the SYNV-N protein complex localized to the nucleus exclusively (Fig 4I-K), whereas coexpression of -N and -P resulted in relocalization of both proteins to a subnuclear locale (Fig 4L-N). The SYNV-P protein complex showed accumulation in both the nucleus and cytoplasm (Fig 4O-Q).

B. Differential interaction of “cargo” with importin-a

Given that the aim of the NSF-funded project is to identify plant factors that interact with viral proteins, the new BiFC vectors were further validated by testing the interaction of rhabdovirus -N proteins with importin-a. Although the association of SYNV-N and -P proteins has been studied in detail, the mechanism by which these proteins are transported into the nucleus is less well-defined. The SYNV-N protein contains an arginine/lysine-rich nuclear localization signal (NLS) at its carboxy-terminus, which has been shown to mediate its interaction with importin-a in vitro (Deng et al., 2007; Goodin et al., 2001). In contrast, SYNV-P does not contain a predictable NLS, and does not bind to importin-a in vitro (Deng et al., 2007). Moreover, although the cognate proteins from Potato yellow dwarf virus (PYDV) lack predictable NLSs, both are localized exclusively to the nucleus (Ghosh et al., 2007).

However, the nuclear transport of proteins lacking canonical NLSs have been shown to be mediated via an importin-a dependent pathway (Wolff et al., 2002). Additionally, while higher eukaryotes typically encode multiple allelic forms of importin-a with at least two known to exist in N. benthamiana (NbImpa1 and NbImpa2), the cargo specificities of these various isoforms are poorly understood (Kanneganti et al., 2007; Palma et al., 2006). Therefore, in order to advance our understanding of plant importin-a proteins, BiFC was used to study the ability of these proteins to bind proteins with non-canonical NLSs, and to determine if isoforms of importin-a differ in their cargo specificity (Fig 4). These experiments showed that, consistent with in vitro binding data, SYNV-N interacted with both NbImpa1 and NbImpa2 (Fig 5).

IV. Conclusions

- “Blue nuclei” transgenic plants that express CFP-H2B can be used to significantly improve image quality and information content of BiFC experiments.
- “Red nuclei” transgenic plants that express RFP-H2B greatly increase the accuracy of scoring nuclear localized proteins, essential for NLS-mapping and related projects.
- “Red-ER” plants permit facile visualization of membrane alteration induced by plant-infecting viruses.
- Validation of the utility of transgenic plants and novel expression vectors developed in the Goodin lab provide the necessary tools required to fulfill the objectives of a major NSF-funded research project.

V. Acknowledgements

This project was conducted in the Goodin Laboratory, Department of Plant Pathology, College of Agriculture. I sincerely wish to thank Drs. Michael Goodin and Anindya Bandyopadhyay for their guidance, and the members of the Goodin lab for their support. This research was funded in part by a eUreKa! Summer Research & Creativity Grant and by National Science Foundation awards to Michael Goodin.
The publication that includes data from this research conducted in the Goodin lab last summer:
I am a senior Sociology and Spanish double major at the University of Kentucky and a member of the Kappa Alpha Delta International Sociology Honors Society. For this research project I was selected as a recipient of the 2009 A. Lee Coleman Outstanding Sociology Senior award, the highest honor bestowed on a student from the department. This project is the outcome of an ongoing research process that began as a term paper for a graduate seminar class (SOC 735) taught by my faculty mentor and close friend, Dr. Ana Liberato. Building on the influences of major cultural studies texts that I was introduced to in her class, I later combined the theory with subject matter from film classes taught in the Department of Hispanic Studies, particularly the Latin American and Spanish Cinema courses offered by Drs. Juana Suárez and Susan Larson. After numerous conversations in offices and coffee shops with Dr. Liberato and countless edited and re-edited drafts of my paper comes the final product of my research.

My interest in reaching across disciplines from sociology to film studies, from scholarship on gender and sexuality to Latin American state politics, is exemplified in this work. Other awards and extracurricular activities during my time as an undergraduate at the University of Kentucky that have also enriched my research and scholarly interests include: spending a semester at Antonio de Nebrija University in Madrid, Spain, conducting a summer internship with the local non-profit organization; Kentucky Coalition for Immigrant and Refugee Rights (KCIRR); serving as the Vice President of the Gay-Straight Alliance (GSA); and receiving the 2008-2009 Arts & Sciences Dean’s Endowment. It is my hope and aim to continue this type of interdisciplinary research at the graduate level, eventually leading to a doctoral degree and a professorship position. Also, I would like to remain continually committed to the causes of community action and social justice that my research and extracurricular involvement as an undergraduate here reflect.

The Crisis of Identity in Post-Revolutionary Cuban Film: A Sociological Analysis of Strawberry and Chocolate

A. Lee Coleman Award for Outstanding Sociology Senior submission

Abstract

This paper analyzes Tomás Gutiérrez Alea and Juan Carlos Tabío’s *Strawberry and Chocolate* (1993) from the sociological perspective of film as a cultural text informed by the political, historical, and social world in which it is produced. A symbolic interactionist/cultural studies model is used as a guide for the interpretive and qualitative analysis of the 1993 film *Strawberry and Chocolate* in historical perspective, which allows for an understanding of the significance of its release just a few years after the fall of the Soviet Union and the subsequent collapse of the Cuban economy. Therefore, the reader can understand how the film served as a platform to communicate a newly conceived revolutionary identity in Cuba, one marked by tolerance and multiculturalism, although only engendered within the context of national crisis brought about by the “Special Period.”

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This paper is very interesting and is of sufficient quality to warrant consideration for publication in *Kaleidoscope*. In particular, there is a clearly stated focus and methodology, and the writing is quite clear, organized, and profound. The analysis shows the importance of film in consolidating myths and ideologies, and communicating social struggles and social contradictions. The treatment of gender is quite strong, as is the concept of sexuality as related to national identity. In particular, the analysis highlights the relationship between machismo, homophobia, nationalism, and identity in revolutionary Cuba, showing how the Revolution used the iconic image of Ernesto Che Guevara to create a heterosexual and male-centered national identity.

The discussion places the 1993 film *Strawberry and Chocolate* in historical perspective, which allows for an understanding of the significance of its release just a few years after the fall of the Soviet Union and the subsequent collapse of the Cuban economy. Therefore, the reader can understand how the film served as a platform to communicate a newly conceived revolutionary identity in Cuba, one marked by tolerance and multiculturalism, although only engendered within the context of national crisis brought about by the “Special Period.”
methods utilized in approaching the film. Of particular interest to the sociological analysis of the film is the changing political context of the Cuban Revolution during the “special period” of the early 1990s, the use of stereotypes in the characterization of the actors, and finally its representation of gender and sexuality as a reflection of the revolutionary discourse in Cuba. The paper concludes with reflections on the importance of film to sociological study and theory in general, using Strawberry and Chocolate as a salient example.

Introduction

Cinema is a mode of cultural production that consolidates identity on many levels. Whether explicitly or implicitly, the images displayed on the silver screen play with viewers’ notions of gender, race, class, sexuality, and nationalism in a number of complex ways. Furthermore, if we read films as cultural texts, as narratives about the society in which they are produced, their underlying ideological messages become useful starting points for understanding and analyzing the social world they attempt to reflect and critique. Many in the area of media and cultural studies have begun to recognize the important connection between the social world and its cinematic representation. Unfortunately however, film has received significantly less attention from sociologists even though much sociological insight may be gained from critically reading films as “cultural texts [with] distinct biases, interests, and embedded values, reproducing the point of view of their producers and often the values of the dominant social groups.” (Durham and Kellner, 2001, p. 6).

This paper attempts to analyze Cuban directors Tomás Gutiérrez Alea and Juan Carlos Tabío’s (1993) internationally acclaimed Fresa y chocolate, released in the United States under the title Strawberry and Chocolate. In examining the underlying ideology of the film as a cultural text, I argue that Strawberry and Chocolate serves as both a challenge to and a perpetuation of myths about Cuban national identity. However, because cinematic representations give meaning to the very concepts of “nation” and “identity” in the minds of the spectators, an examination of the normative implications about gender and sexual identity as they interact with Cuban nationality in the film is at hand.

Moreover, the paper will consider what the film’s contradictory ideological stance on Cuban national identity, gender, and sexuality says about the historical and political context of the social world in which it was produced. The ultimate aim is to demonstrate the sociological significance of film analysis using Strawberry and Chocolate as a poignant example. I will conclude with reflections on how this film specifically is a response to the crisis of the Cuban Revolution, in this way showing how films always respond to the social environment in which they are produced, thus making them useful for sociological analysis.

Methodological approach

Because this paper aims to analyze a film from a sociological perspective, traditional methodological approaches in sociology such as the interview-questionnaire or the survey do not apply for this type of analysis. Instead, I use a purely interpretive and qualitative analysis of the film using Denzin’s (1992) symbolic interactionist/cultural studies model. The three central problems in cultural studies Denzin identified will be used in the analysis of the film: “the production of cultural meanings, the textual analysis of these meanings, and the study of lived cultures and lived experiences,” (p. 34). The ultimate aim is not merely an interpretive analysis of the themes and subthemes in Strawberry and Chocolate, but an interpretation that is also political.

Such a critical and political reading of the film will be accomplished through examining both its historical context and its implicit ideologies on Cuban identity. Through repeatedly watching the film and carefully examining its explicit themes and implicit ideologies in relation to the historical information and academic literature, the film’s messages on gender and sexuality will be shown to be contradictory in that they simultaneously challenge and perpetuate a hegemonic definition of Cuban national identity. This conclusion is drawn from linking the literature to the thematic elements of the film, paying particular attention to stereotyping, characterization, and the connection between the discourse on nationality in the Cuban Revolution and its representation within the film.

The “new man:” discourses of gender and sexuality in the Cuban Revolution

In what way does the film enlighten the spectator to the connection between its cinematic representations and the actual social environment it is attempting to represent? In order to answer this question, one must first examine the pre-existing discourse of revolutionary politics outside of the film narrative. To understand the underlying ideologies and representations of gender, sexuality, and national identity in Strawberry and Chocolate, an understanding of the specific discourses of gender and sexuality the Revolution uses in the construction of Cuban identity is first necessary.

According to Lumsden (1996) the revolutionary discourse combined an anti-capitalist and anti-imperialist critique with gender normativity and homophobia. “At the outset of the Cuban Revolution, machismo was deeply ingrained in the fabric of Cuban society. Gender
roles were clearly identified and sharply differentiated,” (p. 55) and Fidel Castro was quoted as appealing to the masses in support of the revolutionary project saying that Cuba “needed strong men to fight wars, sportsmen, men who had no psychological weaknesses,” (p. 61). Thus, men were assigned to the roles of dominant, strong, providers and women to passive, domesticated, wives and mothers. If the Revolution was a progressive break from the dependence of prerevolutionary Cuba on American capitalism, it was at the same time a perpetuation of prerevolutionary traditional ideals regarding gender, the family, and sexual norms.

The image of the “new man” of the Revolution embodied by Ernesto Che Guevara was militant, strong, and traditionally masculine. At the inception of the Revolution there was an overriding sense of the need to cleanse the nation of all of its past ills, not just in its former dependence on the capitalist economy and the decadent culture of the United States, but also in its moral behaviors as well (Bejel, 2001). Indeed, Che Guevara himself was noted for expressing homophobic attitudes and viewing homosexuals as having no value for the purposes of the Revolution (Lumsden, 1996). The popular ideology dominating the cultural imagination of Cuba at the beginning of the Revolution claimed that homosexuality was a sickness, an “antisocial behavior,” and a counterrevolutionary defect left over from the excesses of American cultural decadence (Bejel, 2001). As Green (2001) has been careful to point out, the creation of machismo has roots that arose well before the start of the Revolution: “The conflation of virility, masculinity, military prowess, and anti-imperialist fervor embedded in the struggle for Cuban independence in the late nineteenth century found continuity in the guerilla ethos of Che,” (p. 651).

The dominant cultural ideology of machismo, as a form of both patriarchy and homophobia, began to be enacted by government policymakers into discriminatory laws in the early to mid-1960s. Homosexuals and other marginalized groups were to experience the first government-sanctioned police raid in 1961 when a mass of “pederasts, prostitutes, and pimps” were rounded up and arrested in the Colón neighborhood of Havana (Lumsden, 1996, p. 58). In 1965, institutionalized discrimination, and specifically institutionalized homophobia, would reach a new radical level with the creation of the UMAP (Military Units to Aid Production) work camps where members of society, many of them religious and gay, would be sent to be “rehabilitated” and transformed into proper revolutionary subjects (Bejel, 2001). Finally, the First Congress on Culture and Education held in Cuba in 1971 would officially define homosexuality as an “antisocial behavior” in need of rehabilitation and regulation by the new State (Green, 2001).

Furthermore, evidence of the effects of such discriminatory policies was reflected in the fact that basically only heterosexual men held positions of power in Cuban society during the Revolution. The Cuban Federation of Women (FMC) was the only women’s organization providing a space to talk about gender in Cuban society, although it has been pointed out that the ideology and political position of the organization regarding gender discrimination in social institutions was severely limited by the imperative to show alliance with the Party (Molyneux, 2000). Also, the only women in positions of power after 1959 had offices, roles, and duties “that befitted traditional expectations of women” (Lumsden, 1996, p. 60), such as secretaries and aids to their male superiors. In addition, following the 1971 Congress on Culture and Education, those officially identified as homosexuals by the State would be barred from employment in “any institution that had an influence on youth” as well as being denied jobs representing the nation abroad for fear of the “dangers of social contact” with the sickness of homosexuality (Lumsden, 1996, p. 73).

The official regulation of gender and sexuality in the nationalist project of the Revolution had to be accomplished through a number of contradictory discourses. Women could only play a minor role supporting the men who would fight for the Revolution. Gays and other marginalized groups had to either be rehabilitated and reformed to meet the conventions of the revolutionary “new man” or otherwise be expelled from the nation altogether. According to Bejel (2000), “the modern Cuban homophobic discourse emerged based on ideological precepts which saw the ‘homosexual’ as a body that endangered the body of the nation,” (p. 157). The irony of this obsessive attempt to regulate bodies and practices through machista cultural norms is that it inextricably linked “homosexual” identity with “national” identity: “so-called ‘national identity’ is determined to a large extent as a function of what it is not,” (Bejel, 2000, p. 155). With this background, the viewer can begin to contextualize and better understand the underlying ideologies built into the cinematic representations of Strawberry and Chocolate. Again, Bejel (2000) is mindful of the fact that “the questioning of the relationship between heterosexuality and citizenship in Cuban society is manifest in cultural phenomena,” (p. 167) most notably found in the example of the film.

**Political and historical context: the “special period”**

Before examining the ideological messages in the film, a brief discussion of the political climate and historical context of Cuba during the early 1990s is necessary.
With the decline of the Soviet Union starting in 1989 and leading to its eventual collapse in 1991, Cuba entered into what Fidel Castro called the “special period in a time of peace,” marked by national economic crisis and great political change (Fitzgerald, 1994, p. 171). The sudden halt of foreign aid from the USSR coupled with the ongoing trade embargo from the United States called into question the very survival of the Cuban Revolution seemingly overnight. To give an idea of the profound effect the Soviet collapse had on Cuba’s economy in numerical terms: “between the period of 1989 and 1993, GDP declined 34.8%, consumption fell 30%, exports fell 78.9%, and imports fell 75.6% ... the ensuing food shortage decreased caloric intake by 38%.” (Benzing, 2005, p. 70).

Obviously, the hardship faced by Cuba in the years following the Soviet collapse tremendously affected the economy, but it also affected the culture, politics, and everyday lives of Cuban citizens as well. As far as film production goes, Strawberry and Chocolate was one of only two films produced in Cuba in 1993 due to the scarcity of resources available (Agosta and Keeton, 1994). In a country that had only officially decriminalized homosexuality a few years before the film’s release and had placed homosexuals and other “counterrevolutionaries” in work camps in the mid 60s (Lumsden, 1996, p. 66), the national success of Alea and Tabío’s collaboration seems to come as a surprise.

However, as the government had to make concessions to alleviate some of the economic blows suffered from the sudden halt of foreign aid from the former Soviet bloc (evidenced by the legalization of the US dollar in 1993, for example), it also had to make social, cultural, and ideological concessions as well. Among those were official recognition of the failure of the revolutionary State to confront inequalities based on race, gender, and sexuality (Molyneux, 2000). In order to maintain the survival of the revolutionary project, not only were economic changes necessary but also the value of racial minorities, women, and gays had to be recognized as part of a new multicultural era of Cuban history. The contributions of these marginalized groups were finally coming to the fore. In particular, Strawberry and Chocolate signaled a changing political climate and historical moment in which “a concession by the regime that its homophobic policies have been counterproductive,” (Lumsden, 1994, p. 194) served as a necessary response to the political and economic crisis brought on by the “special period.”

**The film in the national and international spotlight**

Strawberry and Chocolate was hugely successful upon its Cuban debut in 1993 and its international release in the following year. It was nominated for an Oscar for Best Foreign Language Film in 1995, after being popularized by Robert Redford in the Sundance Film Festival. It also received several other awards from international film festivals including Berlin’s Silver Bear Award, a Goya Award in Spain, and a near sweep of awards at the Havana Film Festival in 1993 (see International Movie Database; and also Agosta and Keeton, 1994). According to Agosta and Keeton (1994), the film, co-directed by one of Cuba’s “most accomplished and esteemed film directors,” not only gained national and international success, but also it became a “part of the growing critical debate about what it means to be Cuban in the context of the Revolution.” (p. 7). Indeed, the critical acclaim that the film garnered in the nation led one Cuban critic to claim that “Fresa y chocolate is the answer of the Revolution to the crisis,” (p. 7). Reviews in American newspapers hailed its release as a signal of a new era of greater “tolerance” and “understanding” of sexual minorities in the communist State (see for example Wise, 1995, p. H26; and West, 1995, pp. 16-21). In spite of all of the media hype over the new “gay Cuban film” that delighted liberal audiences all over the world, Gutiérrez Alea and Tabío insisted in interviews that “the central theme of their film is tolerance and that the gay subtheme is merely a convenient illustration of that question” (West, 1995, p. 16, emphasis added).

**Contradictory messages: gender, sexuality, and national identity**

The film depicts the lives of two men, Diego (Jorge Perugorria) and David (Vladimir Cruz), in the year before the infamous Mariel boatlifts carried hordes of exiles (many of them gay, of course) out of the Havana harbor in 1979 (Rich and Arguelles, 1985). Diego is faithfully devoted to ideals of prerevolutionary Cuban nationalism and Catholicism, evidenced by the iconic shrine he has constructed in his upscale apartment located in Havana’s famous Vedado district. But as a religious, gay Cuban artist, Diego is disillusioned with the repressiveness of the communist State and is thus critical of its attempt to squelch differences, whether ideological, artistic, or sexual.

In contrast, David is a young student in the university, militantly committed to the ideals of the Revolution. He provides evidence of his unquestioned loyalty to the State, flashing his membership card to La Juventud (the youth communist league, which officially barred gays) in the scene in which Diego flirts with him at the Coppellia ice cream parlor. Despite their opposing political commitments and differences of sexual preference, the two men become unexpected acquaintances by the film’s end, serving as the allegorical “terms of reconciliation” that the film offers as a cure to a
A closer examination of the characterization of Diego and David as mediated through the role of the film’s only substantial female presence, Nancy (Mirta Ibarra), reveals a sort of dialectical relationship that ultimately produces _cubanidad_, or a coherent cultural and national identity. First, Diego and David appear in the film as over-determined stereotypes on opposite ends of a polarized spectrum: the flamboyant _loca_ (pejorative term for a gay man) and the macho, atheist “new man” of the revolution. Nancy, on the other hand, acts as a sort of liaison between these two worlds: “the logic of editing repeatedly implies at once an equation of femininity and male homosexuality and a compulsive substitution of the latter by the former” (Smith, 1996, p. 89). In other words, the film questions Diego’s masculinity through the use of “exaggerate[d] stereotypically gay mannerisms,” (Agosta and Keeton, 1994, p. 7). Thus, Nancy, like Diego, represents a threat to the _machismo_ embedded in Cuban nationality (Lumsden, 1996) simply by virtue of her sex. And, at the same time, she also signifies a proper object of David’s desire, thus securing his heterosexual masculinity, his assertion of male power and virility, and by extension his authentic Cuban nationalism.

In this way, as Davies (1996) has suggested, the sexual relationship between David and Nancy becomes a metaphor for “historical trauma” (i.e., coming to terms with the “ugly” side of the Revolution and its current fragile state) and a “crisis in male subjectivity” (p. 179). David and Diego must be represented as binary, stereotyped opposites, as thesis and antithesis, in order for the synthesis of a heterosexual union between Nancy and David to flourish. This synthesis signifies a restored male subjectivity (he loses his virginity to Nancy, thus proving to himself and to the audience the security of his heterosexual identity) and is intended to be read as the reconciliation of Cuban national identity (Santí, 1998; and see also Birringer, 1996) — but a reconciliation that is precarious at best. Diego and Nancy threaten the dominance of both heterosexual masculinity and nationality with difference but, ultimately, David can incorporate them into his own sense of self as not only successfully straight but also legitimately Cuban.

However, what makes an analysis of _Strawberry and Chocolate_ so compelling is not that it perfectly represents David’s heterosexuality and Cuba’s reconciled nationality, but rather it is in the film’s inconsistencies and failures that one begins to find room for more queer readings and critical understandings of these categorical concepts. Although the film was praised both by Cuban and international audiences as a turning point, providing a space for more tolerant views toward sexual minorities in the nation (evidenced by articles in _The New York Times_ with titles such as “In Totalitarian Cuba, Ice Cream and Understanding”), a sociological analysis of the film as a cultural text leads one to ask a series of more critical questions about the political and social environment it reflects.

For example, what ideological framework underpins the discourse of liberation in terms such as “tolerance” and “understanding?” Or what does it mean for the directors to claim that the theme of gay discrimination in the Revolution serves as mere “convenient illustration?” What is being ignored or trivialized in such a claim? Furthermore, within the film’s narrative itself, what does the foreclosure of a possible homoerotic connection between the men signify? And what implications does Diego’s exile at the end of the film have for the possibility of ever reconciling sexual and national identity in Cuba?

The gaps in these questions and the unanswered issues they bring up constitute a nationality crisis, perhaps wrought by the “special period” of Soviet collapse in which the film was produced (Santí, 1998, p. 424), but also, and more importantly even, a crisis of gender and sexual identity that must be managed and regulated. The regulation of gender and sexuality through social norms provides the foundation for any national identity, even in a revolutionary State such as Cuba. These crises are what go unexamined in _Strawberry and Chocolate_ and what get glossed over in the directors’ references to overarching themes of liberal humanism and tolerance. As Bejel (2001) has pointed out, “[T]he film represses even as it illuminates some of the problematic aspects of the relationship between homosexuality and Cuban nationality,” (p. 160), which is to say that also the film stops short of an actual critique of the oppressive aspects of Cuban nationality: namely, patriarchy, heterosexism, and homophobia.

_Strawberry and Chocolate_ attempts to create strict binaries and is “driven by a conception of the mutual exclusivity of the categories of sexual desire” (Foster, 2003, p. 156), yet it never fully separates Diego from David, and it never satisfactorily discloses the possibility of a homoerotic bond. While Diego is exiled at the movie’s end, and the potential of occupying the seemingly contradictory identity of both gay _and_ Cuban becomes an insurmountable obstacle, the hope rests in the fact that the two identities are actually inseparably linked. In other words, by negation, “that which is marginal becomes central” (Bejel, 2001, p. xv) to the Cuban national consciousness. Indeed, the film inadvertently demonstrates that as “queer sexuality alludes to the larger question of the predicament of postcolonial nationalism, its literal place in the social and political order is of central importance as well.” (Leung, 2004, p. 159).

**Conclusion: a sociology of film?**

What would a sociology of film look like? What does
it mean to have sociological knowledge about the movies? ... Ultimately, sociological knowledge of film would surely mean a body of ‘true’ statements about the role of the institution in society, its effects, the organizational context within which it operates, the nature, attitudes, and preferences of its audience, and the interrelations between these and endless other factors. (Tudor, 1975, p. 15)

Because the aim of sociological inquiry is to explain and understand real-world phenomena, what can be gained from examining the fictional text of a film? After all, should the study of film not be left to those in the departments of humanities, English, or cultural studies? Because we live in an increasingly “cinematic society” (Denzin, 1995) flooded with a constant flow of media images, it becomes more and more difficult to separate the “real world” from its representation in film and other types of media. To continue to theoretically distinguish between the “real” or the “social” and its representation in the mass media, and to attempt to delineate appropriate arenas of sociological study from the other disciplines, would not only ignore important cultural shifts that have taken place within our contemporary society, but it would also severely bankrupt sociological theory itself. Much is to be gained from examining the implicit ideologies in film and the political, cultural, and historical contexts of the social environments they reflect.

The attempt of this paper has been to analyze sociologically Strawberry and Chocolate to demonstrate the complex way its contradictory messages on gender, sexuality, and nationalism reflect the political and historical crisis of the Revolution during Cuba’s “special period” in the early 1990s. Just as the economy of Cuba underwent changes faced with the collapse of its major political ally and financial supporter, in a parallel way the political environment of the Revolution changed in regard to marginalized groups in Cuban society. Such was the condition of existence for Strawberry and Chocolate and the international acclaim it received upon its release. In this way, the film provides a window through which the sociologist can explore the socio-political factors of Cuban nationalism, gender, and sexuality in the context of revolutionary discourses and economic crisis.

The challenge of a sociological analysis of the film must shift from uncovering its contradictory ideological stance to examining the real world effects of its ideology on the lives of Cuban citizens. One must keep in mind that “cinema, like other expressions of popular culture, is a crucial site where social and political discussions about the nation’s past, present, and future take place,” (Mora, 2006, p. 2). The aim of a sociology of cinema, as Tudor (1975) envisioned, then is not only to render the ideologies of sexuality, nationality, and identity represented on the screen visible, but also to present the viewers with an alternative way of constructing an identity free from the political baggage and dominant discourses of such ideologies.

Acknowledgements

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Works Cited


Publishing.


Abstract

The purpose of this review is to explore public policies that impact the health of American children and adolescents. The National School Lunch Program (NSLP) has a significant impact on school-age children’s nutritional intake. Foods provided by the NSLP have been analyzed for their nutritional content. Although these foods did not exceed the recommended total caloric intake, they were below other nutritional standards, and these shortcomings are primarily attributable to cultural preferences. Other important contributors to childhood obesity are unregulated school food items sold in vending machines. These items are becoming increasingly more prevalent in schools. Public policy is an appropriate method of curbing the growing incidence of childhood obesity, including the mandatory implementation of school wellness policies for all schools that participate in the NSLP. Many school districts have had success in implementing these programs, but implementation is difficult in low-income rural schools. The wellness programs with the greatest success have been those at the local level, such as the CATCH program in Texas and the Pathways program in American Indian communities. The federal government should be aggressive in creating more healthy school food environments, which might help reduce the prevalence of childhood obesity.
Introduction

Two of the main populations affected by obesity are children and adolescents. The CDC (Centers for Disease Control) reports that 16.3% of children in the U.S. are obese or in the 95th percentile of the current BMI (Body Mass Index) for age growth charts (CDC, 2009). Obesity during childhood can ultimately lead to obesity in adulthood, an important factor behind many health problems such as cardiovascular disease, type II diabetes, stroke, and many cancers. Most adults find it quite difficult to change their dietary and lifestyle habits late in life; if obesity can be prevented in childhood, so can many of the co-morbidities associated with obesity. Children and adolescents spend much of their time each day in school, and it is the food environment there that can be the most influential in their dietary choices.

The federal government funds the National School Lunch Program (NSLP), which is regulated by dietary guidelines established by the Department of Health and Human Services. However, these guidelines are over ten years old and, with the growing rates of childhood obesity, new regulations may be necessary to ensure that children are receiving nutritious meals. Other factors that contribute to school-age childhood obesity are vending machines, school fundraisers, and a la carte items, which have an immense impact on children’s food choices, and are not subject to any sort of dietary regulation. The federal government has mandated that by 2006 all schools that participate in the NSLP must have a school wellness program in place to begin to correct these nutrition and lifestyle risk factors.

National School Lunch Program

The National School Lunch Program is one of the three most utilized federal government food assistance programs, together with the Food Stamp Program and WIC (Women, Infants, and Children). It provides a nutritionally balanced, low-cost, or free lunch to children each school day in public and nonprofit private schools, based on the 1995 Dietary Guidelines for Americans. The program was established under the National School Lunch Act in 1946. However, there are now new dietary guidelines for Americans, established in 2005, and because childhood obesity rates have doubled and adolescent obesity rates have tripled in recent years, researchers have assessed the nutritional components of meals offered via the NSLP.

In Fall, 2003, Graves et al. (2008) analyzed the nutritional content of school lunches in four rural east Tennessee schools. Meals from the School Meals Initiative for Healthy Children, established in 1995, were also analyzed. These schools’ breakfast programs were assessed for their contribution to children’s daily intake of calories, fat, and fiber. Although the breakfasts did not exceed the recommended number of calories for school breakfasts, they did exceed the recommended percent of calories from fat and saturated fat by 13% and 5% respectively. The breakfasts also did not meet the recommended fiber requirements for a school breakfast meal. Biscuits, gravy, sausage, orange juice, and 2% milk were the most often served menu items, most of which are high in fat. The researchers proposed that these menu choices were culturally significant and accepted, and it would be difficult to find healthier alternatives to these menu choices without completely replacing them. Replacement of these menu items would require changes in the diet patterns of this rural Appalachian culture, but what better place to start than with the schoolchildren who are not yet so culturally set in their ways?

School Food Environment

Schools in other locations may be able to better meet guidelines set for school lunches and breakfasts, but there are other food items offered in school that are not subject to any sort of nutrition regulations. These items include snacks sold in vending machines, food sold through school fundraisers, and other a la carte items. These food options can greatly influence the nutrition of schoolchildren due to the amount of time each day they spend in school as well as the great percentage of their daily food intake being consumed at school.

The association between soft drink availability in schools and overall soft drink consumption for elementary school children in the United States was recently analyzed. Almost 40% of elementary schools offered soft drinks and, for children who consumed soft drinks, half of their soft drink consumption took place at school. The researchers suggested that voluntary sales restrictions could be effective in decreasing soft drink consumption of schoolchildren and an agreement has been reached between the Alliance for a Healthier Generation and the American Beverage Association, Cadbury, Coca-Cola, and PepsiCo that stipulates that by the beginning of the 2009-2010 school year, no soft drinks will be available during school hours in public elementary schools (Fernandes, 2008). This agreement is part of a new policy known as the National School Beverage Guidelines, which has taken roughly three years to implement.

School food policies and practices, availability of competitive foods, the presence of school wellness policies, and the content of offered school lunches were analyzed in a nationally representative population of schools by Finklestein et al. (2008). Seventeen factors were used to characterize these school environments as unhealthy or healthy. There were significant decreases in school food environment scores going from elementary to high schools, most probably linked
development of the school wellness policy (USDA board, school administrators, and the public in the representatives of the school food authority, the school wellness policy; and involve parents, students, and a plan for measuring implementation of the local be less restrictive than those of the NSLP; establish guidelines for reimbursable school meals shall not foods available during the school day; assure that nutrition education, physical activity, and other school-educational agency participating in the NSLP to establish a local school wellness policy by the 2006 school year.

These wellness policies must include goals for nutrition education, physical activity, and other school-based activities; include nutrition guidelines for all foods available during the school day; assure that guidelines for reimbursable school meals shall not be less restrictive than those of the NSLP; establish a plan for measuring implementation of the local wellness policy; and involve parents, students, and representatives of the school food authority, the school board, school administrators, and the public in the development of the school wellness policy (USDA, 2004).

**Local School Wellness Policies**

The local wellness policies established by Pennsylvania public schools in response to this legislation were analyzed in 2007. Researchers completed policy checklists at Pennsylvania public school districts that sponsored school meal programs, and found 100% of those districts to have a wellness policy in place aimed at reducing childhood obesity. The Pennsylvania school board provided an optional template for each of their school districts to aid them in establishing a wellness policy that met each of the policy mandate requirements set by the legislation. Almost all school districts (85.6%) met all of these requirements (Probart et al., 2008). It is evident that this federal policy has been effective in causing policy change on a local level, but it remains to be seen whether or not these wellness policies will effectively curb the growing childhood obesity problem.

Schools in lower-income and rural areas often have difficulty in meeting the suggested school nutrition and physical activity mandates of the legislated wellness policy. Middle and high school principals in Utah were surveyed via the 2006 School Health Profiles. School wellness policies differed based on enrollment in the free or reduced-price lunch program (economic circumstances) or on geographic location (rural vs. urban). Utah school districts with the highest percentage of free and reduced-price lunch participants, as well as rural school districts, offered fewer healthful food choices from vending machines and school stores, in addition to many other inconsistencies from the prescribed school wellness policies. The school policy improvements in these socioeconomically disadvantaged areas are of particular concern because no funding has been provided to implement or evaluate the USDA School Wellness initiative in these underprivileged areas (Nanney, Bonner, and Friedrichs, 2008).

The USDA wellness policy implementation is one of the most recent government efforts toward reducing the childhood obesity problem in the United States. There have, however, been several other local efforts prior to the initiative by the USDA. The CATCH (Coordinated Approach to Child Health) Program has been implemented in school districts in 24 states nationwide to help children achieve good health for their entire lifetimes. The CATCH program, funded by the CDC, combines health education, health promotion by staff, health and nutrition services, health counseling, physical education, a healthful school environment, and family and community involvement to promote child health.

The influence of a program such as this is dependent upon efficacy and the extent to which the program reaches its target audience. By surveying the foodservice administrators, all elementary schools in Texas that had employed the CATCH program were analyzed to examine the adoption and implementation of the program. This coordinated school health program had been successfully implemented in the participating schools; all schools surveyed had implemented an average of 80.44% of the guidelines. Another Texas based initiative is the legislation passed by the Texas state senate requiring all school districts in the state to implement an elementary school coordinated school health program that includes health education, physical education, nutrition services, and parental involvement by September 1, 2007 (McCullem-Gomez et al., 2006).

A program implemented on an even smaller scale for a vulnerable population is the Pathways program, an obesity prevention program for Native American schoolchildren involving seven tribes in Arizona, South Dakota, Utah, and New Mexico. This project was funded by the National Heart, Lung, and Blood Institute in response to recognition of the alarming rates of obesity, heart disease, and diabetes among Native Americans. The overall focus of the program and supporting materials were designed to prevent childhood obesity through a classroom curriculum, a family component, a food service component, and a physical activity component, much like the other wellness initiatives now employed nationwide (Center for Health Promotion and Disease Prevention, n.d.).

**Conclusion**

The National School Lunch Program was created to address nutritional needs of children and adolescents, but in today’s world, in which competitive foods and sedentary lifestyles are prevalent, other measures must be taken to combat childhood obesity. One of the most apparent changes that should be made is for the NSLP
to attempt to maintain nutritional guidelines that are current with the latest research and recommendations. The federal government has also required all school districts nationwide that participate in the NSLP to create wellness programs. Many schools are in compliance with this mandate although schools with vulnerable populations, such as rural and poverty-stricken areas, have had a harder time complying, because no funding has been provided to implement or evaluate a school wellness program in these underprivileged areas. It may take the application of a more population-specific program to combat the cultural and economic barriers present in these communities, such as the Pathways and CATCH programs already employed in other parts of the country.

References


A fresh graduate of the Anthropology department with a minor in Russian and Eastern Studies, I spent the last four years toiling as both a scholarship athlete on the Women’s Soccer team and a recipient of UK’s National Excellence Scholarship. This past summer I embarked on my first journey to Russia as a recipient of the US Department of State Critical Language Scholarship to live and study in Nizhny Novgorod. January marked my second trip to Russia on a scholarship from the American Friends of Russian Folklore in combination with a travel and research grant from eUreKa! Resulting from this fieldwork were a slew of ever-changing papers, which I presented in gradually improving order at the Indiana University and Ohio State University Folklore Conference, National Conference of Undergraduate Research in La Crosse, Wisconsin, UK’s Showcase of Undergraduate Scholars, the Undergraduate Research Council’s AAFC Annual Convention in Knoxville, Tennessee with support from eUreKa!’s travel and research funds, and a pending exhibit at the American Folklore Society’s Annual Conference in Boise, Idaho, this coming October.

This summer was spent on the Yucatan Peninsula of Mexico, participating in an archaeological survey with UK Anthropology Professor Scott Hutson. Following this six week delight, I have secured a post teaching English this coming fall in Seoul, South Korea, with the Seoul Metropolitan Board of Education. Meanwhile, I plan to continually rework my article, submitting it to both the American Folklore Society and Western States Folklore Society for, hopefully, publication. On a whim, I hope to submit my original research idea (which was ingeniously reduced to manageable size by my wonderful mentor Professor Rouhier-Willoughby) to an up-and-coming independent publisher as a potential book. Eventually, I will return to Russia, endless tea, the beautiful language and people, and daily vodka toasts to life, good friends, and health.

1. За лесом солнце воссияло, 
Там черный ворон прокричал, 
Прошли часы мои минуты, 
Когда с девчонкой я гулял, 
Прошли часы мои минуты, 
Когда с девчонкой я гулял,

2. Бывало, кончу я работу - 
Спешу на улицу гулять, 
Теперь мне служба предстоял 
Спешу я коника седлать! 
Теперь мне служба предстоял 
Спешу я коника седлать!

3. Седлаю я коня гнедого 
Казачьим убраным седлом 
Я сяду, сяду и поеду, 
Поеду в дальний край далек, 
Я сяду, сяду и поеду,

Faculty Mentor: Professor Jeanmarie Rouhier-Willoughby
Division of Russian and Eastern Studies, 
Department of Modern and Classical Languages

Rachel Ulrich’s article represents the result of research performed in the field in Russia in the winter of 2008-09. She was able to travel to Cossack villages under the auspices of an expedition led by two folklorists from the Institute of World Literature to collect the songs and dances of these people. During the course of this research trip, she began her investigation of the Cossack myth within Russian culture. Her work has hit upon one of the key tropes in Russian cultural history and anthropology: the disconnectedness between the state’s vision of national and cultural identity and that of Russia’s own people. She has produced a work that features an astute analysis of the dilemma faced by the Cossacks within Russia. Historically, the government, most recently Putin’s administration, has appropriated them to be symbols of Russian nationalism. Yet they are residents of villages in economic crisis, who are coping with the abandonment of Soviet-era government support systems, and struggling to find their place post-Soviet society as Cossacks. Ulrich’s nuanced study brings to bear Cossack discourse, folklore, and history to these contradictory strains of Cossack life and Russian society.
Power and Pride: The Mythologization of the Cossack Figure in Russian History and Its Impact on Modern Russian National Identity

Abstract
Our expedition traveled to the Don Cossack Ust-Khopiorskaia Stanitsa to record mythologized cultural practices in the form of rituals and performances. Located on the banks of the Don and Khopior River junction, about 1,500 people reside in a village consisting of several streets of wooden and stone houses, a cultural center, a school, and a few small markets. Most remaining residents in the village are pensioners, who support their meager incomes with backyard gardens. The young who have finished primary school leave for the nearest city, Volgograd, to find work or pursue further studies, because opportunities for neither exist in the village.

Yelena Viktorovna Minyonok, our expedition leader, is a renowned Russian folklorist and chief curator of archives at the Institute of World Literature in Moscow. In an effort to preserve dying traditions, we tracked down members of the old village choir and recorded quintessential songs in the traditional Cossack repertoire. Through participant observation and informant interviews, we investigated the role Cossack mythology plays in dictating how Cossacks see themselves and how others view them, exploring the perceptual transformation of Cossack culture through time.

Cossacks Today
This past January I travelled to the remote Russian village of Ust-Khopiorskaia Stanitsa in the Volgograd province. The village, named after its position on the banks of the intersecting Don and Khopior Rivers, is home to about 1,500 people. It encompasses several streets of wooden and stone houses, a cultural center, a school, and a few small markets. Not three kilometers away stands a much smaller village known as Riibhni Hopeyor with a population of about 100, considered an annex of the larger village. (A stanitsa is a village defined by the presence of a church, while a hopeyor lacks a church. More than one hopeyor may surround a stanitsa; they are often smaller both in population and physical size. Although each village appointed an Ataman, or village chief, most primary and secondary school-aged children of Riibhni Hopeyor were sent to Ust-Khopiorskaia Stanitsa to attend school, demonstrating the affiliation between the two villages.)

Our team of eight members lived with two residents of Ust-Khopiorskaia Stanitsa for two weeks — both were retired, widowed women in their late sixties. Most remaining residents in the village are elderly pensioners who support their meager incomes with backyard gardens and a few small farm animals. Young people who have finished secondary school leave for the nearest city, Volgograd, to find work or pursue further studies, as opportunities for neither exist in the village. Russia is experiencing a simultaneous mass urban migration and gradual population decline of one million each year and, as a result, villages such as Ust-Khopiorskaia Stanitsa are slowly disappearing.

Our expedition leader, Yelena Viktorovna Minyonok, is a renowned Russian folklorist and chief curator of archives at the Institute of World Literature in Moscow. For the past twenty years she has scoured the Russian countryside, documenting all elements of folklore in an effort to preserve dying traditions. Her most recent expeditions have concentrated on the Cossack villages along the Don River, our stop at the famous Ust-Khopiorskaia Stanitsa being the most recent of her trips in this region.

Collaborating with our team was Andrei Sergeievich Kabanov of the Moscow Conservatory and two of his graduate students. Andrei Sergeievich has travelled the Russian countryside for almost forty years, recording over 10,000 folksongs. His expertise in this area is almost unparalleled; over the course of his career he has often recorded at one village numerous times at different intervals, allowing him to observe first-hand the change underway in Russian folk tradition. He had been to our particular village in the sixties and eighties to document folksongs, and is considered the premier scholar on the subject in Russia. In the seventies, he started his own children’s choir in Moscow, using many folksongs, particularly traditional Cossack songs, in his repertoire.

Like most ethnographical fieldwork, the majority of our time was spent developing rapport with the villagers — in essence, consuming vast amounts of tea, vodka and zakuski, or snacks, to accompany the beverages. In an effort to document the traditional Cossack song repertoire, our primary goal lay in enticing former members of the
Beyond the Forest the Sun Shines
(Lyrics translated by Rachel Ulrich from the transcription by Yelena Viktorovna Minyonok, with the assistance of Professor Edward Lee, Russian and Eastern Studies program, University of Kentucky)

1. Beyond the forest the sun shines
There a black raven caws
The hours, my time has passed
When I walked with a young girl
The hours, my time has passed
When I walked with a young girl

2. I used to hurriedly finish working —
Only to meander outside
Now my fate awaits me
Hurriedly I mount the saddle!
Now my fate awaits me
Hurriedly I mount the saddle!

3. I mount the chestnut mare
Upon a Cossack’s decorated saddle
I’m sitting, waiting to set off
Off to a distant, faraway land
I’m sitting, waiting to set off
Off to a distant, faraway land

4. And if suddenly a stray bullet
Kills me from behind a bush
And if a saber, a mighty-wielded saber
Cuts through my skull
And if a saber, a mighty-wielded saber
Cuts through my skull

5. And hot blood pours over me
Flowing like a rapid stream
And my heart, my heart gives its last shudder
Oh, and I am never to return to my native land
And my heart, my heart gives its last shudder
Oh, and I am never to return to my native land

6. Farewell forever, mountains and valleys
Goodbye, village of my birth
Goodbye, my young woman
Goodbye, sky-blue flower
Goodbye, my young woman
Goodbye, sky-blue flower
In this song, the Cossack man must mount
Approaching Ust-Khopiorskaya from the icy banks of the Don River. At one time the village was situated on the opposite shore, until Peter the Great ordered the people to relocate across the river. Waiting until winter, they simply slid their houses over the frozen solid river and picked up where they left off.

Enduring practicality: In a land where the ground is covered in snow for three or four months, a homemade sleigh can be just as efficient as a car.
A member of the original Ust-Khopiorskaya choir listens to a recording of herself for the first time ever. Unfortunately, this may also constitute the last recording of these cultural treasures as urban migration and a declining birth rate slowly eradicate Russian folklife.

According to village custom, the two-week period of Svyatki beginning after the New Year is the most festive. Here we observe old-style Christmas (January 7) by waking before dawn to travel from house to house caroling in return for sweets.

Sometimes language isn’t necessary.
Russian winter freezes everything but gossip: The Ataman considers making a phone call, but no technology can surpass the speed of whispering neighbors. Especially when the news is that the first foreign visitors in seventy years have just arrived in the village of Ust-Khopiorskaya.

Our hostess, Zadaiena Nikolaevna, an embodiment of Russian spirit: unperturbed by hardship and never lacking an appropriately crass comment.
At 30 degrees below zero, a freezer isn’t necessary. Our hostess kept her fish in the first of a series of small rooms designed to trap the penetrating cold.

Rubber boots aren’t fit for a Russian winter, but why sit idle half the year? This pair busily points the way to the outhouse.
his horse and embark on a raid in a distant land. The contrast between his old life of idle freedom and the new destiny that awaits him as a member of the Cossack cavalry is deliberate. By accepting his responsibilities as a member of the group, he is identified as a man, and sits upon a kazachii ybraynii sedlo, or a saddle that has been decorated with the booty of previous raids and pillages, symbolizing the honor of a Cossack warrior. The possibility of death is described in detail and glorifies the brutality of war. The sword that kills him is honored with an ascribed name (shashka likhodeika), invoking the idea that any sword which could take down an invincible Cossack warrior must be legendary in its own right.

Over time, Cossacks have become mythologized as military heroes and defenders of the Motherland, alluded to in literature as rabble-rousers and often serving as the ideal masculine protagonist. Originally, however, the Cossacks weren’t an ethnic group, but rather a hodge-podge band of the socially marginalized — those who “had run away from the political, military, economic, and penal systems of Polish Ukraine or Muscovy to live on what they hoped would be the freer frontier” (Kornblatt, 1992, p. 7). Several factions of Cossacks existed, all of whom developed military prowess to defend themselves against raids, and adopted a nomadic lifestyle to avoid omnipresent enemies. Living in a constant state of “military preparedness,” Cossacks were unable to garner subsistence through agricultural means, and instead depended on “fishing, hunting, some herding, but mostly pillage” (Kornblatt, 1992, p. 7). Cossack men were responsible for providing for their clan through raiding and pillage, living with their wives for only part of the year and leaving the moment duty called, embarking on raids and engaging in border skirmishes.

In this fashion, Cossack culture developed around male activities — folksongs of the Cossack repertoire, traditional Cossack dancing, and the mythologized Cossack images are mainly associated with images of horse-riding, raiding, masculine displays of aggression, bravery on the battlefield, and the glorified warrior. Despite the fact that Cossacks were later employed by the tsar to defend Russia’s borderlands, and eventually practiced subsistence agriculture (both evils by which the original Cossack ancestors swore to never be hindered), the image of the Cossack man is frozen in time and has become larger than reality. Indeed, the Cossack man was further mythologized through the nineteenth and twentieth century in Russian literature, and this image of Cossacks has become well-known internationally.

Since the collapse of the Soviet Union in 1991, the Cossack image has swollen far beyond its historical origins and become recognized as synonymous with the strength of Russia — politically, militarily and economically. As former Soviet bloc countries fragmented and communist party ideology that had once served to unite vast amounts of space and diversity became obsolete, the search for national identity again took center stage. After struggling through repeated economic failures and the disastrous Yeltsin administration, Russia’s desperate need for guidance and reassurance came in the form of President Vladimir Putin. After his inauguration in 2000, Putin wasted no time in promulgating Russia’s revitalization as a world power.

Shortly after coming to power, then-President Putin began systematically invoking the image of a strong and united Russia, both economically and militarily. By “positioning himself as the symbol of a resurgent nation recovering from years of humiliation and weakness” (Ostrovsky, 2008, p. 4), President Putin propelled Russia onto the international plane through competition, “asserting that Russia has regained its status of a ‘mighty economic power’” and promising to “achieve economic and social development which befits a ‘leading world power of the 21st century’” (Ostrovsky, 2008 p. 6). Much reminiscent of Stalin’s five-year industrial plans in the infancy of the USSR, Putin has pushed industrial development, often at the expense of the common people: “Russia is building pipelines to Europe, but much of its own country has no gas or even plumbing. Russia’s ‘great leaps forward’ have rarely benefited its own people, who have traditionally been seen as a resource. Most Russians grumble about their lives, but see ‘international prestige’ as a consolation prize” (Ostrovsky, 2008 p. 6).

The international image of Russia is more important than their quality of life for Russians themselves. Perhaps this perception is because those at the top of Putin’s bureaucracy continue to grow outrageously rich through Russia’s traditional corrupt top-down hierarchy while “the average Russian earns a mere $700 a month” (Ostrovsky, 2008 p. 6).

Despite dismal conditions for the majority of citizens, governmental corruption, and bureaucratic hierarchy, nationalism amongst Russians persists. Putin and his predecessors throughout centuries of Russian history have exploited this inherent nationalism of the Russian peoples. In May of 2008, Putin revived the Soviet-era practice of parading large weaponry during the annual May Day celebration. For the first time in seventeen years, 6,000 marching soldiers, tanks, and rockets — including the new intercontinental ballistic missile — were displayed throughout the streets of Moscow and other major cities across Russia (Harding, 2008). This isn’t the first time that Putin has invoked Soviet-era militaristic symbols to create a new Russian image of strength and unity. As Nikolay Petrov of the Carnegie Center in Moscow stated, “It’s an ideological concept. The point is to show that Russia was great before the revolution, was great during Soviet times, and to say we are restoring its greatness” (Harding, 2008).

Not coincidentally, the resurgence of these militaristic parades coincided with President Dmitry Medvedev’s election and Putin’s inauguration as Prime Minister. As the Eurasia Daily Monitor noted, “A public display of Russian armor and nuclear might is clearly a grand way to welcome Medvedev and to commend Putin” (Felgenhauer, 2008). Putin is symbolically passing down his legacy of militaristic and economic dominance, and promising the international community the same type of powerful reign in Russia’s next phase, with Medvedev as President.
To consolidate this new phase of Russian identity, Putin has masterminded the adoption of Cossack traditions and rituals as Russian national identity. Through systematic revivals of Cossack singing troupes and various staged heritage celebrations, the Kremlin has associated overtly masculine Cossack culture with the idea of Russia as a force to be reckoned with — militarily inclined, united, and nationalized. This borrowing of cultural symbols for nationalistic purposes is possible due to the fact that the Cossack embodies a fluid identity, relatable even to those lacking traceable Cossack ancestry (Kornblatt, 1992, p. 15). In Russia, a country constituting one eighth of the earth’s inhabitable land mass and comprised of over 160 ethno-linguistic groups, the establishment of national identity is of paramount importance, and a matter over which internal strife has persisted for centuries. Cossack identity and the search for Russian national origins became integrated through the rediscovery of The History of the Russes or Little Russia, which “renders an idealized history of the Cossacks and is united with the history of all of Russia” (Kornblatt, 1992, p. 25). In it, Cossacks are depicted as “freedom fighters, organically and historically united to Russia and related in some way to the origins of the Russian people as mythic heroes” (Kornblatt, 1992, p. 26). The establishment of national origin as synonymous with Cossack origin was later combined with the idea of Cossacks as morally ambiguous mythological figures in literature. Because Cossacks were originally nomads, raiding and pillaging the steppe, free from the ties of land and master, they became “associated with barrierlessness” and therefore “the Cossack hero could easily absorb negative traits connected with him” (Kornblatt, 1992, p. 15). Lack of geographical boundaries translated into a lack of character trait polarization, or the inability to define the Cossack through binary opposites. Representing an idealized whole, the Cossack is able to provide one plausible solution to the long-standing identity crisis within Russian culture that cooperates seamlessly with Putin and Medvedev’s political agenda.

However, this idea of acceptance and identity with Cossack culture has failed to pervade the everyday lives of Russian citizens, and the Cossacks themselves continue to suffer from economic hardships and marginalization. Just as the rest of the country functions in a top-down, hierarchical manner, folklore itself has been transformed from an artistic expression inextricable with everyday life to a symbol of the power of intellectuals from urban epicenters over those remaining in ‘backward’ villages and ways of life. I was able to view this reallocation of power first-hand during our recording sessions in Ust-Khopiorskaia Stanitsa.

During the sessions, Andrei Sergeievich was the uncontested leader — directing his students in setting up the recording equipment and coaching the villagers in the correct way to sing traditional songs, changing the combination of people, who sat where, what lyrics were correct, and the timbre and pitch of various singers’ voices. In one instance a particularly low bass, a former member of the renowned 1970s choir originating from our village, was only allowed to record individually because he decided that the man’s pitch was too low and did not mix well with the women’s descant portion. (Traditionally, Cossack songs are performed by all-male choirs — even the higher descant portion — but due to numerous wars and the premature death of many male villagers, women began to fill in descant portions. Now it is very rare to find a male villager with the ability to sing descant.) In another instance, Andrei Sergeievich asked the village Ataman, the traditional public figurehead of the Don Cossacks and an esteemed member of the community, to sit farther away from the microphone because he did not know the words well enough. (This Ataman position was established during the formation of Cossack groups in the fifteenth and sixteenth centuries. Today the position is retained mostly as a public figurehead, because much of the associated power has been lost. The Don Cossacks refer to their chief as an Ataman, while the Dnieper Cossacks use the term Hetman.)

To an American anthropologist, the way in which Andrei Sergeievich conducted the recording sessions might provoke confusion and even anger. Concerning his methodology, Professor Minyonok contends that the villagers simply loved working with Andrei Sergeievich — they respected his abilities and trusted his judgment. Some even proclaimed that they felt they had ‘returned to their youth’ after working with such a master. When Andrei Sergeievich was queried as to why he wouldn’t record the villagers without prior coaching, he replied that to have travelled such a long way to record a ruined tradition would have been a waste of time. The way the villagers sang before Andrei Sergeievich taught them the ‘correct’ way was a ruined tradition, and Andrei Sergeievich felt he was in a unique position, having recorded this village at intervals both forty and twenty years prior to the present date, to know exactly what the songs should sound like. Throughout the trip, Andrei Sergeievich and his two students sang traditional songs aloud themselves for the various villagers we met, at times asking villagers to join in even if they weren’t sure of the words themselves.

My own experience and very similar experiences detailed by ethnographers conducting fieldwork in Russian villages (Olson 2004, pp. 207-218) suggested to me the hierarchical way in which information is interpreted in Russia. Both intellectuals from Moscow and the villagers themselves accepted folksongs as a bounded, frozen entity, able to be performed ‘correctly’ in only one way. For example, during Soviet times, brigades of urban intellectuals were sent to the villages to educate the villagers in Western ways and to promote ‘progress’ (Riasanovsky and Steinberg 2005, p. 568). The same ideologies and methodologies were employed in the way intellectuals from the Moscow Conservatory, interacted with villagers concerning their own traditions. Village traditions and folklore are no longer associated with the village — they cannot be considered folklore because folklore is seamlessly
intertwined in everyday life, often richest when life is most difficult, and never set on a stage or viewed as a performance. Cossack songs as performed by ensembles in Moscow, such as the children’s choir headed by Andrei Sergeievich, are a form of high art — a mark of prestige, intellect, and power. In this sense, Cossack people have lost the power to control their own identity.

Cossack folklore ensembles and the perpetuation of Cossack identity add to this fabricated image at a cultural level, perpetuating the idea that Russia will not hesitate to defend its borders using military force, just as Cossack nomads developed a reputation as warriors and skilled horsemen while protecting Russia’s borders during the tsarist era. Meanwhile, modern Cossack villagers continue to be marginalized even as Russia has adopted Cossack dress, songs, and traditions as national identity. Many live off pensions of less than 200 dollars a month, eking out a living from individual backyard gardens. Monopolized farming conditions alienate many small farmers from their ability to sustain themselves and their families from their own land.

While we were visiting Ribhnii Hopeyor, the villagers and Ataman spoke openly concerning economic difficulties. The Ataman described his difficulties as chief of his village, because he earned no wages for these responsibilities, and was forced to run a taxi business on the side, employing fifteen drivers and using twenty-year-old vans. All of the men agreed that this situation was due to the onset of capitalism and economic corruption. A few years earlier there had been five smaller private farms on which the men had worked, but a larger farm absorbed all the failing smaller farms. Villagers could no longer keep animals and simultaneously make profit, but instead were forced to grow grain exclusively. The Russian government has refused to allow NGOs (non-governmental organizations) to assist villages such as Ust-Khopiarskaia Stanitsa in establishing economic foundations.

Despite economic dislocation, lack of government assistance, and intense pride in their own culture, Cossacks in Ust-Khopiarskaia Stanitsa and Ribhnii Hopeyor have a great deal of pride and love for Russia. In the tiny schoolhouse of Ribhnii Hopeyor, an entire room is devoted to the Battle of Stalingrad, a nine-month long battle in which the Russians withstood German advances during World War II. Many of the poems the villagers recited were of their own creation and dealt with heroic Cossack deeds in battle, the valor of the battlefield, and village pride in Cossack military prowess. During poetry recitations, some villagers would be so overwhelmed with emotion — cracking voices and welling eyes — that they were unable to finish the poems.

One elderly village man — a pensioner — lamented how the villagers had migrated to the city in search of work in a struggling economy, he found himself useless in a city — holding up his hands and shaking them, he proclaimed that a man needed something to do with his hands, something to keep himself busy and productive. His government looked upon pensioners as useless citizens, despite years of dedicated service and fierce pride in their country. Today he lives on 200 dollars a month and maintains a small garden for sustenance. While the Moscow Kremlin has adopted this Cossack man’s history, culture, and legacy as Russian national identity, he is economically marginalized and forgotten, as the country marches on. He holds onto the promise of progress while his country maintains a unique position of cultural dissonance toward his village and traditions — simultaneously berated for their backward image and praised for their embodiment of true Russia.

Acknowledgements

I would like to thank the following people and institutions: Yelena Viktorovna Minyonok and the American Friends of Russian Folklore for working tirelessly to bridge cultural gaps and preserve dying Russian traditions; my faculty mentor, Professor Rouhierr-Willoughby, for countless editing rounds; Evie Russell and eUreKa! for relentless efforts to provide me with invaluable and life-altering research opportunities; Professor Koch of the Anthropology department and Professor Lee, Professor Ruder, and Professor Petrone of the Department of Modern and Classical Languages for intellectual stimulation, advice, and support; Professor Udvardy, Director of the International Studies Program, for graciously allowing this chaotic independent study to count for actual college credit; and, most importantly, Mom and Dad for packing my bags and seeing me off at the airport, although neither one really knew to where they had bid me goodbye.

Works Cited


I am a Senior working on a B.S. in Biology. I am Executive Vice-President of the National Society of Collegiate Scholars (2008-2009) and an AMSTEMM Research Fellow. Also, I have received a eUreKa! Research Grant.

My future plans are to attend medical school. This submission relates closely to my future plans because I am highly interested in neuroscience, gerontology, and how Alzheimer’s disease (AD) significantly affects the character of the person who is diagnosed with it. I am intrigued by this disease’s power to radically change a person’s life. Not only does Alzheimer’s disease cause severe memory loss, this disease also causes the ruthless diminishment of cognitive thinking skills. Some people who have late-onset AD (LAD) lose the ability to perform simple, daily tasks normal people take for granted, such as the ability to speak or to remember one’s own name.

By working with Dr. Butterfield, I have gained much insight and knowledge regarding AD. I was privileged to work with Dr. Butterfield’s research group, considering that I had no prior research laboratory experience. Dr. Butterfield mentored me through this research of AD for over a year, and he has given me great advice on not only school-related subjects, but also on life in general. He is someone to whom I can go for advice on applications to graduate school, on study questions in biology, chemistry, and biochemistry, and on what I should do to make myself a stronger student inside and outside the classroom. I am honored that someone as prestigious as Dr. Butterfield was able to give me a hands-on experience in science. In addition, I have gained many friends. All of the graduate students, post-doctorates, and research associates always offer a lending hand, and no is ever excluded.

My most important extracurricular activities are volunteering at St. Joseph Hospital, summer clinical experiences with physicians from Harlan Appalachian Regional Healthcare Hospital, playing the piano, exercising (which is extremely important in the prevention of Alzheimer’s disease), cooking, and baking.

This work has been presented at the Kentucky Academy of Science, the AMSTEMM Research Colloquium, the National Conference on Undergraduate Research (NCUR), and the UK Showcase of Undergraduate Scholars. This research work will be combined with the work of Dr. Sultana and plans for submission for publication in a professional journal are underway.

As a research student on AD, I am quite optimistic that someday AD will be a thing of the past. This success can and will be achieved as research advances and new unknowns are solved. I believe that researchers will be capable of solving all of the unknown facets of this disease and will be able to synthesize a definite cure one day. That is my hope, and I want to be a part of the solution. Ultimately, I wish that everyone can attain a full, satisfying life — a life filled with memories unforgotten.

The study completed by Ms. Tiu is outstanding. It is rare that an undergraduate is allowed to use human brain specimens, but Ms. Tiu is so careful in her work that an exception was made for her. Ms. Tiu found levels of key brain proteins are altered in the brains of subjects with mild cognitive impairment (MCI), arguably the earliest detectable form of Alzheimer’s disease (AD). Our laboratory’s previous research had shown that oxidative damage to the brain in MCI is present. The proteins whose levels are altered in MCI likely reflect this oxidative damage, and these proteins are involved in signaling and/or neuroinflammation. Consequently, the significance of this research is that the altered levels of these proteins determined by Ms. Tiu in the brains of subjects with MCI strongly support the notion that oxidative stress-induced brain protein alterations are important in the progression of AD. Ms. Tiu conducted this research and wrote the paper by herself, with some editing assistance from me.
Abstract
The purpose of this study was to measure the expression levels of key signaling proteins in brain tissue from subjects with mild cognitive impairment (MCI) compared to control subjects. MCI is considered to be the beginning phase of Alzheimer’s disease (AD). Tumor necrosis factor alpha (TNF-α), nuclear factor kappa beta (NF-κB), phospho Bad (pBad), and ubiquitin C-terminal hydrolase-L1 (UCH-L1) are four of the proteins that were investigated. Trends of either decreases or increases in protein expression levels in MCI vs. control brain were investigated. Western blot analysis was used in order to identify these trends. These signaling protein levels are reportedly up-regulated or down-regulated in the AD brain; consequently, investigating protein expression levels in MCI brain may provide insight into how these proteins contribute to the transition from MCI to AD.

Introduction
Alzheimer’s disease (AD) is a disheartening illness to not only those who have developed it, but also to family and friends of AD patients. According to current research, it is estimated that 14-16 million Americans and more than 22 million people around the world are expected to develop AD in the near future, unless an intervention can be developed (Butterfield et al., 2007). However, that much-anticipated intervention is closer to reality due to the efforts of Professor Butterfield and his team.

Mild Cognitive Impairment (MCI) is considered to be the “intermediate stage between normal aging and the AD brain” (Butterfield et al., 2007). In the early stages of MCI, many people go on living their daily lives quite normally. However, in amnestic MCI there is a noticeable decline of memory compared to prior years, but there are no signs of dementia in the early stages. Still, some researchers consider MCI to be the earliest stage of AD. Using redox proteomics to investigate molecular aspects of AD and MCI, Professor Butterfield’s team has tracked and recorded the degrading effects of oxidative stress (Butterfield et al., 2007).

Earlier studies have illustrated the importance of oxidative stress in the pathogenesis of AD. Oxidative stress is caused by an imbalance between the production of toxic reactive oxygen species (ROS) and the body’s antioxidant systems. Protein oxidation can lead to extracellular amyloid plaques, intracellular neurofibrillar tangles, oligomers of amyloid β-peptide (Aβ), and synapse loss (Butterfield et al., 2007). The Aβ (1-42) peptide is the peptide of interest in the study of AD pathology. Aβ (1-42) is a peptide that is derived from the proteolytic cleavage of a Type I integral membrane protein known as amyloid precursor protein (APP) and is thought to underlie the pathogenesis of AD (Butterfield et al., 2007).

Protein oxidation causes notable adverse effects. Oxidation of proteins can cause protein dimerization, in which two molecules of the same chemical composition can form a condensation product. In addition, protein oxidation can lead to denaturation of proteins, a process in which a protein unfolds from its usual structure, and its normal conformation is lost. This process is detrimental because the unfolding allows the hydrophobic (“water-fearing”) amino acid residues to be exposed to the aqueous environment. This exposure can lead to a loss of structural or functional activity and cause protein aggregation, such as tau aggregation that is evident in the AD brain.

Tau aggregation is responsible for forming the neurofibrillary tangles, while senile plaques are composed of extracellular, fibrillar Aβ (1-42) that histopathologically characterize the AD brain. The senile plaques are associated with activated astrocytes and copious amounts of microglia at the site of deposition of Aβ (1-42) in AD (Bernhardi and Eugenin, 2004). Furthermore, the activation of the inflammatory response is thought to be crucial in quantifying the rate of the neurodegenerative process (McGeer and McGeer, 1998). β-Amyloid activates glia to synthesize an assortment of inflammatory factors such as tumor necrosis factor-alpha (TNF-α), reactive oxygen species (ROS), nitric oxide (NO) and inducible nitric oxide synthase (iNOS), which may increase the rate of the development of AD (Jiang et al., 2007).

Materials
All chemicals used were purchased from Sigma-Aldrich (St. Louis, MO) with the exception of nitrocellulose membranes (Bio-Rad, Hercules, CA), electrophoretic transfer system (Trans-blot Semi-dry Transfer Cell; Bio-Rad), and Western blotting (Calbiochem, LA Jolla, CA).

Subjects
The University of Kentucky Rapid Autopsy Program of the Alzheimer’s Disease Clinical Center (UK ADC) provided frozen hippocampus samples from MCI subjects and age-matched controls. The patients were diagnosed with probable MCI according to criteria produced by the National Institute of Neurological and Communicative Disorders and Stroke (NINCDS) and the Alzheimer’s Disease and Related Disorders Association. The control subjects did not have any neurological disorders nor did they have a history of dementia. They had undergone annual mental status testing and semiannual physical and neurological examinations as part of the UK ADC normal volunteer longitudinal aging study. Table 1 describes the background of the patients.
Table 1. Characteristics of control and MCI patients (mean ± SD).

<table>
<thead>
<tr>
<th>Demographic variables</th>
<th>Control Subjects</th>
<th>MCI Subjects¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of subjects</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Gender (male/female)</td>
<td>3/4</td>
<td>3/4</td>
</tr>
<tr>
<td>Postmortem Interval (hours)</td>
<td>2.87 ± 1.14</td>
<td>3.125 ± 1.033</td>
</tr>
<tr>
<td>Brain weight (grams)</td>
<td>1260 ± 120</td>
<td>1120 ± 61</td>
</tr>
<tr>
<td>Braak² stage</td>
<td>I-II</td>
<td>III-V</td>
</tr>
</tbody>
</table>

1. MCI: mild cognitive impairment
2. The standard, six-stage description of a patient’s level of AD, from extremely mild to full-blown dementia, named for the German researcher who developed the scale.

Sample preparation

The brain tissues (hippocampus) from controls and MCI subjects were homogenized in ice-cold isolation buffer containing 10mM Hepes buffer, 137mMNaCl, 4.6 mM KCl, 1.1 mM KH2PO4, and 0.6 mM MgSO4, as well as proteinase inhibitors leupeptin (0.5 mg/ml) and pepstatin (0.7 mg/ml). Homogenates were centrifuged at 14,000 g for 10 min to remove debris. The supernatant was extracted to determine the total protein concentration by the BCA method.

Twenty μl of either 150 μg or 100 μg of control and MCI samples from the hippocampus (one of the first regions of the brain to suffer damage from AD) were used in the 1D Western blots. 1D Western Blots were used to determine the protein expression levels in control and MCI brain tissues. Gel electrophoresis was utilized to separate the denatured control and MCI brain proteins, and the proteins were then transferred to a nitrocellulose membrane. Primary and secondary antibodies detected the proteins that were on the blot.

The science underlying tagging antibodies is actually quite simple. First, an animal such as a rabbit is injected with a protein, such as TNF-α. The rabbit’s immune system then produces antibodies against the foreign protein, TNF-α. The antibodies are then collected and are called primary antibodies. A second animal, such as a goat, is injected with the primary antibodies that the rabbit’s immune system created. The goat’s immune system then creates antibodies against the newly injected primary antibodies and the secondary antibodies are thus created.

Western blotting analysis

In the process of Western blotting, a primary antibody is added to the nitrocellulose membrane in order to tag the protein of interest, such as TNF-α. The secondary antibody then tags and recognizes the primary antibodies. Specific substrates, 5-bromo-4-chloro-3-indolyl-phosphate and nitroblue tetrazolium (BCIP and NBT), are then used to catalyze the reaction and develop the blot so that the proteins can be seen. A purple color is the result of the reaction. A distinctive band of the specific protein is expected to show up first, especially with monoclonal antibodies.

There are two different kinds of antibodies used in this project — monoclonal and polyclonal antibodies. Monoclonal antibodies are specific for certain amino acid sequences and their motifs. A blot that uses monoclonal antibodies usually shows fewer bands than polyclonal because monoclonal antibodies are more specific to the particular protein’s amino acid sequence. With the case of polyclonal antibodies, more bands show up because repeating amino acid motifs in proteins other than the particular protein of interest (TNF-α for example) are tagged as well. However, because each protein has its own molecular weight, determining which band belongs to the protein of interest is not difficult. The blots are then scanned with Adobe Photoshop and quantified with Scion Image (PC version of Macintosh-compatible NIH Image) software.

Tumor Necrosis Factor-Alpha, TNF-α

Tumor necrosis factor-alpha (TNF-α) is a member of a cytokine family that can cause cell apoptosis (programmed cell death) and cellular proliferation and differentiation. Cellular differentiation can be observed in macrophages, inflammatory cells that originate from white blood cells. TNF-α is produced by specific cells of the immune system in response to adverse conditions, such as exposure to ionizing radiation, elevated temperature, viral infection, or toxic chemical agents such as those used in cancer chemotherapy (Karp, G., 2005; Tangpong et al., 2006). TNF-α is a pro-inflammatory cytokine that participates in inflammation, cell survival, and cell death processes (Gomez-Chiarri et al., 1994) and can trigger cell death through cell apoptosis and necrosis.

This particular cytokine is a signaling protein that is secreted from immune system cells that ultimately changes the action of other immune cells. TNF-α regulates immune cells and causes inflammatory responses. These inflammatory responses are necessary in order to defend the body against pathogens. However, increased levels of inflammation are evident in neurodegenerative disorders and are implicated in the etiology of Alzheimer’s disease, Parkinson’s disease, and ischemia (Lovell et al., 1998; Liao et al., 2001; Gao et al., 2002). In mice treated with pro-oxidant adriamycin or in AD brain, neuroinflammation arbitrated from glia overproduction or dysfunctional regulation of TNF-α.
Mechanism
In its normal mechanism of signaling cell apoptosis, TNF-α first binds to its receptor, either TNFR1 or TNFR2. TNFR1 is the receptor that is constitutively expressed in most tissues. The activated receptor then binds TRADD and FADD, two cytoplasmic adaptor proteins, and procaspase-8 to create a complex that is located on the inner surface of the plasma membrane. FADD and TRADD interact with each other in regions known as death domains, and procaspase-8 and FADD interact with each other in what are known as death effector domains. Once assembled together, the procaspase molecules cleave each other to create Caspase-8, an initiator complex that directs the cell to its final destination of cell apoptosis. It is important to note, however, that after TRADD binding, two other pathways can be initiated. They will be discussed later.

Hypothesis and Data
Because neuroinflammation is elevated in the AD brain, I hypothesized that neuroinflammation can be observed in the MCI brain. Therefore, TNF-α levels are hypothesized to be increased in the MCI brain samples. The results thus far confirm my hypothesis. Brain tissue was obtained from five different subjects (n = 5) for both control and MCI. There is a clearly significant increase in TNF-α protein levels in MCI. (p < 0.01). There is variation due to the biological nature of the samples from human individuals.

Nuclear Factor-Kappa Beta, NF-κβ
As explained above, after TRADD binding, two other pathways other than cell apoptosis can be initiated. One pathway is the activation of NF-κβ. The other pathway is the activation of the MAPK pathways. The protein in this particular study was the p65 subunit of NF-κβ.

Mechanism
In its normal function, after TRADD binds to the death domain, TRADD assembles TRAF2 and RIP, a serine-threonine containing kinase. TRAF2 then recruits protein kinase, IKK, a multi-component protein. This recruitment permits RIP to activate IKK. An inhibitory protein that is bound to NF-κβ, known as I, inhibits NF-κβ from translocation. I is then phosphorylated by IKK and is degraded. This process releases NF-κβ so that it can translocate to the nucleus. NF-κβ is a transcription factor that initiates the synthesis of proteins that are involved in anti-apoptotic factors.
inflammation, and cell survival and proliferation.

**Hypothesis and Data**

Because p65 of NF-κB is a transcription factor that mediates the transcription for cell survival and anti-apoptotic factors, I hypothesized that there will be an increase in p65 of NF-κB in the MCI brain, because neuroinflammation and pro-apoptotic factors are expected to be increased in the AD brain. NF-κB can provide the brain with neuroprotection, and if NF-κB is not released into the nucleus, the result will be a lack of important, protective proteins. According to prior research, p50/p65 of NF-κB, has been reported to be activated in AD brain (Kaltschmidt et al., 1997; Yan et al., 1995; Yoshiyama et al., 2001). According to that research, p65 is expected to be increased in AD brain. However, is there an increase of p65 in MCI brain? There have been several studies that demonstrate that, if NF-κB is introduced to an inhibitor, or even its inhibitory protein, I, is blocked with a repressor, the protective effects are nullified.

Nakao et al. (2008) demonstrated that galantamine (a drug that is currently being used to treat mild to moderate AD) and its protective effects are nullified with the inhibition of NF-κB or the repression of its bound protein, I. This finding suggests that NF-κB is crucial in the reduction of inflammation and the mechanism of defense. Therefore, it is hypothesized that there will be an increase in NF-κB levels in MCI. My results support the hypothesis of a trend toward an increase in NF-κB levels in MCI brain, and the results also illustrate near significance as assessed by the Wilcox p-value of 0.06.

**Phospho Bad (Serine 112) (Phosphorylated Bcl-2 associated death promoter)**

Bad is a member of the B cell leukemia-2 (Bcl-2) gene family. When Bad is phosphorylated, it is called phospho Bad (p-Bad). Serine 112 phospho Bad was used in this study. Alterations in phospho Bad antagonist apoptosis function in Bad (Jeong et al., 2007). Oxidative stress can cause alterations in protein expression and perhaps efficiency. Bad’s main role is to signal cell apoptosis to cells that may be damaged, from oxidative stress for example. Phosphorylation initiates Bad to signal pro-apoptotic pathways in order to rid the brain of damaged components of a cell.

**Mechanism**

Oxidative stress is one factor that causes cellular stress that ultimately leads to cell apoptosis. Cellular stress causes a pro-apoptotic factor such as Bad to insert itself into the outer mitochondrial membrane. The insertion of the protein, Bad, then signals the release of cytochrome c molecules from the intermembrane space of the mitochondria. When the cytochrome c molecules are translocated to the cytosol, they form a multi-subunit complex with caspases that then, in turn, activate the downstream executioner caspases that cause apoptosis.

**Hypothesis and Data**

Because phospho Bad’s function is to cause cell apoptosis, it is hypothesized that there will be a decrease in phospho Bad protein levels in MCI brains in order to provide neuroprotection from oxidative stress. The reason for this decrease is that when an environmental factor, such as oxidative stress, affects the brain cells, phospho Bad is signaled to cause pro-apoptotic caspases to rid the brain of damaged cells and to regulate the cell death processes. In the normal brain, I hypothesized that a decrease in phospho Bad activity or a loss of function could result in the aggregation of unwanted proteins.

The data below illustrate no change in phospho Bad protein levels in MCI brain, suggesting that these unchanging levels contribute to unwanted protein accumulation and neuronal toxicity in AD brain. Yoon et al. (2006), support these data, stating that the “cultured neurons have shown that okadaic acid (OA) evokes tau phosphorylation to initiate a neurodegeneration that resembles the pathogenesis of AD. Western blotting revealed that ... expression of Bad was decreased as early as 4 hours after OA treatment, although the level of phospho Bad was relatively constant.” These
levels were observed in cultured cortical neurons.

**Ubiquitin Carboxyl Terminal Hydro-lase L1 (UCH-L1)**

Ubiquitin C-terminal hydrolase L1 (UCH-L1) is an enzyme that is a main component of the ubiquitin proteasome system and has catalytic hydrolase properties that can hydrolyze peptide-ubiquitin bonds and recycle ubiquitin monomers to be used again in the same process (Healy et al., 2004). UCH-L1 is a member of the deubiquitylating enzymes and is one of the most abundant proteins in the brain. Whereas other UCH members are ubiquitously expressed, UCH-L1 is selectively expressed in neurons (Sakurai et al., 2006; Wilkinson et al., 1989). Moreover, it is an enzyme involved in the process of proteolytic degradation of misfolded or damaged proteins by the proteasome (Castegna et al., 2002).

Analysis of proteasome function in post-mortem human AD brains has shown a strong inhibition of activity in the proteasome and lower protein levels for UCH-L1, suggesting that the neuronal ubiquitin-proteasomal system is linked to the pathogenesis of AD (Gong et al., 2006). Research from our lab also confirmed a decrease of UCH-L1 activity in AD brain. According to Sultana et al. (2006), the measurement of enzymatic activity of CA II, UCHL-1, and enolase from AD hippocampus revealed decreased activity compared to control.

UCH-L1 is important for proteasomal-mediated clearance from the brain of aggregated or misfolded proteins. Protein aggregation, such as tau aggregation, is seen in the AD brain. The decline of UCH-L1 proteasomal activity likely contributes to protein aggregation and thus neuronal toxicity. Less UCH-L1 in MCI brain is predicted to result in more ubiquinated proteins, decreased activity of the 26S proteasome, and, consequently, an accumulation of aggregated and damaged proteins. All were observed in MCI brain.

Because there is evidence of a decline in UCH-L1 activity in AD brain (Sultana et al., 2006), I hypothesized that there will be a decline of UCH-L1 protein levels in the MCI brain as well. The results below support my hypothesis.

**Statistics**

For all trials, a Student’s t-Test was performed in order to determine significance. Q-test analysis was also performed to determine the outliers for statistical analysis. The results are presented as the mean plus or minus the standard deviation. Because biological samples were used in this project, variation was expected to occur.

**Discussion**

Because NF-κB is downstream from TNF-α, it is hypothesized that there will be a proportional relationship between the two proteins. If TNF-α increases in the brain, then NF-κB is expected to increase as well. The increase in oxidative stress creates a signal that anti-apoptotic factors from NF-κB need to be synthesized.

Phospho Bad is pro-apoptotic, which means that it causes cell death. When TNF-α is activated, because of oxidative stress for example, NF-κB is activated in order to create proteins that can counteract the oxidative stress. Phospho Bad activates downstream caspases that ultimately lead to cell apoptosis. The unchanging levels of phospho Bad offer an explanation if there is an accumulation of unwanted proteins and neuronal toxicity in MCI.

The unchanging levels of phospho Bad in AD brain can be tied to the decrease in UCH-L1 activity. UCH-L1 is known to be decreased in AD brain (Castegna et al., 2002; Sultana et al., 2006). This finding means that its normal functional levels are decreased and therefore lead to histopathological characteristics that are evident in the AD brain. For example, less UCH-L1 in MCI brain is predicted to result in more ubiquinated proteins, decreased activity of the 26S proteasome, and, consequently, an accumulation of aggregated and damaged proteins. All are observed in MCI brain.

UCH-L1 is a member of the deubiquitylating family. It is part of the proteasome pathway that

**Figure 4. UCH-L1 Protein Levels in Control and MCI Hippocampus**

(A) Western blot with eight lanes. Lanes 1-4 are control samples. Lanes 5-8 are MCI samples. (20 µl of 100 µg samples were added to each well.) Lanes 1 and 2 (control) clearly display higher intensities than the MCI samples and illustrate the significant decrease in UCH-L1 protein levels in MCI. (B) Lanes 1 and 2 are control samples. Lanes 3-5 are MCI samples. (C) Graphical analysis of control and MCI band intensities, respectively. The graph illustrates the significant decrease in UCH-L1 from control and MCI comparison. (p < 0.05). C-HP, control hippocampus; MCI-HP, MCI hippocampus.
rids the brain of protein aggregations and misfolded proteins. UCH-L1’s down-regulated levels that are evident in AD brains contribute to neuronal toxicity, because unwanted proteins accumulate in the brain. Because oxidative stress signals TNF-α production and, therefore, NF-κβ is signaled to produce proteins that help to counteract oxidative stress, phospho Bad is signaled to induce apoptosis to dispose the damaged proteins.

UCH-L1 is affected by oxidative stress as well. Because UCH-L1’s proteasomal and degradative properties are decreased in both MCI and AD brain, this means that UCH-L1 cannot rid the brain of damaged, unwanted proteins. This failure will result in protein aggregation and neuronal toxicity.

Conclusion
Through this research, new insights into the histopathology and biochemical alterations observed in MCI brain have been found. Data presented in this paper illustrated that there is an increased level of oxidative stress in MCI supported by increased levels of TNF-α, NF-κβ, and decreased levels of UCH-L1. Phospho Bad’s unchanging protein expression levels could mean that there is no activation of pro-apoptotic pathways stimulated by this pathway, and that could lead to an accumulation of damaged components in brain.

Acknowledgements
This work was supported by Professor Butterfield’s grants from the National Institutes of Health and the grants that I received from the Experiences in Undergraduate Research and Creative Activities (eUreKa) office of the University of Kentucky and from the Appalachian & Minority Science, Technology, Engineering, & Mathematics Majors (AMSTEMM) Summer Fellowship funded by the National Science Foundation (NSF).

Works Cited


am in my senior year as an English major and sociology/psychology double minor in the College of Arts and Sciences. I am an officer in Delta Epsilon Iota honor society, an active member of the National Society of Collegiate Scholars, and a Career Center Ambassador. I am studying at the University of Kentucky on a Governor’s Scholar scholarship. My particular interest is in imperialism, social thought, and oppression of the Other, as reflected in literature, specifically that literature beginning in the Victorian era. During the process of exploring this subject, my mentor, Dr. Hannah C. Freeman, has inspired me to not only pursue English as a career, but to analyze literature on the level of symbolism, which often introduces an entirely deeper (and often undetected) level of understanding. An abbreviated version of this research was presented at the 2009 Showcase of Undergraduate Scholars. My future plans involve delving deeper into Victorian literature and broadening my understanding of the cultural effects of highly influential texts.

Faculty Mentor: Dr. Hannah C. Freeman
Department of English
I recommend Stacy Wilder’s essay “Power and the Cultural Other: Insights from Jane Eyre and Wide Sargasso Sea” for publication in the journal Kaleidoscope. Wilder offers an insightful reading of cultural imperialism in two classic works of literature, Charlotte Bronte’s Jane Eyre and Jean Rhys’s Wide Sargasso Sea. Exploring the color red as a motif, Wilder uncovers moments of resistance by marginalized characters as well as the exercise and abuse of power by the English. In her investigation of the prototypic Victorian novel and its postmodern re-vision, her essay examines the ways in which the relationships between agents of the British Empire and those under its rule shift over time. Gender figures into her argument as she looks at how women are active agents in the subordination of the colonized while themselves experiencing gender discrimination. Wilder’s prose is clear and mature; she treats cultural and literary issues with complexity.

Power and the Cultural Other: Insights from Jane Eyre and Wide Sargasso Sea
A Critical Literary Analysis

Abstract
World history has repeatedly been characterized by countries dominating one another, controlling everything from social norms and expectations to currency. It is difficult to consider modern Western culture without regarding the influence of past power struggles between conflicting nations — nations whose own cultures have shaped the ones existing today. History texts detail these relations, and although many of these factual accounts of nation ownership provide a broad, sweeping idea of life in an imperially dominated country (those countries operating under the rule of another nation), literature supplies a much more detailed, intimate examination of what it means to live in one country ruled by another. Fictional narratives, though they utilize imagined characters leading invented lives, reflect the actual situation of their day, making them relevant to us even today as we examine the past to better understand how such power struggles from the times of old have shaped modern culture. Two such literary works are Charlotte Bronte’s Jane Eyre (1847) and Jean Rhys’s Wide Sargasso Sea (1966), both of which explore the notion that such a power imbalance serves to benefit those in authority while suppressing the ruled. The resulting reciprocal relationship that develops suggests that what one gains, another must first lose. It is this phenomenon present in these works that I am keen to investigate.
Introduction

Charlotte Bronte’s *Jane Eyre* (1847) and Jean Rhys’s *Wide Sargasso Sea* (1966) mutually manifest the emphasis, extent, and consequences of British rule on the home front as well as on the West Indies islands. The effect of British power is illustrated in both of these novels via the use of two frequently recurring images that impart how Britain’s rule affected women from each region.

Jane Eyre of England and Antoinette Cosway of Jamaica find themselves repeatedly surrounded by fire and the color red; these symbols are used to convey a deeper meaning that over the course of each novel develops into a dissimilar foreshadowing of the same fundamental concept. In *Jane Eyre*, fire and the color red may be interpreted as symbols of emotional power, romantic love, and beneficial gain, whereas in *Wide Sargasso Sea* the same represents destruction, insecurity, and emotional and physical loss. As the result of the contradictory uses of these symbols, two very different women’s lives are fused together in such a manner as to make fortune seem biased toward one and hopeless destruction the regrettable destiny of the other.

Because of the sharp distinctions in the use of the fire symbol and the color red, British rule’s impact is seen giving Jane, of British heritage, a definite upper hand in both fortune and happiness at the expense of Antoinette, the daughter of the cultural Other. Both novels illustrate Antoinette losing desirable qualities, such as love or dominance, whereas Jane is granted such qualities. These novels share the common theme of Jane triumphing in life and, more importantly, triumphing over Antoinette.

Discussion

An early example of this power dynamic is symbolized in Jane Eyre’s childhood. This incident takes place in the Red Room, a scene that introduces what later becomes a major theme of the novel: the color red. After losing a violent argument with her cousin, Jane is sent to the ominous Red Room as punishment, the bedroom where her uncle had passed away years before. The room, complete with a massive pillar-supported bed, dark mahogany wood furniture, and throne-like chair, serves as Jane’s temporary prison cell. During her incarceration, thoughts and superstitions of the room’s circumstances topple repeatedly in her mind, leaving her anxious and uneasy. Her panic eventually culminates in a spell that leaves her unconscious. When more closely examined, the symbols of this episode depict the color red as a dominating, emotionally-provoking force. Jane’s imprisonment portrays red as an inescapable force, an overwhelming power that grips one’s mind and has the ability to inflict emotional and physical consequences.

Nevertheless, the color red is not specifically illustrated as a particularly negative force. Despite becoming spastic and being unsuccessful in searching for an escape, Jane does manage to calm down enough to reminisce about her uncle’s former occupancy of the room, during which he gave his wife, Jane’s Aunt Reed, instructions to treat Jane as one of her own children upon his death. Jane’s recollection of her deceased uncle’s last wish suggest that Jane is entitled to better treatment at Aunt Reed’s hands than that which she is receiving. Despite the room’s initially perceived demonic force, a closer inspection of what the room represents, that is, a source of strength for the mistreated, constructs this space as the empowering environment that will later be revealed to grant Jane the emotional fuel needed for a defining conflict with Aunt Reed.

Shortly after her dramatic experience in the Red Room, Jane discovers herself yet again in an overwhelming situation denoted by red, this time in conjunction with fire. Due to the outburst that resulted in her imprisonment in the Red Room, Aunt Reed decides to send her to Lowood, an underfunded charity school for orphans and unwanted children. Mr. Brocklehurst, the hypocritical master of Lowood, visits Jane’s home to make the acquaintance of his new pupil. Though Jane makes no effort to impress Mr. Brocklehurst, she especially does not do so for her aunt after their guests leave. In fact, it is after Mr. Brocklehurst’s departure that Jane’s fiery passion is initially released in the form of words (and not merely through physical resistance) in the presence of someone who exercises power over her. While her aunt sits in front of the fire, Jane expresses her confined rage and disdain for the woman who has so cruelly mistreated her. She describes to her aunt the agony of living with a family that denies her love. Jane makes a flawlessly clear promise to her aunt that she will never consider her family, and that regardless of where her future takes her, she will most certainly never again reside with the Reeds.

It is not just the physical location of Aunt Reed in front of the fire in this scene that creates a depiction of emotion and force, though. Jane had just been released from her confinement in the Red Room where she noted fires are rarely lit. It seems from her confrontation with her aunt that Jane absorbed the overwhelming passion induced by the Red Room and lit an emotional fire for herself in the presence of her aunt, a woman who looked on Jane with her “eye of ice” (Bronte, 1996, p. 47). Aunt Reed, in essence, is a cold person due to her own lack of lighting fires, her eye of ice, and her failure to love Jane. Taking it upon herself to transform her heated feelings into a reality, Jane unleashes her fiery passion while a literal fire serves as her background, in an effort to ensure she melts her aunt’s rigidity. Jane accomplishes just that, and remarks that “Mrs. Reed looked frightened; … even twisting her face as if she
would cry” (Bronte, 1996, p. 48). Hence, Jane actively illustrates how the sense of power she discovered in the Red Room gave her the ability to establish within herself a passionate store of overwhelming feelings possessing the valuable potential to produce life-altering effects for her betterment and benefit.

Jane is not the only central character living amidst redness and fire in the times of the British Empire; Antoinette Cosway also experiences the like. Early in her childhood, her house is set ablaze by Jamaican natives because of their anger over her family’s past slave ownership. Abruptly woken in the middle of the night, Antoinette is told to get dressed and get out of her house, an estate known as Coulibri. Although Antoinette feels unprotected and unsafe regardless of her location or situation, her home is where she feels safest. Now, however, it is engulfed in flames, symbolizing how the fury of others serves as the catalyst for the destruction of what happiness and scant trace of safety she does possess. It is not singly the fact that her home is set ablaze that will be the life-long scar, though. After escaping the flames, Antoinette stumbles upon her only childhood friend, a native girl named Tia. However, Tia, just as the rest of the natives, is also experiencing the effects of passionate revenge against Antoinette’s family, and throws a rock at her former friend’s face. This scene, which is saturated with emotion gone awry, is described by a heartbroken Antoinette who says, “When I was close I saw the jagged stone in her hand but I did not see her throw it. I did not feel it either, only something wet, running down my face. I looked at her and I saw her face crumple up as she began to cry. We stared at each other, blood on my face, tears on hers. It was as if I saw myself. Like in a looking-glass” (Rhys, 1966, p. 45). The blood that flows down Antoinette’s face symbolizes the destruction of safety as her body has been physically harmed just feet away from her burning home. The devastation of her broken friendship with Tia is also conveyed in this bloody image, as their relationship is now just as broken as the skin on Antoinette’s forehead. She is left friendless as well as homeless. Both leave Antoinette deeply affected, furthering her belief that she is never safe as a social outcast. What leads to this compromise of safety and social acceptance — that the riot takes place at all — can be traced back to her family’s former slave ownership and her own racially mixed ethnicity. Had Antoinette’s family not been involved with the British rule over that island, the natives might not have felt nor expressed the anger that led them to destroy Coulibri. Thus, Antoinette is suffering because of the effects that power (and notably, her own family’s power) has had upon her, a force that can deny her a safe home as well as the only friend she has ever known. Unfortunately, this is not the final instance of redness and fire symbolizing destruction that will be encountered in Antoinette’s life.

In a scene following the tragic fire, Antoinette again is tortured by red. After awaking from unconsciousness following her confrontation with Tia, she finds her “plait, tied with red ribbon” and “thought it was a snake” (Rhys, 1966, p. 45). She lost her hair as another destructive result of the fire. What is notable about this scene is the way in which she looks at her ribbon-tied plait and associates its shape with that of a snake. It is unusual that she automatically connects her own hair with a creature that is infamous for creating dreadful, fearful feelings. The reader is thus made aware of a negative and dangerous image that is not only denoted by the color red, but is actually being bound and held together by the color, as if to say that even more dangerous than a snake is the color red, the element holding that snake in place. This implies that red possesses the negativity of the image (as it is the bounding force of the plait), making red not just a form of danger, but the source of it. The fact that the red ribbon was holding Antoinette’s hair together suggests that harm and danger will always be bound together with whatever grows from Antoinette, whether it be physical hair or emotional instability (which does grow out of Antoinette’s head, though it is not tangible as literal hair). Hence, it is foreshadowed that if Antoinette will be subjected to anything in the future causing her to lose something of great value, just as the fire caused her to lose her home, security, and sole friend, the emotional response that grows out of it as a result will be identified by the characteristic red.

The color red shortly causes additional damage to Antoinette’s mental stability, as is seen during her journey to the conven, which becomes her home following the fire. As she walks to her new residence for the first time, she is taunted by two young children. The boy who belittles her with snide remarks, though he is of Jamaican descent and is thus considered negro, is described as follows: “a dull ugly white covered with freckles, his mouth was a negro’s mouth and he had small eyes, like bits of green glass. He had the eyes of a dead fish. Worst, most horrible of all, his hair was crinkled, a negro’s hair, but bright red, and his eyebrows and eyelashes were red” (Rhys, 1966, pp. 48-49). Again, red is present, not just in the form of unattractive features, but as the worst among all the unattractive features. This red not only stands as a mark of physical ugliness and annoyance, however. This instance of red demonstrates another encounter with a force of undesirability, one that affects Antoinette’s self-security as a racially mixed individual among natives who consider themselves more legitimate. This effect is accomplished by the boy’s taunts and use of language that makes Antoinette feel physically threatened while
adding to her already mounting pile of emotional issues centering on her perceived vulnerability. A final analysis of this scene finds red as it was when her house was engulfed in flames — a force that compromises her well-being while making her ever aware of that fact that she is not considered either truly English nor truly native; she will not be able to find a comfortable position in her relationship with others of either descent. This inability to find acceptance and safety will continue to be marked by fire and the color red in her adulthood.

Images of red and fire remain central in adulthood for Jane Eyre, particularly after she arrives at Thornfield Hall, the estate owned by her employer Edward Rochester. One particular evening, after being awakened by foreign noises, Jane opens her bedroom door to find a lit candle on the floor. After hearing further noise, she proceeds to Rochester’s room, where she finds him sleeping amidst flames. She extinguishes the fire, saving his life. This scene serves as a metaphor that represents Jane running into a passionate relationship with Rochester, one that began with slight, almost unnoticeable romantic feelings (represented by the single flame of the candle outside her bedroom door) and grew into a more elaborate state of deeper and passionate feelings (represented by the more immense fire). That she once again finds herself in a room characterized by red (though it is now due to flames rather than decor) foreshadows that Jane will here find the same type of emotions she found the last time she was in a red room — emotions that will eventually lead to the granting of her own power and happiness.

Also of interest in this passage is that, although the last time a literal fire was seen as a symbol of overwhelming emotion in Jane’s life was on the occasion she daringly confronted her aunt, this fire is seen in a much different context. The difference between this fire and that from her childhood is that on this occasion the fire takes place after Jane has learned valuable, life-changing lessons through various circumstances that teach her how to better handle her emotions. The foundation for more mature feelings that Jane will later enjoy entertaining — that of romance and love with an equally passionate person — is being set during this scene. This scene depicts how her life and personal development has progressed and illustrates how, because of what British heritage has granted her, she has been able to reach a point in her life at which not only can she enjoy the benefits of a job (and such was a rarity for women of her time), but a source of love as well. Thus, this fire portrays Jane’s heightened sense of emotion that allows her to obtain more than what she has previously been able to.

The romantic feelings Jane develops for Rochester lead to another scene in which the color red becomes a dominant image yet again. Shortly before she and Rochester are to be married, a monstrous creature trespasses into her bedroom in the night and ravages her wedding veil. Jane is distressed by this horrifying figure who, upon glaring at Jane, exhibits “a discolored face...a savage face” (Bronte, 1996, p. 281), making Jane wish she “could forget the roll of the red eyes” (Bronte, 1996, p. 281). To intensify these vicious eyes is the build of their owner, a monstrous being possessing immense strength wrapped in a portentously oversized stature. Red is connected to all these descriptions in such a way that, after reading the prequel novel Wide Sargasso Sea, they can be understood to represent Antoinette’s (as she is this monster) frustration and hurt over her own failed relationship with Rochester. Because red symbolizes power and emotion with Jane and dangerous destruction and suffering with Antoinette, it is interesting to note how, despite the differences in the meanings of the symbols for each character, Jane and Antoinette’s lives are intertwined while still maintaining the opposite values of these symbols. This scene can thus be interpreted as Antoinette’s hurt because of a man meeting Jane’s passion for that same man, a combination that will have tremendous significance by the end of both novels, but giving only one of the women a desirable destiny.

After enduring the frightening night with the mysterious red-eyed creature, who is later revealed to be Mrs. Antoinette Rochester, Jane runs away and eventually comes to reside with cousins in another town. Her only male cousin, St. John Rivers, plans on leaving England for India in order to be a missionary to the peoples whom the British have come to rule. Because he feels he would be most effective with the help of a partner, and that the only honorable way to take his desired partner is to first marry her, he asks Jane to become his wife and submit to what he deems a holy calling. Jane, however, feels quite the opposite and refuses. Her decision ultimately is rooted in the reality that she feels no chemistry with St. John — he is as ice to her, a feeling she imparts by saying that “St. John was a good man, but I began to feel he had spoken the truth of himself, when he said he was hard and cold” (Bronte, 1996, p. 383).

These characteristics are easily seen in his want of passion for her, as he is not romantically attracted to her fiery personality. Because the two are so different, their fire and ice personalities are metaphorically battling one another — the fire is attempting to melt the ice, while the ice is simultaneously attempting to extinguish the fire. Jane realizes that she can never be truly content if she marries St. John, and does not want to lose touch with her passion. Ultimately, she does not see the point in continuously attempting to do the impossible and melt the ice of St. John’s heart. Thus, she and St. John pursue separate paths. St. John travels to the foreign land of India, a land known to be so hot that his ice may be the very factor keeping him cool enough to avoid heat-related death in the Indian climate. In essence, his personality found the purpose it was to serve. However, Jane’s fiery emotions still need something or someone to consume, and it does not take her long to be reacquainted with the object that will serve this purpose.

Antoinette’s adulthood is similarly defined by fire and images of red. On one particular occasion, her new husband Edward Rochester plans on taking a walk through the island’s wilderness. Antoinette warns him to watch for red ants, telling him, “Look for the red ant, that is the worst. It is very small but bright red so you will be able to see it only if you look. Be careful,’ she said” (Rhys, 1966, pp. 86-87). The red ant represents Antoinette, a politically and socially unaccounted for individual who is capable of inflicting pain. Antoinette has felt small throughout her life as a friendless social outcast lacking a stable home life and the strong family ties...
that are usually provided therein. However, just because the ants are small, says Antoinette, does not mean that they do not pose a threat to someone much bigger. Antoinette, despite her inferiority, seems to be foreshadowing her own potential threat to Rochester, letting him know in advance that her position to him, no matter the sense (physical, social, economical, or emotional) should not be considered on size alone. Red is portrayed as a dangerous color, giving even those who are usually disadvantaged in one way a form of destructive power over others. It is later seen in Wide Sargasso Sea as well as in Jane Eyre that Antoinette will use this color in her effort to become a danger to both Rochester and Jane’s safety and happiness, though she will be unsuccessful in these attempts. Ultimately, Jane and Rochester are able to overcome Antoinette’s destruction, though she will not be so fortunate as to overcome her own potential for harm. Thus, red will remain an overall risky symbol for Antoinette despite her own ability to cause damage.

The most memorable and enduring image of fire and the color red seen in Antoinette’s life takes place during the infamous scene in which she burns Thornfield to the ground. Possibly because of her unhappiness and insecurity before her marriage, and potentially because of the pain experienced due to the surplus of power Britain exercised over Antoinette’s own nation, (which remained a factor into her adulthood), Antoinette takes a drastic measure and performs the action she has often dreamt of in her sleep: set fire to the English prison in which her husband has confined her. Whether or not she kills Rochester does not appear to be her primary concern — she seems only to wish for an end of her own pain. Thus, in the final moments of her life, Antoinette is seen jumping from the burning roof of Thornfield Hall, appropriately clad in a red dress. Because she realizes she has had very little, if any, power throughout her life, she makes quite a memorable impression in this scene, because not only is she wearing the color she foreshadowed would grant her destructive power, but she displays that very power by using the same concept that destroyed most of hers — fire. Ultimately, Antoinette ends her life with the two symbols that had haunted her from the opening of Wide Sargasso Sea. Thus, she succumbs ultimately to letting fire destroy her.

The fire that kills Antoinette does not go disregarded by Jane. Because she was not present when the fire occurred, she did not know if Rochester survived it. Upon discovering that he is still alive, Jane feels an overpowering sense of gratitude and relief that leads her to immediately reunite herself with her lost love. She finds Rochester at his new home and confesses her devotion. Shortly after, the two are married and enjoy what is the classic illustration of a content Victorian marriage, despite his injuries. However, none of this would have been possible had Antoinette not been killed in the fire, leaving Rochester a widower. Hence, Jane’s happiness in her marriage was granted to her by the same destructive fire that killed Antoinette. Thus, the love, romance, and passion that Antoinette yearned for is ultimately denied her via the red dress and the Thornfield fire, while the same fire granted Jane the opposite, placing her in a much more privileged position.

Conclusion

Fire is first seen in Antoinette’s childhood as something that destroyed the only place she had to call home. Later in her life, red and fire serve as reminders of her insecurity via the little boy’s taunts and her husband’s lack of interest in her, which leads him to imprison her in their own home. It is no surprise, then, that a fiery red blaze deals her the ultimate loss and demands her life. However, red and fire are seen early in Jane’s life as the gateways to emotional triumph with her aunt and a true, lasting romance with Rochester. Thus, it is no surprise that the fire that kills Antoinette leaves Jane in a superior situation. Essentially, both results mirror the impacts that the color red and fire had on these two women over the span of their entire lives and reveals that the two symbols were consistent in their connotations throughout both novels. These two works prove that what can be destructive to one can be beneficial to another; what can overpower one can be harnessed by another; what curses one blesses another. This allows red and fire to be two images that cannot be used necessarily to represent evil or good, because their dual roles in these two novels do not allow for them to be placed neatly in any specific category. Therefore, it can be observed that although Jane Eyre uses fire and the color red to represent mental freedom and empowerment, Wide Sargasso Sea uses the same symbols to stand for destruction and the compromise of safety. This use also suggests that Britain’s rule over the West Indies impacts the outcome of individuals’ lives, symbolically illustrating how the British gain tremendous benefit at the cost of those they rule — the cultural Other.

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Works Cited

The use of stock characters in commedia requires the individual identities of masks to be discernable immediately. When making a mask or teaching commedia in mask making it is important to understand the significance of those differences. This article gives a brief history of Commedia dell’Arte and an example of one of the stock characters, in addition to a main portion, which includes several at-home methods for making commedia masks. The history explains why each character’s mask is so individualized, and why certain characteristics are reserved for specific characters. The application portion of the paper articulates methods of mask construction for this article, and is intended to be used for theatre productions or as teaching aides.

Introduction

The use of stock characters in commedia requires the individual identities of masks to be discernable immediately. When making a mask or teaching commedia in mask making it is important to understand the significance of those differences. This article gives a brief history of Commedia dell’Arte and an example of one of the stock characters, in addition to a main portion, which includes several at-home methods for making commedia masks. The history explains why each character’s mask is so individualized, and why certain characteristics are reserved for specific characters. The application portion of the paper articulates methods of mask construction for this article, and is intended to be used for theatre productions or as teaching aides.

History

In beginning any avenue of research one must begin with history. How does one trace a genre of drama that has few or no precisely written texts surviving? Such is the issue with tracing the history of Commedia dell’Arte, the 16th century Italian improvisational theatre. Improvisational theatre is a form of theatre less structured than traditionally scripted theatre. In the improv theatre of commedia, actors knew their character (hence the importance of stock characters) and, through knowing their character, they would know how that character related to the others in the piece. Generally, the commedia pieces were unscripted, meaning that the actors would receive a scenario just before performing — they might have up to two days to prepare — but their lines would be of their own making, as would the
The physical action of the play. Little theory or influence can be completely ascribed to commedia, although it is highly influential in many contemporary and future forms of drama such as Shakespeare’s *Othello*, *Othello* as a performance before a theatrically-versed Renaissance audience, for whom Iago’s and Othello’s improvisational modes, in conjunction with the stylization of the major characters…would have enforced an illusion of the play as a performance of Italian *commedia dell’arte dell’improviso* (Faherty, 1991, p. 179).

Commedia is difficult to accurately depict, because its existence consisted of improvisational sketches. The improvisational nature of commedia precludes the existence of extensive documentation. Even in translating “Commedia dell’Arte” scholars are at odds; “the name *commedia dell’arte* is difficult to translate. Literally it approximates ‘comedy of the artists,’ implying performances by professionals as distinguished from the courtly amateurs” (Kahan, 1976, p. 7). Although there are several books of “lazzis,” a term used to describe actions attributed to a certain character, they are difficult to cite or learn from because each commedia performance would depend on producing an alteration of that scenario. Examples of this would be the character of Doctore making wide and sweeping gestures when…

Figure 1

Figure 2
*A sixteenth-century Pantalone from the Recueil Fossard*, National Museum, Stockholm (Rudlin, 93)
speaking, or Pantalone constantly fiddling with his money bag—generally any characteristic movement, gesture, or stance that can only be connected to a single character or character type.

Commedia itself has shifting theories of its origination. Three older theories of origination include a theory of mime ancestry “concerning their putative Roman father,” one “hypothesis that makes the masks direct descendents of comic personages in the mystery plays,” and finally one that “traces back commedia dell’arte motifs and figures into the folk literature of the middle ages” (Smith, 1912, p. 21).

In juxtaposition with this trio of ideas, Smith favors a theory of the evolution of commedia,

*commedia dell’arte* might better try to account for itself by looking about in the sixteenth century where it first comes to consciousness … carnival dances, folk plays, courtly mythological spectacles, moral allegories and sacred legends all satisfied some of the general demands for amusement, and each in turn contributed to something toward the education of those wandering entertainers … gradually the players formed themselves into guilds whose prerogative was acting … thus only after the middle of the sixteenth century do *commedia dell’arte* as we know them — outline plots filled by extempore dialog — begin to be recorded (Smith, 1912, p. 27).

Those 16th century records are the sources to which most commedia scholars are first drawn. However, if a researcher is more inclined to the mask aspect of commedia, then period art sources and art referencing performances and characters are more useful than texts. The characters are one of the most central portions to commedia, in which the performances were improvisational but characters were well established stock creations.

Stock characters are the portion of commedia about which the most is known. The characters are repeated in every artifact left by commedia — scene books, paintings, and advertisements. Their presence is best preserved in the individualized masks created to represent the qualities of each character. Because of the sources such as paintings and advertisements, the most is known about the physical representation of the stock characters. The most notorious character is Pantalone (see figures 1-3) the father figure in commedia.

“He typically wants to marry the same woman as his son Flavio, or is too mean to provide a dowry for his daughter, Isabella” (Rudlin, 1994, p. 95). Pantalone is physically characterized as having a “back that bends … giving him an old man’s stoop, protecting his purse and penis and effectively restricting the motion of the legs. The feet are together, toes apart, knees well bent and facing apart” (Rudin, 1994, p. 93). However, the most notable portion of each character is the mask, in Pantalone’s case, characterized as “long, hooked nose, with bushy eyebrows, sometimes also a moustache. Pointed beard juts forward as if to meet the nose coming down, thus giving a very dynamic profile” (Rudin, 1994, p. 93). These depictions can be seen in art work of the commedia period containing the characters as well as the reproduction of masks by mask makers.
Practical Application

In the practical application section we will detail several attempted production methods for commedia masks. The practical creation of the commedia masks for this project required several attempts that included leather production and various types of plaster bases. Assessment of the processes for theatre application included weight, durability, aesthetics, duration of the production of the mask, ease of production, and flexibility in design. Methods that were deficient in several areas were assessed to be possible learning tools rather than to be used in a theatre setting.

Sculpy® Masks

One method of producing the masks for theatre and teaching purposes is through the use of commercially produced Sculpy®. This product is one of many home-oven bake clays found at local and chain craft stores. The process for producing a mask this way is fairly simple; however the masks are not as light-weight and durable as those needed for repeated stage performances. The product of this process is more suitable for presentations and as a learning tool.

The first step in producing a mask from Sculpy® is to create a base out of aluminum foil. Depending on which mask you are attempting to replicate, the initial base has a variety of shapes, some including only the forehead and round nose, such as Doctore, while others require the entire upper face and long nose, such as Pantalone. With the foil, you create the curve of the mask as well; an easy technique to achieve this curve is to simply press the tin-foil over the curve of your own face. This gives you the horizontal curve of the mask so that it fits the face from ear to ear. At this point you may also append foil additions to support the clay structure and allow for a thinner covering of clay — for wrinkles a small roll of foil tapered at the ends and curved into a smile shape works well.

The next step is to apply the Sculpy® to the base (see figure 4). For the fastest bake time and lightest mask, the clay should be as thin as possible, approximately 2 mm flat. When applying the clay you can roll out a flattened piece large enough to cover the entire base, or at least one side, and fit that over the base pushing it into grooves and crevices with your fingers or small wooden clay-working tools (see figure 5). After the base is completely covered, all the cracks and overlay lines are smoothed together using your fingers or the same wooden tools, in whatever combination works most effectively.

Figure 4: Sculpy® and tin foil molding

Figure 5: Wooden tools for shaping and molding clay
for you. Next, bake the model, using the temperature and time recommendations on the product you have chosen. Most people underestimate the thickness of their model, but the model can be returned to the oven for more bake time even after it has cooled. Once the model has been baked and allowed to cool with proper ventilation it is ready for cosmetic coloring or the application of facial hair. For low-budget productions, loose cotton such as a pulled apart cotton ball can be applied with glue for convincing eyebrows, mustache, or a beard. For those productions requiring more detail, portions cut from old wigs and applied with an adhesive also create the desired effect. If the model is desired for display, a finishing technique that emphasizes the molding of the mask includes applying ceramic antiquing and then finishing with an acrylic fixative.

After attempting this process — one of producing a mask made primarily of Sculpy®, I determined that it is not the most effective process for stage use. The mask resulting from this process is light-weight enough, and appears durable enough for stage use; however the process of using a foil base leaves the mask less molded to the face than is desirable for performance. The mask is too flat (see figure 6), standing out on the sides/cheeks, which leaves too much room between the mask and the performer. This tin foil based process may be suggested for beginning mask-makers, to grasp an introductory idea of shaping and molding, however, it is decidedly better as a learning tool than a costuming process.

Paper-Mâché Masks
The second method attempted was a paper-mâché product with a wire skeleton (see figure 7). This was another attempt to make the mask construction viable as an at-home activity. Once the wire support base was completed I realized that it would not give the desired look for the masks. The paper-mâché would have been too ridged, leaving an undesirable texture, and the product would likely have been too easily damaged for theatre use.

Plaster Cast Methods — Base
The next several methods contain the same initial preparation. This preparation requires a plaster cast of the actor’s face on which to mold the mask. Materials include plaster-impregnated bandages (available at most local medical supply stores), Plaster of Paris (craft stores), a stocking, and petroleum jelly. Next find your model — generally the best practice is to use the actor who will be playing the part as the model, so that the
mask is formed for his or her face exactly. It is important the model or actor remain still (including facial features) for the space of 15 minutes (see figure 8). He or she should also not be claustrophobic.

To prepare your model, first firmly fix hair away from the face, and then cover with the stocking. When placing the stocking, make sure any seams are not on the face or forehead because they will cause undesirable crevices in the mold. Next, gently coat your model’s face with the petroleum jelly, paying particular attention to eyebrows, the sensitive skin around the eye, and under the chin as far back as the Adam’s apple (or a similar location on a female). Before applying any of the bandages it is desirable to have them pre-cut. Bandages generally come in rolls 6 inches wide. For application on the average human face you can safely precut bandages to 3 inches wide and 14 inches long (they can be trimmed once applied to suit the specific location). Considering the three layer minimum necessary, you should precut at least 25 to 30 bandage strips, as well as 5 to 10 smaller pieces for patching. Next, follow the instructions on your packaging of plaster bandages (generally to immerse, squeeze and apply). You will be covering the face from ear to ear, and from the crown of the head to under the chin. Start with a vertical layer of strips, and then a horizontal one, and finally a finishing vertical layer; with each layer make sure to smooth the plaster of the bandages until completely smooth. One important note is to leave the nostrils uncovered, most simply achieved by ending a strip of bandage at the tip of the nose, then beginning a new one under the nostrils. Upon beginning with the first layer of application the model must remain completely still, because any movement under the bandages will cause loss of detail and bubbling in the mold. Coupled with this stillness, the person applying the plaster-bandages must take extra care to press the bandages firmly into natural crevices in the face — including areas around the eyes, the crease in the lip, and any others. After the plaster has dried (most
easily determined by the model), lean the model forward and have him or her alternate facial features — anything to stretch or loosen cheeks, mouth, and forehead — until the mask loosens and falls off (into someone’s hands).

After the mold has dried for at least 6 hours, cover the nostril holes. This mold will require some hours to dry completely (generally in the area of 24 to 48 hours depending on the brand of bandage). During the drying process, once it has been removed from the model’s face, the mold will need to be set in something rigid such as a shoebox with fabric or tissue to pad the curves, to retain its shape.

When the mold is completely dry, follow the mixing directions on the Plaster of Paris, cover the inside of the mold with petroleum jelly, then fill the mold at least past the corner of the eye by ¾ to 1 inch. You may fill the mold as much as possible without causing it to overflow. When the plaster is dry (generally 48 or more hours) peel the bandage from the plaster, do not attempt to pull the plaster out or it is likely to crack and fracture. Then, allow the plaster cast to completely dry. (see figure 9). You now have a structure to which you can append clay additions (see figures 10 & 11), over which you can stretch and mold leather, plaster, and felted mask materials. This structure will be used and referred as the “base” in the next several projects unless otherwise stated.
Plaster Cast Methods — Leather Chamois

The first process attempted on this base was a mask produced from leather chamois. In the effort to produce a light-weight leather mask, the chamois was selected for its malleability and stretch. The leather is first soaked, for a minimum of 48 hours. The leather is then placed over the base, and stretched using fingers and a smooth wooden tool (see figure 12). The leather is stretched by repeatedly and gently pushing it into the crevices formed by the mold. Because of the properties of some leathers, when it dries it will retain the shape achieved when wet. After the leather has achieved the shape desired, it must be allowed to dry (see figure 13). This drying can be achieved in either of two ways; if time is not a concern, letting the leather air-dry is completely appropriate; however, if time is an issue, then the leather may also be dried using a heat source. A portable hair dryer works effectively. Once the leather is completely dry you apply a hardening agent. Hat sizing would be recommended, however this attempt was made with glue in the effort to discover at-home products for use. Apply the glue while the leather is still stretched over the base (I used Modge Podge © and a neutral pH adhesive by Lineco, Inc. at full strength). Allow to dry completely then remove from the form.

This process — the use of leather chamois — is again not meant for theatre application. The product is flimsy, too soft, and does not hold its own shape well enough for wear-ability (see figure 14). The mask does not retain the contours of the face; it flattens out and loses form. Although the process could be used to demonstrate beginning techniques of leather stretching, the product is unsuitable for theatre uses.
Plaster Cast Methods —
**Traditional Leather**

The next leather product attempted was traditional leather, approximately 1/8th inch thick. As with the chamois, this leather was soaked for over 48 hours prior to application. The leather was stretched over the same base and molded with the same finger techniques as before. The leather remained too thick and stiff for easy malleability. The next attempt was to stitch the leather across the back of the base, drawing it tight with the stitches. This process was also not responsive enough to produce any viable results. The thicker leather did not respond to cold-water soaking and hand working.

Plaster Cast Methods —
**Various Finishes**

After these adequate but not entirely desirable results, the production method was shifted to working on a plaster mask base and applying various finishes to that base. The base was formed of the same plaster-impregnated bandage material as the mold had been earlier. The bandages were applied to the sculpted face and allowed to dry on the “base” for 15-20 minutes (follow the drying instruction time on the packaging). After the mask base is dry to the touch — it often feels slightly damp or cool as well — it must be carefully pried off the facial base. To complete this step without damaging the face or the mask is tricky and, after several failed attempts, it appears that the best process is that one should pry up the edges of the mask using a slender metal prying tool (a butter knife or a piece of metal boning will do the trick). Once the forehead, cheeks, and areas around the eye are loose from the facial base, the rest will generally lift off easily (see figure 15).

The only major problem with this method is that, more often than not, the clay pieces applied to the facial base will come off in the bandage mask. This is not an issue because the clay pieces can be easily removed from the mask and reattached to the molded base. However, this rough treatment causes the clay pieces to have a shorter life-span. After two or three applications they will need to be replaced by newly molded pieces.

After the bandage mask has been removed from the facial base it must be allowed to dry for an additional 24 hours before any finishing products can be applied. After that drying period has elapsed, it is recommended that the mask be covered with 2-3 layers of gesso (found at any local craft store). This covering will smooth the finish of the mask as well as strengthen it. Once the gesso is dry, the mask-maker can trim the edges of the mask base to refine the shape of the mask. Once this is complete, the mask base is prepared and finishing techniques may be applied. In addition to this finish of gesso, you may choose to provide extra support at the edge of the mask with the use of wire reinforcement (see figure 16). The wire will strengthen the edge without adding bulk or inhibiting the application of finishes. In this process the wire was affixed with Elmers Glue© and held in place by clothes pins until the adhesive dried.

One of the many finishing techniques that can be applied to this construction method is applying paint, antiquing, or another color medium directly to the mask base. In this example the medium used was a brown shoe polish, available in any local shoe store that carries leather dress shoes. This type of finish is
applied by rag or bush, a heavy coat is put on covering the front surface of the mask, then, before the polish begins to dry, excess is wiped away with a rag, which leaves crevices darker and exaggerates the features of the mask. Because the shoe polish dries and clumps rapidly it is best to apply it to small sections of the mask at a time (see figure 17). If applied to the whole mask at once the result tends to appear blotchy and uneven.

The same technique of brushing and wiping is used for the application of antiquing (generally found with ceramic finishing supplies). If possible, allow the polish to dry for 24 hours before applying a fixative. You may use acrylic fixative or a spray lacquer, which can be found in a variety of finishes from matt to super shiny (your choice should depend on the use of the mask; one used in a show with lots of artificial lighting should have a matte finish to decrease light glare; one used in a class-room setting could use a shiny finish to attract more attention — again it will depend on the use of the mask). Spray the mask with the fixative following directions on the packaging, assuring that you have proper ventilation.

Once the lacquer or fixative is dry, you may affix the strap or elastic band to the interior sides of the mask with super-glue, and adhesive tape for single uses, or by applying more of the plaster bandage over the straps to imbed them in the mask. If the plaster bandage is crumbling around the edges of the mask, you may want to finish the edges with either a wax seal or simple glue seal. Just spread the seal with your fingers around the edge of the mask and it reduces the crumbling.

Because the original (16th century) masks where made almost solely out of hardened leather, this modern method produces a somewhat stylized mask (see figure 18), however, even that stylization suits the overall style of most commedia pieces because it is not unlike a painted leather mask. Also, with this method the characteristics of characters may be even more exaggerated by the use of color and texture on the mask. This process does create a very textural mask that would be inappropriate for more glamorous occasions, unless deeply finished with gesso or sanding until the texture was removed. It is still somewhat fragile, but is definitely capable of withstanding two weeks (possibly longer) of the run of a show with careful handling. As with all hand-made accessories, proper care must be maintained to ensure the safety of the piece.
Plaster Cast Methods — Fabric Finishes

The next technique includes the affixing of a fabric to the surface of the bandage mask. Choice of fabric is integral in this method, because different fabrics have positive and negative traits with regard to stiffness, stretch, texture, and weave. The desired fabric should be thin enough to not over-fill the creases of the mask-face; stretchy so that it can be pulled taut around the mask; have a texture that enhances the look of the mask, rather than detracting from it; and have a weave that does not interfere with the wrapping of the mask, nor how the fabric fits into the grooves of the mask-face.

Once the fabric has been selected, it is time for the application. Before applying the fabric to the whole face, take several small scraps and glue them to the edges of the eye-holes, this is to prevent the mask-base from showing through because when you poke out the eyes, the fabric will not overlap, but rather it will spread apart. It is simpler to cover the edges before applying the fabric. Once these areas are dry you may move on to the over-all fabric covering. The mask base will first be covered with a thin layer of clear-drying glue (again, I used Elmers Glue® for the attachment and Modge Podge® for a stiffening agent). The layer should be thin enough so that it does not soak through the fabric but thick enough to ensure that the fabric will remain affixed. The glue may be applied by hand or with a brush, but it must evenly coat the front of the mask base. Once the glue has become tacky (immediately for glues such as Elmers®, longer for slower drying glues), lay the fabric over the mask — ensure that you have over an inch excess on each edge — and press down into the crevices with fingers (see figure 19). Avoiding excess glue is important, because if it soaks through the fabric, it will bond to the fingertips during this step, and the fabric will pull away from the mask base. Allow the glue to dry completely.

Next, wrap the excess fabric around to the back of the mask, gluing it along the edge to prevent the mask base from crumbling as well as to avoid fraying of the fabric. When necessary, you may slit the fabric up to the edge of the mask, so that the overlap may lie over itself gently. The main trouble spot in this step is near the nose (if the nose has nostrils attached) when the fabric is slit (as in the eye holes) it will spread apart rather than overlap. This spreading can be a serious issue if your chosen fabric does not blend easily together, so avoid recognizably patterned fabrics and all those with prints when first attempting this process. If you slit

Figure 19: Beginning faux-leather fabric covering
the fabric near the nostrils and see that it is beginning to spread, cut another scrap and place it under the slit, covering the exposed area, then continue gluing. 
In gluing, you may find it necessary to temporarily hold the fabric down while the glue dries, binder-clips or clothes pins are useful, if used not directly touching anything soaked with glue, and carefully applied so that they do not crumble the edge of the base. Once the fabric has dried around the edges of the mask, open the eyes of your mask by slitting the fabric covering them and gluing down the edges as before. When this step is complete, you may affix an elastic band or straps by sewing them on. This can be achieved by drilling small holes through the edge of the mask and sewing through the holes. Be careful not to drill too near the edge or it will crumble.

With this method, the first fabric attempted was a velveteen cloth (see figure 20), although being admirably suited because it was soft, stretchy, and malleable, the fabric resulted in an undesirable product, because the “heaviness” of the texture made the lines and creases in the mask undetectable. Although the mask is aesthetically pleasing, the luster of this fabric causes most of the detailing wrinkles to be lost. This result is undesirable for theatre use but might be acceptable for costume parties in which the mask is closer to the audience.

The second fabric attempted was a faux-leather mottled and thin fabric (see figure 21). It filled all the requirements being stretchy, thin, malleable, and the texture did not distract but rather enhanced the look of the finished piece. Although this fabric does not entirely mimic leather, it gives the impression of a leather product, while adding a texture not present in real leather. Another positive aspect of this fabric is that it does not ravel easily and, therefore, concern about the edges unraveling is minimal for the course of one production.
Conclusion

The fabric-covered plaster mask appears to be the most adaptable to theatre use. Covered with the faux-leather fabric it had the most appealing look. It was also the best combination of durability and weight. This article contains a number of methods for mask construction; at least one should be suitable for whatever requirements you may need. Most of the methods can be altered to suit other environments, such as teaching or outdoor theatre with little modification. Some methods were found to be more suited as teaching aides, while others appear to fulfill the requirements of active stage use. The coupling of research with technique is required when one is searching for new ways to produce replicas of older articles, and that research is also bound to give researchers ideas on how known techniques can be adapted to apply to their avenue of application.

Acknowledgements

I would like to give thanks first to Nelson Fields, my faculty mentor for this project. Without his support I would not have completed the task I set myself. He is truly an inspiration. Also thanks to Robert Haven for making me aware that I was capable of this kind of work, and to Rhoda Gale-Pollack for having piqued my interest in ancient masks and mask-making. Beth Daniels for being my mold-model (even if she couldn’t stop talking which resulted in my mold having no defined lips), and Jason Lambert for helping with some of the photography and whatever else I needed. Special thanks to my mother for starting my interest in sewing and everything creative. Also, the entire Theatre Department at the University of Kentucky has contributed to my interest and ability for these projects. Thanks to all. And especially thanks to everyone who continues to believe in me.

Works Cited


Every top-twenty university has, as a fundamental component, an outstanding undergraduate program. At the University of Kentucky, The Chellgren Center for Undergraduate Excellence is not only the symbol, but the embodiment, of its commitment to the finest undergraduate education. The Chellgren Center embraces a comprehensive array of teaching and research programs, professors, and services designed to enhance, develop, foster, and deliver the exceptional undergraduate experience that is one of the major components of the University’s mission.

**Chellgren Fellows Program**

The Chellgren Fellows Program is for students with exceptional academic potential and aspirations who are eager to participate in a special learning community designed to cultivate extraordinary achievement. Chellgren Fellows (Chellos) are students who have the potential not only to excel at UK but also to compete successfully for the highest honors and awards within and outside of the University. The learning community consists of the collaborative interactions among students, faculty, and staff that create an intellectually stimulating environment, nurture high academic aspirations, and foster scholarly and personal development reflective of undergraduate excellence. Each spring, a new class of Chellgren Undergraduate Fellows is selected, while returning fellows serve as models and mentors to incoming fellows. Each fall, the newly selected Chellos engage in a major scholarly creative or research project under the mentorship of a faculty member, and take a course in Methods of Scholarly Inquiry in which they learn and employ advanced techniques in their own projects.

**Mentoring**

Outstanding faculty from across campus serve as individual mentors for the Chellos as they engage in their scholarly projects. Through regular meetings and conversations, mentors help students develop strategies for engaging in the intellectual life of the University with an emphasis on opportunities available to them both within and outside the UK community, such as service learning experiences, internships, education abroad, undergraduate research, community service, and leadership opportunities. Mentors may elect to invite students to participate in sessions with their graduate students, attend lab meetings, review and discuss papers or projects being planned, and attend scholarly talks. Mentors help Chellos identify external scholarship opportunities and assist them in preparing applications and developing skills used to acquire these awards (e.g., writing personal statements, successful interviewing).

**The Chellgren Center Community Experience**

The learning community consists of Fellows, faculty mentors, and professional staff affiliated with the Chellgren Center for Undergraduate Excellence, all working together to make the Chellos’ undergraduate experience one of an exceptionally high standard.

Chellos are expected to attend regular meetings with mentors and peers, as well as other pertinent events organized by the Center such as lectures at local colleges and universities, musical performances on and off campus, and art exhibits. At regularly scheduled meetings, Chellos learn about special educational programs and opportunities such as undergraduate research experiences, education abroad, internships, and volunteer activities.

**The Chellgren Fellows Service Learning Project**

To help extend learning to the real world and foster responsible citizenship, each Chellgren Fellow participates in an annual service learning project or projects designed by the Fellows themselves with guidance from faculty affiliated with the Chellgren Center.

**Selection Process and Timeline**

Chellos are accepted through a competitive application process. Students are eligible to apply to the program after their first semester at UK. Applicants must have a 3.75 GPA or above. A committee of faculty evaluates and selects Chellos based on the following criteria:

- Academic credentials and extracurricular activities from junior year in high school
- Academic performance at UK (GPA, course selections, extracurricular activities)
- Essays completed as part of the application
- Letters of recommendation
Chellgren Center Highlights from 2008-2009

On the following pages, several of the highlights of Chellgren Center-associated programs during the previous academic year are described. First, members of the third cohort of Chellgren Undergraduate Fellows provide abstracts of their scholarly inquiries. Then, students from several eUreKa! programs relate their research, including the Beckman Scholars Program, the summer research and creativity awards, support for undergraduate travel to scholarly conferences, and the Oswald Research and Creativity Program. Finally, a gallery of images from the fourth annual UK Showcase of Scholars, an event sponsored by the UK student Society for the Promotion of Undergraduate Research (S.P.U.R.), is presented.

Paul W. Chellgren

The benefactors of the Chellgren Center for Undergraduate Excellence are Paul W. Chellgren and his family. A UK graduate, Mr. Chellgren was an Honors Program student, a star intercollegiate debater, and President of the Student Body his senior year. He subsequently earned a Harvard MBA and a D.D.E. from Oxford University, where he has been named an Honorary Fellow. In addition to a celebrated career in business, one that included service as the CEO of Ashland Inc., Mr. Chellgren has been an active UK alumnus, having served for eleven years on the UK Board of Trustees. With the generous gift from Mr. Chellgren and his family, the University of Kentucky established the Chellgren Center for Undergraduate Excellence.
he Beckman Scholars Program, established in 1997, is an invited program for accredited universities and four-year colleges in the US. It provides scholarships that contribute significantly to advancing the education, research training and personal development of select students in chemistry, biochemistry, and the biological and medical sciences. The sustained, in-depth undergraduate research experiences and comprehensive faculty mentoring are unique in terms of program scope, content and level of scholarship awards. The University of Kentucky has been invited to apply for the program three times, and was selected to participate for three years beginning in 2002, in 2005, and again in 2008. We will reapply in the fall for another scholarship through 2011-2014.

The Beckman Scholars Program provides support for no more than three outstanding undergraduate researchers per year. Scholars receive support for two summers and the intervening academic year, including a generous scholarship award plus stipends for supplies and travel. Scholars must conduct their research in chemistry, biochemistry, the biological and medical sciences, or some interdisciplinary combination of these disciplines, in the laboratory of and under the mentorship of a University of Kentucky faculty member approved by the Beckman Foundation. The currently approved Beckman mentors are listed below.

Being named a Beckman Scholar is an extraordinarily high honor. The process by which a scholar is selected is quite rigorous. The selection is conducted by a committee of research faculty members each with a strong record of mentoring undergraduate researchers. The selection process evaluates 1) the ability of the candidate in both written and oral communication by considering a required research essay and conducting an interview of each finalist; 2) the past achievements of the candidate by reviewing the entire undergraduate transcript, academic honors received, and all previous research experience; 3) the candidate's intellect, character, and potential to excel as a researcher by appraising a required written research plan and at least three letters of support from current and prospective faculty mentors and 4) the candidate's potential for a career in research by evaluating a required written statement of educational and career plans.

To apply to become a Beckman Scholar, a student must be a sophomore or junior at the University of Kentucky, majoring in Chemistry, Biology, or a closely related discipline (such as chemical engineering or agricultural biotechnology), and have already completed at least one semester of research experience.

The Beckman Scholars for the year 2008-2009 were Clay Turner (mentored by Professor Robin Cooper) and Lesley Mann (mentored by Professor Christopher Schardl). The Beckman Scholars for the year 2009-2010 are Laura Crawford (mentored by Professor Diane Snow), Jessica Houtz (mentored by Dr. Karyn Esser and Bruce O'Hara) and Marti Robinson (mentored by Professor Robin Cooper). In the following articles, the 2008-2009 Scholars explain and discuss their research.

For more information on the Beckman Scholars Program at the University of Kentucky, visit www.uky.edu/beckman.

### Approved Beckman Mentors

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During my senior year of high school, when I really began considering my college options, I began discriminating based on opportunities to be involved in active research. UK convinced me that they had ample exciting projects that I would be welcome to join even as a lower-classman. This persuaded me to join the incoming class in 2006 as a Singletary Scholar. In the second semester of my freshman year I did a study of DNA stability in the presence of nicotine under Dr. Stephen Testa for BIO 395 credit. This initial research experience led me to search for a more permanent research placement.

The Office of eUreKa! informed me of various opportunities, including the Beckman Scholarship Program, which immediately became a personal goal. After reading about the research programs of all the Beckman approved mentors, I felt naturally drawn to Dr. Christopher Schardl’s outstanding work. I asked to join his lab in the Plant Pathology department, and he generously took me in with virtually no knowledge of the subject. My brain was a sponge that first summer, and in many ways those 8 weeks transformed me into a scholar. Troubleshooting, hypothesizing, and designing experiments changed my view of science and the way I approached my education and problems. I have worked year-round in the Schardl lab ever since then, and received the Beckman Scholarship to support my independent research at the end of my sophomore year.

Research under the Beckman scholarship has advanced my education further than any other component of my experience at the University of Kentucky. Classes are an integral part of an education, but they became exponentially more enriching for me when the knowledge I was gaining became real tools for the lab, not just test material. This experience has also allowed me to build a priceless relationship my mentor, from which I have benefitted disproportionately more. Dr. Schardl is the true reason I am a Beckman and Goldwater scholar and his confidence in me has encouraged me to apply for things I have found daunting and ultimately has led to some of my best experiences.

Under Dr. Schardl’s mentorship, I have been studying studying the Lolium pratense - Epichloë festucae symbiotum, which is a model system for symbioses of Epichloë and Neotyphodium species (endophytes) with C3 grasses. These endophytic relationships are of great significance in agriculture because the endophyte provides grazing grasses with increased drought tolerance but can also be toxic to grazing animals as a result of the alkaloids it produces. My work is aimed at studying genes involved in disease development versus benign plant colonization, with particular attention on seed transmissibility of the fungus. I began by studying the gene expression profiles of several secreted fungal proteins in various tissues of the plant using RT-qPCR (Real Time Quantitative Polymerase Chain Reaction). I am doing an in symbio localization study on the genes I found to have intriguing expression patterns. This genes, with their native promoters, have been cloned int expression vectors to generate C-terminal translational fusions with an autoflorescent protein, and introduced into E. festucae. Meadow fescue has been inoculated with my transformants to observe the expression of these genes via confocal fluorescent microscopy. I am currently visualizing vegetative parts of the grass, the goal of my Beckman project, and hope to observe the stromata and inflorescences next summer when they are produced.

With the financial support of Beckman, I have been able to present my work at the Fungal Genetics Conference in Asilomar, CA, the BioSysBio conference in Cambridge, England, the National Conference on Undergraduate Research in La Crosse, Wisconsin, the Kentucky Academy of Sciences in Lexington, Posters-at-the-Capitol in Frankfort, KY, and the Showcase of Undergraduate Scholars at UK. Currently, I am preparing to present at my final conferences as a Beckman scholar, Plant Biology in Honolulu, HI and the Beckman Symposium in Irvine, CA. Presenting at these conferences has allowed me to become a better scientific communicator and has given me the thrill of being in the middle of knowledge creation. Most importantly though, I have been able to meet successful researchers in my field, developing connections that I know I will call upon later.

I have one more year at UK but will be studying abroad in England in the fall, so my tenure at the Schardl lab will be ending in a few weeks when I leave for the Plant Biology conference. As heartbreaking as it will be to clear off my bench and say goodbye to my friends in my lab, I will be leaving as a better person, scholar and researcher, with more and better opportunities awaiting me than I had even considered when I began my stay here. I will be applying for top-ranking PhD programs in Plant Sciences this fall and feel apt candidate for this next step toward my career as a research scientist. For this, I have the Schardl lab and the Beckman Scholarship to thank.
All through my middle and high school educations my lab courses interested me. I was fascinated by the discovery and the hands-on engagement in the process. My junior year of high school I contacted Dr. Cooper at the University of Kentucky and this began my research career. My three years at UK have only nurtured my passion for research. Dr. Cooper, along with programs like EUreKa, gave me numerous opportunities as an undergraduate researcher. The Beckman Scholarship only furthered my research experience by providing me with funds to attend conferences and fund my experiment.

Dr Cooper has always told me that research is worthless if it is not shared. After attending the Beckman Symposium in July, I am not only confident that Dr. Beckman would agree with this philosophy, but I would go on to say that this is the essence of the Beckman scholarship. His generous award has enabled me to travel to research conferences both here and abroad. This has not only benefited my current research project, but has exposed me to cutting-edge research from around the world, increasing my perspective as a researcher and motivating me for a career in a research field.

Thus far, my research has been investigating the function of dopamine using pharmacologic methods. Since the larval development cycle is understood and is well established, I first wanted to assess the effects of AMVT on this process. I administered the larvae AMVT at the second instar stage, or the phase about two days following the laying of the egg. Since there has not been any literature published where larvae were administered AMVT before the final development stage, I had to develop an appropriate method. It is crucial to feed the larvae AMVT as early as possible so that developmental impacts can be assessed. Using similar methods as my previous study investigating serotonin, I began feeding the larvae at the first instar stage, right after the egg hatched [Desari, Turner et al 2007]. In preliminary studies, I found that AMVT was extremely lethal at the first instar phase, but the larvae were more tolerant at the next stage of development. Each larva was monitored every four hours individually for time from egg to pupation and from pupation to eclosion. A difference was not noted in either developmental time frame for larvae fed AMVT at any of three concentrations compared to controls. Next, I investigated the effect of AMVT on behavior. Larvae fed AMVT were seen to have decreased mouth hook movements, the larval eating behavior, as well as decreased body wall movements, the larval locomotive behavior, in a decreasing dose response fashion. Adults fed AMVT from early eclosion demonstrated a decreased locomotive behavior also in a dose dependent manner. This study is particularly meaningful to me since locomotive struggles are characteristic of Parkinson’s disease. Stress tests reveal that adults fed AMVT have a decreased tolerance for a heat stress than do adult controls; however, larvae have an increased survival when fed AMVT in the heat stress environment when compared to larvae fed AMVT in room temperature. This could be due to the well understood fact that larvae develop at a faster rate as temperature increases. It could be possible that the larvae in the heat stress environment reached pupation before the drug could induce its lethal effects. Tolerance to different stressors, such as a vortex, will be investigated.
On April 29, 2009, The Office of Undergraduate Research and Creativity/eUreKa! and SPUR (the Society for the Promotion of Undergraduate Research, UK’s undergraduate research organization) presented the fourth annual Undergraduate Showcase of Scholars, organized and run primarily by students. All of the refreshments were prepared and served by a senior class of undergraduates in nutrition and food services, and a bound volume of abstracts was prepared and distributed by SPUR. Over 120 students made poster presentations, approximately 20 students gave oral presentations, and the UK Jazz Ensemble performed.

A number of students who participated as presenters at the Showcase have articles or abstracts published in this issue of Kaleidoscope. The gallery below includes scenes from the Showcase. An extended version of the gallery is available in the on-line edition of the journal at www.uky.edu/kaleidoscope.
Office of Undergraduate Research and Creativity/eUreKa!

eUreKa! (Experiences in Undergraduate Research and Kreative Activities) is one of the units comprising the Chellgren Center for Undergraduate Excellence. The purpose of eUreKa! is to provide coordination and leadership for the many programs designed to encourage and support undergraduate research, scholarship, and creativity at the University of Kentucky. When united, these programs benefit from the symbiosis of cooperation, and the University receives strengthened programs and more efficient administration.

eUreKa! includes the following programs:
- Kaleidoscope
- The NSF-funded AMSTEMM program (see www.uky.edu/amstemmm)
- The Beckman Scholars program
- The Showcase of Undergraduate Scholars
- The “Posters-at-the-Capitol” program
- The Undergraduate Research and Travel Support program
- The Summer Research and Creativity Awards program
- The Oswald Research and Creativity Awards
- SPUR (the Society for the Promotion of Undergraduate Research) student organization
- The UK Undergraduate Research Program (UK URP)
- The “Bucks for Brains” summer research mentorship
- Coordination with recruitment of faculty and undergraduate students having an interest in research, scholarship, and creative activities.

Each of these programs provides students with special opportunities and support for extended scholarly experiences, beyond the classroom. A number of students who have participated in these programs are represented on the following pages. For more information about eUreKa! and its programs, please visit www.uky.edu/eureka.
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. Fieldwork 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 a 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,
or soil turnover rate, of the soil for each location. Higher slopes on this chart correspond to higher decomposition rates. The highest rates will be found in Big Everage, and the lowest rate is expected to be found at 0-year reclamation sites. Afterwards, a plot of \( \delta^{13}C \) vs. time (in years) will be created for each depth interval. These two graphs will be combined to obtain TOC vs. time at each depth interval. Summing each of these graphs will result in one graph representing TOC vs. time. The integral of this graph from 0 to time \( t \) will be equal to the uptake of carbon into the soil after reclamation until \( t \). The resulting value will have units corresponding to [kgC yr\(^{-1}\)m\(^{-2}\)]. This number can be expanded using an area analysis of surface mining in the SAFR to represent kilograms of carbon absorbed into the soil per year.

Previously published data of terrestrial carbon pools will be used to complete the carbon cycle for this process. An estimate will be made for the SAFR. The removal of this carbon before mining will need to be quantified in order to make comparisons with the carbon recovery model.

A “static” model will be employed in this study. It is possible to predict and quantify the restoration of terrestrial carbon into the soil in the SAFR. This does not take into effect that as time progresses and this carbon is uptaken from the atmosphere, more land is being cleared in preparation for surface mining and, therefore, more carbon is being released into the atmosphere. A dynamic model capable of accounting for the growth and continuation of surface mining would be required.

**Expected Results**

The plots of \( \delta^{13}C \) vs. time and TOC vs. time is expected to approach the base line data, being Big Everage. This assumption will help construct the plots.

Due to the nature of reclaimed soil, it is not expected that the model will display TOC reaching forested levels for the reclaimed sites. In other words, the timeframe in which this process occurs is expected to be unreasonably large. This, however, is the goal. With this result in hand, recommendations on more effective reclamation processes that account for the carbon loss to the atmosphere can be made. A faster recovery rate of the soil carbon would be desired.

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**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.

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**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 intact 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

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 106ºF) 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 lignocellulosics, 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 Shugn project. Shugn 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 Shugn. This information consists of raw data such as the audio of elicitations from native speakers, and analyses such as the database of the Shugn 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. Hippisley 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
Summer Research and Creativity Grants (CONT.)

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 main stream media. In 2008, Ricky Lake and Abby Epstein premiered their documentary film, *Shifting Women from the Center*.
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 legitimation. 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.
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>
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<td>1.58</td>
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<td>1.24</td>
<td>1.45</td>
<td>1.48</td>
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<tr>
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<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>
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</table>

Table 2: Four pools with 8 females and their mass

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<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>
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<td>4</td>
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<td>1.71</td>
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<td>1.7225</td>
<td>1.71375</td>
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</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 of 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-laforin 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-lafortin 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-lafortin 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-lafortin 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 Sérusier, 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...
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...
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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 greenhouse 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 colonization. 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.

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:
important than public exposure. As palace plans illustrate, the library’s restored rooms and its ornamented entrance were situated along a primary route through the palace, a route followed by heads of state, ambassadors, humanists, and artists. In fact, Platina himself praised the library for being in a “much frequented space.”

If the plans alone imply more than practical concerns in the library project, then Sixtus’ appointment of Platina — the leading humanist in Rome and a vociferous enemy of the previous pope, Paul II (1464-71) — to the position of bibliotecarius verifies the possibility. Contrasting Sixtus’ background as a theologian and considering previous humanist libraries, it seems more likely that the project for the papal library was as much a political endeavor as a scholastic one, intimately connecting humanist considerations with those affecting papal image. Among Sixtus’ many building projects, the library alone was able to ensure an alliance with the Roman humanists, given its unique capacity to redefine the pope as an enlightened ruler, the papacy as a position requiring secular and theological leadership, and Rome as a cultured center hospitable to the learned.

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 NF-κB

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 NF-κB mechanism that activates inflammation and prolongs its existence. This pathway is important to the survival and strength of many cancers and autoimmune diseases.

The NF-κB 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 NF-κB. The activation of NF-κB 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 NF-κB 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 NF-κB 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 IκB-α. IκB-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. IκB-α is recognized, ubiquitinated, and subsequently degraded by the proteasome. This action causes the disassociation of IκB-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 IκB-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 IκB-α is being phosphorylated. There is also a delay in which p50 and p65 form a dimer (two proteins complexed to one another that share DNA) 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) preterm 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 etch tracks, 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**

**Brett Nolan**

**What Racial Barriers Still Exist**

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,
Summer Research and Creativity Grants (CONT.)

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 ¼ 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 concreteness 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 McCravy, 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**


**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
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 a 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 (Tidsdale 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
**Growth and Evolution of Catalysts on Graphene**

**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 repeated this process 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 CeO₂ 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 Haridas, 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 gryi.” (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 Control and MCI brain.

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 Argentinians 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 Argentinian 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 healthcare 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.
Undergraduate Research and Travel Fund

eUreKa! offers undergraduate students travel support. The purpose of this support is to help students gain experience in showcasing their work at and participating in professional conferences on a national and sometimes international level. Keep in mind that research takes place in many different forms and in all disciplines: the study of social problems, the creation of a piece of fiction or poetry, the study of a scientific theory or historic period of time, and the solution of engineering and mathematical problems all qualify as research, among many other activities.

Students may apply for travel support to attend national or international professional conferences or competitions. To be eligible, a student must:
• be a full-time undergraduate student at the University of Kentucky
• have a faculty sponsor
• be registered for the conference or competition
• present (i.e., paper, poster, research, performance) and/or participate (orally)

During 2008-09, the Undergraduate Research and Travel Fund provided support to 20 undergraduates attending 19 different conferences and competitions. The students, 15 females and 5 males, were from 12 different departments in six different colleges, and ranged from first- to fourth-year students, demonstrating the ubiquity of scholarly inquiry at UK. This year, students traveled to conferences and competitions in Kentucky, California, Florida, Georgia, Louisiana, Maryland, Missouri, New Mexico, Tennessee, Texas, Washington D.C., and Canada.

In addition to these students, eUreKa! supported 33 students who were accepted to present their research at the National Conference on Undergraduate Research (NCUR). NCUR is an annual conference of approximately 2,000 undergraduate scholars who are selected competitively from among several thousand applicants. UK students have traditionally been highly successful in being chosen, compared to other peer research institutions, and eUreKa! is proud to be able to support those who attend. Several of the projects reported elsewhere in this volume of Kaleidoscope were presented at NCUR this year.
Alex Harmon Performing on the opening day of the Percussive Arts Society International Convention with a quartet from the University’s Percussion Department. Alex was the only undergraduate performer representing UK within the assembly and at the entire conference.
Undergraduate Awards and Honors

Astronaut Scholarship for Research 2009-2010
Samuel Niciase
Samuel Niciase, Electrical Engineering student, was awarded a $10,000 scholarship by the Astronaut Scholarship Foundation (ASF). The scholarship is presented to dynamic undergraduates or graduate students who exhibit innovation, imagination, and exceptional performance in the fields of science and engineering. ASF honors students whose talent foreshadows a career leading to advancement of scientific knowledge and technology. Established by the original astronauts in 1984, the foundation has gone on to include more than 50 astronauts from the Gemini, Apollo, and Shuttle programs. The foundation is dedicated to helping the U.S. retain its world leadership in science and technology by providing scholarships to students pursuing careers in those fields.

Beckman Scholarship Recipients for 2009-2010
Laura Crawford
Jessica Houtz
Marti Robinson
Crawford, a junior from Corbin, Ky., majoring in agricultural biotechnology, is performing her project under the mentorship of Diane Snow, professor and researcher in the Spinal Cord and Brain Injury Research Center in the UK College of Medicine. Crawford is also a Singletary Scholar, Chellgren Fellow, peer mentor for UK AMSTEMM, and member of the UK Society for the Promotion of Undergraduate Research (SPUR).

Jessica Houtz
Marti Robinson
Houtz, a junior majoring in agricultural biotechnology from Lexington, Ky., will perform her research under the mentorship of professors Karyn Esser, in the Department of Physiology in the College of Medicine; and Bruce O’Hara, in the Department of Physiology in the College of Medicine. Houtz is also a Singletary Scholar, Chellgren Fellow, peer mentor for UK AMSTEMM, and member of the UK Society for the Promotion of Undergraduate Research (SPUR).

Marti Robinson

Goldwater Scholarship
The Barry M. Goldwater Scholarship and Excellence in Education Foundation operates an educational scholarship program designed to provide opportunities for American undergraduate students with excellent academic records and outstanding potential. Goldwater Scholarships support study in the fields of mathematics, engineering and the natural sciences as preparation for careers in these areas.

Lesley Mann
Mann is a junior majoring in agricultural biotechnology and has been very involved in undergraduate research since arriving on campus her freshman year and currently is doing research as part of the UK Department of Plant Pathology in the College of Agriculture. She is a member of the Honors Program and president of the Society for the Promotion of Undergraduate Research (SPUR), where she works to ensure other undergraduates obtain valuable research experience in their area of studies at the university. In addition, she serves as a biochemistry tutor. Upon graduation, Mann plans to pursue a doctoral degree in plant sciences. She would like to conduct research contributing to sustainable agriculture and teach at the university level.

Tom Dodson
Dodson, a senior, is among the many potential scholars studying more than one major at their university. A Henry Clay High School alumnus, Dodson is currently majoring in computer science, computer engineering and physics at UK. He also is pursuing a minor in mathematics, and considering additional minors in biology and linguistics. During his time at UK, Dodson has done undergraduate research at UK’s Space Systems Laboratory under the direction of James E. Lumph Jr., an associate professor in the Department of Electrical and Computer Engineering. He also has previous research experience in the Department of Computer Science where he worked under the direction of Professor Judy Goldsmith. Both these research opportunities were through the UK College of Engineering.

Jack Kent Cooke Scholarship
Kayla Rae Whitaker
2009 Recipient
The scholars are chosen from a nationwide selection process that draws approximately 1,000 nominees from across the country. Each scholarship is worth up to $300,000 ($50,000 per year for a maximum of six years), which is among the largest scholarships offered in the United States. The value and duration of each scholarship varies based on the cost of attendance or other grants each student receives. Each university is allowed to nominate only two students for the award. Whitaker will use the scholarship to pursue her passion for writing as she works toward a master’s degree.

National Leadership Council
Brittany Martin
2009-2010 National Leadership Council
The council is a leadership opportunity offered by the National Society of Collegiate Scholars, an honor society inviting freshmen and sophomores. Martin is a junior majoring in psychology and social work.

2009 Chellgren Fellows
The Chellgren Fellows Program is for students with exceptional academic potential and aspirations, who are eager to participate in a special learning community designed to cultivate extraordinary achievement.

Elizabeth Dunn
Philip Houtz
Allison McVey
Shady El-Maraghi
Jun Huang
Kristyn Mickley
Lindsey Elza
Matthew Hufford
Deepa Patel
Laura Feder
Adesuwa Ighodaro
Megan Schultz
Lisa Fioretti
Sidrah Khan
Zachary Willand
Amber Gay
Andrea Lowe
Fei Xiong
Eric Gilland
Courtney Lynch
Alyssa Yson
Kathryn Clair
Courtney Lynch
Gaines Scholars
Gaines Fellowship Program for the 2009-10 and 2010-11 academic years

Ben Barnes, James Chapman, Kit Donohue, Jason Grant, Nazeeha Jawahir, Bailey Johnson, Rachel Keller, Christina Kuchle, Jonathan Laurel, Raven Newberry, Katherine Reynolds, Stephanie Straub

Gaines Fellowships are given in recognition of students' outstanding academic performance, demonstrated ability to conduct independent research, interest in public issues, and desire to enhance understanding of the human condition through the humanities. Fellowships are awarded for the tenure of a student's junior and senior years, or for the last two years of a five-year program; students in all disciplines and with any intended profession are given equal consideration. The Gaines Fellowships carry a stipend of $2,000 in the junior year and $3,000 in the senior year.

COLLEGE OF AGRICULTURE

Ali Cibon
2009 Intercollegiate Horse Show Association (IHSA) Championships Monetary award given to the highest achieving Biosystems & AG Engineering Student

Cibon, an agricultural economics major from just outside of Chicago, earned an individual national championship in intermediate equitation over fences at the 2009 Intercollegiate Horse Show Association (IHSA) Championships in Murfreesboro, TN. UK was selected as reserve national champion in the Hunt Horse Show Association (IHSA) Championships Monetary award given to the highest achieving Biosystems & AG Engineering Student. Ali Cibon

COLLEGE OF ARTS & SCIENCES

Ben Barnes  American Physiological Society Undergraduate Summer Research Fellow recipient

Ben Barnes, an undergraduate student in the College of Arts & Sciences and a topical studies major with a focus on aging and gerontology, was announced as a 2009 American Physiological Society Undergraduate Research Fellow. Barnes’ academic advisor is Esther Dupont-Versteegden, an associate professor in the Division of Physical Therapy. Fellowship winners spend the summer in the laboratory of an established scientist and APS member. Now in its 10th year, this program aims to excite and encourage students about careers in biomedical research.

Aun Ali Munis  Sullivan Awards for and Corinne Keel  Commitment to Community Service

Two seniors, Aun Ali Munis and Corinne Keel, received the 2009 Algernon Sydney Sullivan Medallions. The Sullivan Medallion recognizes students whose commitment to community service shows characteristics of heart, mind, and conduct that evince a spirit of love for and helpfulness to other men and women. Munis, president of the Muslim Student Association, was chosen for his leadership of fundraising events on behalf of the Catholic Action Center, a shelter for homeless men, women and children. A member of the Phi Delta Theta fraternity, Munis also helped plan and organize events to raise funds for Lexington’s ALS Foundation and Service for Sight. He has also performed volunteer work with the St. Joseph Surgery on Sunday Program, UK DanceBlue and Habitat for Humanity.

Keel served as a member of AmeriCorps for a year between high school and enrolling in college, assisting in a variety of projects in West Virginia and Virginia. At UK, she was active in the local and campus communities, serving as a teaching assistant for Booker T. Washington Elementary School students and as an invited conference delegate and regular volunteer for UK’s Students Educating and Empowering to Develop Safety (SEEDS) program. Keel also has served as president of UK’s Gay Straight Alliance, and served as a mentor for the Gaines Fellows program to develop an online resource for Lexington residents who suffer from HIV and AIDS.

COLLEGE OF BUSINESS & ECONOMICS

Hammad Khan  Adelstein Award

The Adelstein Award is named for the late Carole S. Adelstein, wife of retired UK English professor Michael Adelstein. Carol, who used a wheelchair because of polio, was an inspiration to persons with disabilities by leading a meaningful, successful life at a time when individuals with disabilities were not encouraged to be independent and contributing members of society. The Adelstein Award is given by the UK Disability Resource Center to students with disabilities who are inspirations to others. Hammad Khan, who is visually impaired, is a communications senior who wants to pursue a law degree after graduation. He is a diligent and hard worker, being continuously active on and around campus.

COLLEGE OF DESIGN

Rebekah Schaberg  Association of Woodworking Furnishings and Suppliers’ (AWFS) national Fresh Wood competition first place winner

The biennial furniture competition is held as part of the AWFS*Fair, an international trade show featuring all products and supplies for the woodworking industry that brings together the entire home and commercial furnishings industry, including manufacturers and distributors of machinery, hardware, lumber, construction materials and other suppliers to the furniture makers, cabinet manufacturers and custom woodworkers.

COLLEGE OF ENGINEERING

UK Solar Car Team  Formula Sun Grand Prix, UK Team placed 2nd

13 members of the UK Solar Car Team made the trip

The UK Solar Car Team placed 2nd at the Formula Sun Grand Prix at Motorsport Ranch in Cresson, Texas. The UK car, Gato Del Sol III, completed 393 laps over three days, with its fastest lap timed at two minutes, 33 seconds. Thirteen members of the UK Solar Car Team made the trip; all are students in the UK College of Engineering.

UK Solar Decathlon Team  2009 U.S. Department of Energy Solar Decathlon 9th Place

For three weeks in October 2009, the U.S. Department of Energy hosted the Solar Decathlon—a competition in which 20 teams of college and university students compete to design, build, and operate the most attractive, effective, and energy-efficient solar-powered house. UK’s team developed its Simple, Modular, Affordable, Renewable, Transportable, Building Living, Understanding, Energy-efficient, and Sustainability or SMART BLUES House for the competition (and took 9th place).
16 students from the Dept. of Mechanical Engineering participated in the University Open – first place receiving an additional $5,000 cash award and second place receiving $2,500 cash award. The awards include full UK undergraduate (tuition) scholarships with flight handling qualities and practical and affordable manufacturing requirements while providing a high vehicle performance.

**UK Chemical Engineering Students**

Named an outstanding chapter for 26th consecutive year at the November 2008 AICHE Centennial Meeting.

The University of Kentucky’s American Institute of Chemical Engineers (AIChE) student chapter was very active in the annual meeting and centennial celebration in Philadelphia, PA. Twenty-six undergraduates attended this meeting and participated in the wide variety of events. The UK AIChE student chapter was honored as an outstanding chapter. Each year, only about 10% of student chapters receive that designation. The Chapter received this national award for the 26th year in a row.

**COLLEGE OF FINE ARTS**

**1st Place - Elizabeth Maurey**

**Youth Vocal Competition**

From its beginning in Indiana in 1992, the William E. Schmidt Foundation has sought to find and nurture high school singers through the Schmidt Youth Vocal Competition. The competition was established to encourage and nurture the pursuits of young people in the arts.

**1st Place - Elizabeth Maurey**

**The Alltech Opera Scholarship Competition**

**2nd Place - Keymon Murrah**

Undergraduates vied for two awards presented by UK Opera Theatre and Bryant’s Rent-All. The awards include full UK undergraduate (tuition) scholarships with first place receiving an additional $5,000 cash award and second place receiving an additional $2,500 cash award. Elizabeth Maurey is a soprano from Brazil, Indiana. As a junior, Maurey won last year’s Schmidt Youth Vocal Competition in Indiana. The second place undergraduate winner is Keymon W. Murrah, a tenor from Louisville, Ky.

**Richard Hoagland**

“University Open” – first place

University Open is a juried competition between undergraduate fine arts students at Kentucky colleges and universities. This year’s competition featured work from 38 of the state’s student artists. Winners were announced at an opening reception held in April at Lexington’s Downtown Arts Center. Hoagland, a resident of Lexington, received first place honors for his series of digital prints titled “Ralph Juxtaposed.” As Best of Show winner, the student artist received a $500 cash prize.

**Office of Student Activities, Leadership & Involvement (Student Volunteer Center)**

**Savannah F. Craddock**

**Maurice A. Clay Award Recipients**

**Jeffrey R. Steller**

**Jennifer N. Burkman**

**Andrew H. Trimble**

**Kevin R. Fox**

**Nicholas M. Covault**

**Rachel D. Fields**

**Timothy M. Bowman**

**Nicholas A. Purol**

**Myra Elizabeth Shuffett**

**Nicholas A. Such**

**Elizabeth A. McDonald**

**David P. Nicholson**

The Maurice Clay award is sponsored by the UK Chapter of Omicron Delta Kappa (ODK), presented to a graduating senior in each UK college, and based on leadership among the student body. As a testament to the loyalty and dedication of Dr. Maurice A. Clay, the Maurice A. Clay Leadership Development Initiative exists to provide financial support to individual circles seeking to establish specific programs to enhance leadership development on the campus and in the community.

**Zachary D. Brien**

**Joseph P. Kennedy Student Development Scholarship Recipients**

**MacKenzie A. Gathoff**

**Benjamin J. VanderHorst**

**Ryan M. Hayes**

**Krista M. Braun**

The Student Development Council has the opportunity to award ten $1,000 scholarships each year thanks to generous gifts made by Kennedy Book Store. The selection process for the Joseph P. Kennedy Student Development Council Scholarships is highly competitive. The criteria for this award include a strong history of academic achievement as well as a demonstrated dedication to leadership and service both on campus and off.

**Joseph A. Wright**

**Charles T. Wethington, Jr. Fellowship**

In honor of Charles T. Wethington Jr., the president of the University of Kentucky from 1989 to 2001, the University annually provides funding for fellowships up to $20,000 to be awarded to UK graduating seniors who plan to continue their post-baccalaureate education in one of the University’s graduate or professional programs. The fellowships are awarded for a first year of graduate or professional study at UK and are not renewable for subsequent years. Preference is given to Kentucky residents who are first-generation college students.

**Joseph L. Fink III**

**Robert G. Zumwinkle Student Rights Award**

The award is given to one student and one staff member or other person who is dedicated to the preservation of student rights. The award is based on what the nominee has done to further student rights at UK. In the nomination it is important to describe exactly what the nominee has done to protect, enforce and further student rights. Each recipient will receive a $300 gift.
This award is presented to students who have demonstrated superior leadership, academics, and service to the community. UK faculty members decided to begin the award for graduating seniors. They named the award after former UK president, Otis A. Singletary.

This selfless spirit award. For fourteen consecutive years, UK has recognized a student for the Darrell VanMeter Award in honor of Darrell A. VanMeter. Darrell, (a sophomore at the time of his death in 1991), was recognized by the University community and his home community for his positive contributions dedicated to serving others. The impact of his “good Samaritan” approach to helping others was apparent to faculty, staff and students alike. He touched the campus community with his selfless heart and continual acts of service.

At least three thousand dollars ($3000) will be allocated toward University of Kentucky Student Government Association Student Scholarships. The Senate shall elect a committee of five to establish criteria and applications for the scholarships.

This prize was first awarded in 1986 and is for outstanding service to the Honors Program and the University community at large.

At least three thousand dollars ($3000) will be allocated toward University of Kentucky Student Government Association Student Scholarships. The Senate shall elect a committee of five to establish criteria and applications for the scholarships.

The Viji Jeganathan Scholarship for Cross-Cultural Understanding is an endowed scholarship in memory of an outstanding international student who died of leukemia while studying at UK. The $1,000 award is presented to an individual who demonstrates leadership and ability in bridging cultural differences and who promotes communication among students of diverse nationalities at UK or in the Lexington community.

The Stephen Diachun Award, named after the first director of the Honors Program, has been presented since 1982 to a graduating senior who has “demonstrated outstanding research talent in the form of his/her Independent Project and who holds high promise for further professional development in graduate school.” The Diachun Award comes in the form of a check for $1000 to be used for expenses in graduate or professional school.

This award is bestowed each academic year on a student who has, by his or her actions, exemplified a high degree of personal integrity and a commitment to the betterment of the community or campus. The recipient is awarded a fifteen hundred dollar ($1500) academic stipend in both the fall and spring semesters of the following academic year. The award is in honor of Lyman T. Johnson, the first African-American student to be admitted to the University of Kentucky.

This award is given to residence hall staff and/or government hall leaders. In particular, the award is based upon exceptional leadership contributions to Residence Life.

Recognizes students for dedicated service to students.
Oswald Research and Creativity Program

Any current UK undergraduate (full- or part-time, enrolled for either semester) who does not already have a four-year degree is eligible for this competition and may submit papers and other projects in the following categories:

1. Biological Sciences
2. Design (architecture, landscape architecture, interior design, etc.)
3. Fine Arts (film, music, painting, sculpture, videotape, etc.)
4. Humanities: Creative
5. Humanities: Critical Research
6. Physical and Engineering Sciences
7. Social Sciences

Entries are judged on originality; clarity of expression; scholarly or artistic contribution; and the validity, scope, and depth of the project or investigation.

The following are the winners of the 2008-2009 competition:

(Extended versions of some of these entries are available at www.uky.edu/kaleidoscope.)

CATEGORY 1: Biological Sciences

1st Place
NAME: Sudipa Chowdhury
Chemistry major

Alzheimer’s disease (AD) is a chronic and prevalent neurodegenerative disease, affecting approximately five million individuals in the United States. AD is characterized by disorientation, intellectual damage, and ultimately leads to death. Primarily, these physiological symptoms have been attributed to the accumulation of B-amyloid fragments, which tend to form hard, insoluble plaques between neurons. The development of an artificial, macrocyclic B-sheet via a solid-phase peptide synthesis (SPPS) followed by solution-phase cyclization that imitate the hydrogen bonding edges of protein B-sheets could serve as inhibitors of protein-protein aggregation. One edge consists of “Hao”, an unnatural amino acid previously developed by the Nowick lab, coupled with two other amino acids, while the other edge contains five additional amino acids. Two alpha-Orn side chains link the two edges together, thus producing, a macrocyclic molecule. SPPS and solution-phase cyclization provide valuable and simple tools to generate macrocyclic B-sheet peptides that can have useful purposes in several neurodegenerative diseases, such as AD. The goal of this research is to identify how the structure of B-amyloid sheets of AD relates to the function from an organic synthesis approach in hopes of providing a more insightful look towards evaluating a potential therapeutic agent for AD.

2nd Place
Georgianne Tiu
Biology major
TITLE: The Expression of Signaling Proteins in Control Brain Versus Mild Cognitive Impairment Brain: Insights into Alzheimer’s Disease

The purpose of this experiment was to measure the expression levels of key signaling proteins in brain from subjects with mild cognitive impairment (MCI) compared to control subjects. MCI is considered to be the beginning phase of Alzheimer’s disease (AD). Tumor necrosis factor alpha (TNF α), nuclear factor kappa beta (NF κβ), phospho Bad (pBad), and ubiquitin C-terminal hydrolase-L1 (UCH-L1) are four proteins that were investigated. Trends of either decreases or increases in protein expression levels in MCI vs control brain were determined. Western blot analysis was used in order to identify these trends. These signaling proteins are reportedly either up-regulated or down-regulated in the AD brain; consequently, investigating protein expression levels in MCI brain may provide insight into how these proteins contribute to the transition from MCI to AD.

CATEGORY 2: Design

1st Place
NAME: Joshua Berry
Landscape architecture major
TITLE: Lane Allen Plaza Greyfield Redevelopment

This greyfield redevelopment project revitalized an underutilized and outdated greyfield site currently occupied by an indoor mall and a sea of parking (Turfland Mall). An in-depth analysis provided insight into many opportunities for community access to the site, better usage of commercial and residential space, and more efficient stormwater management practices. The new design concept formed a New Urbanist development with commercial and mixed-use clusters, residential areas, excellent pedestrian and bicyclist access, and large amounts of community park space.
Tie 2nd Place  
NAME: Emily Thompson  
Architecture major  
TITLE: Franklinton Community Center.
This is a project that was completed this past fall semester in a third year architecture studio. This project was investigating how architecture can create an impact on an existing community. I chose Franklinton in Columbus, Ohio. This project was trying to reestablish a sense of community before it becomes gentrified through developers and artist. Franklinton is currently an area that consists of low-income families. In Franklinton, there is a lot of crime and drugs. My hope is that by reviving the community that is directly dictated by the members, there will be less of an unwanted outside gentrification process. This will hopefully prevent the current residents from being pushed out of their homes. So there is a need for the children of Franklinton to have a safe place. There is also a need for the community to have a gathering place. So this community center provides the solution to both of these problems as well as the overriding problem of preventing gentrification.

Tie 2nd Place  
NAME: Valan Daniel  
Architecture major  
TITLE: Floating Space
This project is an addition to the Boston Public Library. It was an architecture studio project assigned by Prof. Karen Lewis in the Fall of 2008. The formal quality of the structure is designed around the history of the Back Bay area and the programmatic needs of the existing Boston Public Library. The project display consists of a 96” x 36” layout and a small wooden model of the addition. The layout needs to be pinned up to a wall and the model needs a stand for viewing.

CATEGORY 3: Fine Arts  
1st Place  
NAME: Jaime Lazich  
Psychology major  
TITLE: Comorbidity.
“Comorbidity” Size: 10 8”x 10” mattes hanging or easel display. Comorbidity is defined as a concomitant but unrelated pathological or disease process or more simply, the simultaneous presence of two chronic diseases or conditions in a patient. When someone is afflicted with both anxiety and depression the two disorders feed upon each other and it is sometimes difficult to tell the difference between the two. I wanted to explore a similar theme in these double-exposed photographs. You see one photograph, but two different exposures within the frame. So we are presented with two separate visual landscapes that are superimposed onto each other, and they contrast each other. They each try to stand independently from the other, but they also complement each other. It is impossible to attempt to view one exposure outside of its relationship with the other. We cannot differentiate one exposure from the other because we will always see it in relation to its counterpart. Its comorbidity is encapsulated in the photograph.

CATEGORY 4: Humanities: Creative  
1st place  
NAME: Laura Benton  
English major  
TITLE: Rosses Point
The title of my creative writing piece is Rosses Point. These poems are carefully linked through a variety of common themes, motifs and images. They are inspired by the poetry of William Butler Yeats and my own travels throughout Europe. Many of these poems were written in Sligo, a county in Ireland where Yeats spent much of his childhood. It is in Sligo that I found a unique and exciting creative expression.

2nd Place  
NAME: Eric Schlich  
English major  
TITLE: The Tourist
The Tourist is a short-story I wrote last semester in ENG 507: Advanced Creative Writing Workshop with Professor Gurney Norman. It is inspired by my experience of traveling abroad in Europe (Spain, Italy, France) in the Fall Semester of 2007, particularly rooted in the alarming feeling of being out of place and not belonging that accompanies the role of the tourist. The short-story is written in a bit of an experimental style for my writing, although I would not classify it as postmodern or under the heading of any specific school of writing. However, I do see it as a specific type of story: an in-depth analysis of the psyche of a character, not necessarily written in the traditional plot-driven literary technique.

CATEGORY 5: Humanities: Critical Research  
1st place  
NAME: Katherine Noe  
French and English major  
TITLE: Subject Meets Object: Real Women of the 19th Century America Confront Biblical Representations of Femininity
This paper explores the Biblical criticism of 19th century women’s rights activists, such as Elizabeth Cady Stanton and Matilda Joslyn Gage. The major issues discussed are
individual agency and self-improvement and how the authors incorporate these ideas into their interpretations of the Bible. Also at issue is the relationship between woman as a symbol and real women. The title is “Subject Meets Object: Real Women of 19th-century America confront Biblical representations of femininity.

2nd Place
NAME: Jessalyn Ubellacker
International studies major
“The Burden of the Free” project developed from my introduction to the field of philosophy through the Gaines Fellowship in the Humanities seminar course led by Dr. Daniel Breazeale. Studying the works of Simone de Beauvoir in this seminar provided me the insight of viewing freedom as an ambiguous dilemma between the oppressed and the oppressor groups that exist in our society. This perspective developed into a research paper through which I found a connection between my great-grandmother’s life in Austria during the Holocaust and the ideas proposed by de Beauvoir. By relating my great-grandmother’s experiences to the philosophies of Simone de Beauvoir, I was eventually able to propose my own thoughts on the ethics of ambiguity surrounding the concept of freedom, which support the conclusion no one in our society can be truly free, unless everyone possesses freedom.

CATEGORY 6: Physical and Engineering Sciences
1st place
NAME: Juan Carlos Cordova
Chemical engineering major
TITLE: Biodegradable hydrogels as orthopedic implants for growth plate regeneration.
Biodegradable hydrogel systems are some of the most promising biomaterials for controlled drug delivery, and often medical implants. In this research the synthesis and characterization of biodegradable hydrogels has been completed for a target application as orthopedic implants in patients suffering from growth plate injuries. Specifically tailored poly (beta-amino ester) biodegradable hydrogel systems have been developed which possess a given set of properties including appropriate degradation profiles, mechanical properties, porous structures created using various methods, and biocompatibility. Initial work included the synthesis and characterization of the macromer precursors. Macromers were characterized using gel permeation chromatography (GPC). Then, the macromer conversion to hydrogel was observed using FTIR analysis. Other characterization that was completed included mechanical properties through compressive analysis, pore characterization through scanning electron microscopy (SEM) imaging, and biocompatibility of systems through cell toxicity studies.

CATEGORY 7: Social Sciences
1st place
NAME: Linsen Li
History major
TITLE: From Tiananmen Square to Tianfu Square – A Narrative of the 1989 Student Protests in Chengdu
This paper examines the 1989 student protests in Chengdu, China, and its correlation with the simultaneous but better-known protests in Beijing. While scholars generally acknowledge the importance of the Chengdu protests in the 1989 national movement, little research has been carried out thus far. The paper looks to analyze the Chengdu government’s role in handling the protests and to compare and contrast the 1989 protests in the capital and at the provincial level. It asks the questions: How extensive were the Chengdu protests relative to the rest of the country? How did the Beijing leaders’ handling of the protests influence Chengdu leaders’ decision-making?

Based on primary sources in both Chinese and English, including the Chengdu Annals, transcripts of Chengdu provincial radio service, official edicts, party leaders’ speeches, The Sichuan Daily, western media coverage, and witness accounts, the paper first reconstructs a narrative of the events in Chengdu. The narrative confirms that not only did Chengdu witness some of the most extensive protests at the provincial level; it also suffered what was likely the bloodiest crackdown outside of Beijing. Using this narrative and government-related sources, an analysis can then be drawn to gain some insight into the Chengdu government’s handling of the student protests. Preliminary analysis suggests that the local officials, uncertain of the extraordinary situation they faced, were entirely dependent upon the central leadership’s orders, which were often mixed and continually shifting. As a result, the Chengdu leaders acted indecisively during much of the movement, thus allowing it to eventually develop out of hand and resulting in a tragic ending.

2nd Place
NAME: Emily Wright
Landscape architecture major
TITLE: The Physical and Political Barriers to Wind Energy Development in the United States.
This paper explores the potential of wind generated energy in the United States and explains some of the reasons these resources have not been more adequately utilized. Once these barriers are addressed, solutions are proposed that reference policies in place in some U.S. State governments and in many European nations.
AICHE Student Chapter named Outstanding Chapter at the November 2008 AICHE Centennial Meeting

The University of Kentucky’s American Institute of Chemical Engineers (AICHE) Student Chapter was named an outstanding chapter for the 26th consecutive year. Only about ten percent of student chapters receive this distinction annually. The students presented a workshop on leadership development and fundraising at the Centennial meeting in Philadelphia, PA. The workshop was prepared and presented by Lauren Rosenbeck, Alex Montague, Aaron Hickey, and Don Johnson.

The UK chapter also participated in the AICHE Computing and Systems Technology Division sponsored video contest. The contest required students to submit a video of no more than seven minutes demonstrating their creativity and vision about the future of chemical engineering. The University of Kentucky received $200 for the effort and the video was showcased at the Annual Student Conference Bash. The video was created by Lauren Rosenbeck, Alex Montague, Don Johnson, Stephen Batt, Corey Barnett, and Joel Vice.

Several students also participated in the Undergraduate Student Poster Presentations. Alex Montague presented “Poly-Acrylic Acid Functionalized Membrane for Iron Immobilization and Fenton Reaction.” Juan Carlos Cordova presented “Biodegradable Hydrogel Systems on Orthopedic Implants for Growth Plate Regeneration.” Finally, Don Johnson presented his poster “Synthesis and Characterization of Temperature Responsive Hydrogel Nanocomposites.”

BIG BLUE V

“BIG BLUE V” is a workforce development project currently in its fifth year at the University of Kentucky (UK). This unique multi-university, multidisciplinary project is providing students with opportunities to learn about and to prepare for aerospace engineering careers. BIG BLUE is a comprehensive aerospace project experience to design, build and conduct a complex, high altitude experiment to verify the feasibility of inflatable-wing technology for Mars exploration. To date, three successful high-altitude experiments have been completed, along with participation in a student unmanned aerial vehicle competition. From the workforce development perspective, students involved in BIG BLUE join the aerospace workforce while participating in the challenging research-oriented project, which influences their decision to choose and pursue an aerospace career.”

Design/Build/Fly

The Cessna/ONR Student Design/Build/Fly contest was founded as a “hands on” student experience to increase their knowledge and ability to work in an industry environment after graduation. The organizers had noticed that many of the new graduates entering their companies had no practical experience in design. As their first assignment with a large aerospace company was typically a small part of the overall design, many of them worked for several years before having the opportunity to see the “big picture” view of how different design decisions interact.

With that in mind the first and foremost objective of the competition has been to become and to remain an educational tool.

The goal of this project is to design, build, and fly an electric R/C airplane to achieve a specified objective (range, payload, speed, etc). The winner is determined by the best combination of written report and flight performance, determined at the competition flyoff.

In order to keep the competition fresh, students are challenged with new design objectives every year. This also requires a fresh look by the organizing committee at writing the rules, with continued attempts to learn from the previous years’ experience.

The UK Design/Build/Fly team completed the last day of competition on April 19, 2009 by getting to fly with the plane. The first flight, mission 1, was a success. A pilot from another team flew the plane the first time to test it. UK then repeated mission 1 allowing the team pilot, Brady Doepke, to fly the plane. This flight was also successful.

The second mission was 4 laps with a full water
bottle which added roughly 10 lbs to the plane. 3.5 laps were completed before power issues prevented the plane from continuing. Fortunately, the plane was still mostly intact after the impact.

Due to the damage that was done to the plane and the power issues, the team decided to stop with mission 2 and be able to arrive home with a plane. The team felt the competition was a success. They were in the top 50% of the competition. There were a large number of teams that weren’t able to qualify due to the inspections. UK’s team goal for this first venture in the AIAA DBF competition was to qualify and successfully complete a mission, which they achieved.

UK Team Performs CT Scans of Ancient Papyrus Scrolls
by Kathy Logsdon

The Enhanced Digital Unwrapping for Conservation & Exploration (EDUCE) project began approximately five years ago. Dr. Brent Seales, Computer Science professor, began using X-ray to obtain hidden information from artifacts non-destructively. During the summer of 2008, the members of EDUCE digitalized the oldest copy of the Iliad and put it online. Seales’ trip to Venice, Italy to digitally “unroll” the Iliad led to interest in this project and connected him with people and resources, which helped gain access to the papyrus scrolls.

The scrolls were buried in a volcanic eruption of Italy’s Mount Vesuvius in the resort town of Herculaneum about 2,000 years ago. The lava flows incinerated most of the scrolls from the town’s private collection and the intense heat carbonized the scrolls. About 2,000 scrolls were dug up, one layer at a time. The King of Naples received four of the remaining scrolls as a gift and gave them to Napoleon. Napoleon sent them to the National Institute of France. Two of the scrolls have been opened or lost; the other two are the only scrolls no longer housed in Italy.

The EDUCE team, a project of the University of Kentucky’s Center for Visualization, arrived July 6, 2009 at the Institut de France. Matt Field and Ryan Baumann, Master level students, were part of the five member team who travelled to Paris. Matt went for the first half of the trip and Ryan went for the second half. The remaining three members who travelled to Paris included Dr. Seales, IT support and a document photographer.

Last winter, Claire O’Toole (an undergraduate student) took a class about digitalization of historical books under Dr. Seales and became involved in the EDUCE project. The scrolls in question, which are now located in the French National Institute in Paris, have never before been opened or read. O’Toole said the goal of the project is to continue developing new technology to provide a safe way to decipher and preserve more scrolls from Herculaneum.

After arriving in Paris, the team mounted the scroll in a special container to support it during scanning inside the SkyScan 1173. With protection from this custom mounting container, the scroll can stand on end while the scanner rotates it in a gentle pirouette. The team setup to begin acquiring scans at the best resolution and with the best possible contrast, revealing the internal layers and giving hope to the goal of eventually “virtually unrolling” the layers to read the text. They took images of the scrolls in the Musée du Louvre in Paris where they took Computed tomography or CT scans of the scrolls.

CT scanning combines special X-ray equipment with sophisticated computers to produce multiple images or pictures of the inside of an object. These cross-sectional images of the area being studied can then be examined on a computer monitor or printed. Digital geometry processing is used to generate a three-dimensional image of the inside of an object from a large series of two-dimensional X-ray images taken around a single axis of rotation. EDUCE tested the effects of 3D X-ray scanning of the two carbonized papyrus scrolls. The internal structure in 3D was clearly visible without damaging the scrolls.

The research environment came together from three different countries, and includes twelve terabytes of storage capacity, the SkyScan 1173 micro-CT scanner, and several computers to drive the EDUCE team’s software. The portable CT scanner, SkyScan is a loan from Bio Labs in Belgium and weighs between 600-700 lbs.

In addition to the successful preliminary scans, the team was also honored by a visit from M. Jean Leclant, Secrétaire Perpétuel de l’Académie Fabienne Queyroux, Conservator, places scroll into the scanner.
The next step was the systematic and time-consuming process of scanning every millimeter of both scrolls (PHerc.Paris 3 and PHerc.Paris 4) at the highest resolution possible. These scans, once captured and safely stored in the redundant data storage system, gave the team enormous options for analysis, including the search for visible text. For now, the internal structure in 3D is clearly visible.

As the team began examining the scans they saw an internal structure that is chaotic, far from the regular spirals one might expect from a scroll. Given the intense heat and pressure of the Vesuvius explosion, followed by two thousand years of survival, perhaps the miracle is that there is anything left from the Herculaneum library.

After many hours of CT scanning with the SkyScan 1173, complete data sets were compiled for both Herculaneum scrolls at the Institut de France. From this data the entire internal structure of the papyrus can be seen: folds, breaks, creases. This exceptional look into the interior of the rolls was captured in a non-destructive way, leaving the rolls undisturbed for future analysis.

These scans helped acquire a wealth of data. For example, each x-ray projection is a 16 bit image at 4000 x 2000 resolution. Computed Tomography requires projections of at least 180 degrees or 360 degrees for a cleaner reconstruction. By collecting an x-ray projection every 0.2 degrees, the data set ends up with 1800 projections over a 360-degree rotation. This is roughly 18 MB of data per projection times 1800 projections which covers one section of the scroll. The scrolls were divided into five zones to capture data over the whole length. Five zones, 1800 projections per zone, at 18 MB per projection gives about 170GB of raw data. This is the input to the reconstruction algorithm. Once reconstruction takes place, the 3D slices are generated: 8000 slices, each 16-bit at 4000 x 4000 resolution. This yields another 250GB of data for a total of 420GB. This amount of data is for one scan. The team has captured several scans of each scroll under varying parameters.

O'Toole said the group took computer images of the scrolls, adjusted the light, and set a batch of projects to compile in the hope of finding text or older copies of artifacts they know existed years ago. People have tried for centuries to open them, but the scrolls kept disintegrating. The old ink on the scrolls contains metal. The team was concerned about the ink used in the scrolls. If the ink was carbon-based, it might not have been possible to visually separate the carbon ink from the carbonized papyrus. In other words, the scrolls could be unreadable. But since the original writer used a metal-based ink, a readable computer image could be obtained more easily.

The CT images were sent back to the Visualization Center electronically. O'Toole and Kyle Kolpeck are undergraduates who were hired to do the work of pulling everything apart for viewing and analysis of the computer images. Unfortunately, the group only has the software license until November 2, and then they will pull everything apart and see what data is available.

The scanning itself is just the first step; once the data is liberated from the physical handing of the scrolls themselves, it can take on a life of its own as teams push forward to analyze it and understand its significance. This kind of “virtual analysis” is a remarkable step forward, lessening the need to handle the scrolls and opening up the possibility for analysis to a wider community.

With concentration first and foremost on the safety and careful handling of the scrolls, the work has been methodical and slow. The structure of the slices clearly shows that the segmentation of the visible layers into meaningful, flattened regions will be a very big challenge. The team will be working to “digitally unwrap” promising sections in the search for a way to tease out an image of the writing itself, which is the ultimate goal. It is impossible to tell at this stage if this will be successful.

They have considered using an MRI scan, but it is not manageable due to size. They haven’t done anything with MRI scanning up to this point.

“If we have positive results from any of these tests, I think it will open doors for us,” stated Field. He said they may go back to reimage in a year or two.

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**UK Solar Car**

By: Steven Hughes

Qualified. It’s nice to know you have what it takes. For the second summer in a row, the University of Kentucky Solar Car Team’s Gato del Sol III qualified for racing. As a driver on the race, I felt like my duties were already completed. After passing egress testing and zooming around the figure-8 a few times, qualification seemed to me like the end.

Last summer, our team had qualified for the North American Solar Challenge, a 2400-mile cross-country race from Dallas, Texas, to Calgary, Alberta. We ended up finishing 11th in that race, taking home the pride of completing our first race ever with our third-generation sun-powered vehicle.
This summer, at the Formula Sun Grand Prix track race in Cresson, TX, the atmosphere was different. Race experience and a qualified, reliable car were no longer just aspirations. We knew that we had what it takes. Qualification was an expectation, and finishing in the top three had become our new aspiration.

Day 1 of racing, Wednesday, did little to brighten our spirits. Waking up to see a sky full of clouds and hearing reports of thunderstorms in the area, most of us had our doubts as to how this race would turn out. We were already exhausted after a couple of late nights spent trying to get the motor controller functioning properly.

At the end of the day, exhaustion and rain had transformed into energy and sunny skies. Despite having slow lap times, we finished that first day in 4th place, thanks to a highly reliable car. Wednesday’s 10 hours of racing saw only three 5-minute pit stops by our team, and all the hard work from the previous night had paid off to the tune of 100 percent mechanical and electrical reliability.

Day 2 of racing, Thursday, wasn’t even partly cloudy. The only thing that seemed to outshine the sun was the performance of our car and pit crew. The car only had to spend 10 minutes of total time off the track that day, driver changes and all, which turned out to be a race record. While other teams, including first-place Minnesota, were having tire blowouts or battery issues, our car was faithfully cruising around the track without a problem.

Thursday’s performance bumped our team up to an unofficial 2nd place. Needless to say, we were all excited and proud of our success so far; but there was still one day left. There were still 10 more hours of racing left to prove that our team was among the elite.

Day 3 of racing, Friday, couldn’t have been longer. Once again, our car was proceeding around the track without a problem. Things were slowly intensifying and picking up speed as all the teams moved towards one simple game plan for the afternoon—to squeeze out every last bit of energy from their batteries and tally up as many laps as possible.

Our team was no exception. We recorded very fast lap times most of the day, often averaging more than 40mph around the 1.7-mile track. With about an hour left in the race, and a 2nd-place finish nearly guaranteed, the team had already begun to celebrate. Gato III was still flying around the track when some bad news came in from the telemetry crew. Apparently, one of the car’s 28 battery modules had significantly dropped in voltage. If it continued to decrease, the battery protection system would soon kick in and trigger an immediate shut down of the car.

The driver was told to slow down in order to let the battery module charge back up, but it already was too late. During what was supposed to be the final lap of the race, the car shut off on an uphill section of the farthest bend of the track. It would not start back up again; but we were determined to get the car across the finish line without having to call in the tow truck.

Shortly thereafter, and in nothing less than epic fashion, we found ourselves in the middle of what turned out to be quite a nice cardio workout. Much to the entertainment of the other teams, we were able to push and pull Gato del Sol III for about a mile around the last half of the track, all the way back to the finish line, where we were greeted with smiles and congratulations for a dramatic 2nd-place finish.

As I recovered my breath, I took a second to think about what we had accomplished. Just a year ago, our team was essentially a first-timer at solar racing, happy to be qualified and squeezing out an 11th place finish in the North American Solar Challenge. This summer, by means of the same car that had limped those 2400 miles over ten days last summer, our revamped team was taking the Formula Sun Grand Prix 2nd-place trophy back with us to the bluegrass.

In light of our success at FSGP 2009, it’s hard not to be excited about UK’s future in solar car racing. All thoughts are now turned towards Gato del Sol IV and NASC 2010. Once again, our goal is to be one of the top three finishers, but this time, the competition will be tougher. Up until now, our team has been playing catch-up to some of the more experienced American teams such as Michigan and Minnesota. Now we too are on the frontier, pushing research and design of solar cars to a new level. When completed, Gato IV will be in the company of the most advanced solar cars in the world.

The first new addition is an improved solar cell array. Previously, the team has employed silicon solar cells in array construction. Although relatively inexpensive and easy to work with, silicon cells have a maximum operating efficiency of only 20 percent. The new array will be composed of over 2000 triple-junction gallium-arsenide cells, each operating at upwards of 28 percent efficiency.

Another improvement takes the form of a lighter, more aerodynamic shell. Gato III’s shell was made of foam and fiberglass and the new shell will be a composite structure that combines a lightweight Nomex honeycomb core with a rigid carbon-fiber outer layer. Aerodynamic drag has also been greatly reduced by altering the shape of the car (i.e. moving the cockpit back) in order to increase laminar flow.

Other improvements include the addition of custom 16-inch wheels,
a more energy-dense lithium-based battery pack, a Tritium WaveSculptor motor controller, and a charge balancing system that ensures maximum battery charge/discharge consistency. As a finishing touch, the steering wheel will contain some of the driver controls and an LCD to depict speed, array power output, and some other data.

Despite the many improvements, quite a few aspects of Gato del Sol IV will remain largely unchanged from Gato III. Of course, the three-wheeled, one-seat, no-doors, and airfoil-shaped design is here to stay. Other components, including the nine-horsepower DC brushless motor, aluminum chassis, battery protection system, and CAN network have seen few modifications. The maximum power point trackers (MPPTs), which govern the solar array, will also be roughly the same design as before, although they will require some adjustments to accommodate the new gallium-arsenide cells.

Aside from design and manufacturing, the business team has been hard at work finding sponsors and raising money to fund the construction of the new car. The total expense of Gato del Sol IV is estimated to be about $230,000.

All in all, building a functional solar car is very much a team effort. Many people question whether the finished product is worth all the time and money that is put into it. Our mission is to design, finance, build, and race solar powered cars. However, the end goal of our team is much more significant:

Solar power is widely regarded as the best potential source of renewable energy. It is also extremely underutilized. Although photovoltaic cells can be pricey, the materials to manufacture them are plenty, and the theoretical uses of solar energy are virtually endless. More research, discovery, and experimenting are the only things that stand in the way of solar energy becoming a primary source of energy worldwide.

As students at the University of Kentucky, we already have many great resources at our disposal; but nothing provides inspiration and hands-on experience like the solar car team. With 35 members and a world of potential in front of us, the University of Kentucky Solar Car Team is ready to push research and design to greater heights than ever—and I know that we are more than qualified to do it.

UK S•KY BLUE House Took Ninth Place in the U.S. Department of Energy Solar Decathlon

For three weeks in October 2009, the U.S. Department of Energy hosted the Solar Decathlon—a competition in which 20 teams of college and university students competed to design, build, and operate the most attractive, effective, and energy-efficient solar-powered house. The Solar Decathlon is also an event to which the public is invited to observe the powerful combination of solar energy, energy efficiency, and the best in home design. Exact dates of the 2009 event were:

- Oct. 8-16—Teams compete in 10 contests
- Oct. 9-13—Houses are open to the public
- Oct. 15-18—Houses are open to the public
- Oct. 19-21—Teams disassemble their houses.

The Solar Decathlon consisted of three major phases:

- Building: This is where most of the work—and the learning—happens. In addition to designing houses that use innovative, high-tech elements in ingenious ways, students have to raise funds, communicate team activities, collect supplies, and work with contractors. Although the Solar Decathlon competition receives the most attention, it’s the hard work that students put in during the building phase that makes or breaks a team.

  - Moving to the Solar Village: When it’s time for the Solar Decathlon, the teams transport their houses to the National Mall in Washington, D.C., and rebuild them on site.
  - Competing: During the competition itself, the teams receive points for their performance in 10 contests and open their homes to the public.

The Solar Decathlon has several goals:

1. To educate the student participants—the “Decathletes”—about the benefits of energy efficiency, renewable energy and green building technologies. As the next generation of engineers, architects, builders, and communicators, the Decathletes will be able to use this knowledge in their studies and their future careers.
2. To raise awareness among the general public about renewable energy and energy efficiency, and how solar energy technologies can reduce energy usage.
3. To help solar energy technologies enter the marketplace faster. This competition encourages the research and development of energy efficiency and energy production technologies.
4. To foster collaboration among students from different academic disciplines—including engineering and architecture students, who rarely work together until they enter the workplace.
5. To promote an integrated or “whole building design” approach to new construction. This approach differs from the traditional design/build process because the design team considers the interactions of all building components and systems to create a more comfortable building, save energy, and reduce environmental impact.
6. To demonstrate to the public the potential of Zero Energy Homes, which produce as much energy from
renewable sources, such as the sun and wind, as they consume. Even though the home might be connected to a utility grid, it has net zero energy consumption from the utility provider.

University of Kentucky’s S•KY BLUE House descended on the U.S. Department of Energy (DOE) Solar Decathlon competition at the National Mall in Washington, D.C. where it joined 19 other schools from across North America and Europe in the prestigious competition that demonstrates homes powered entirely by the sun do not have to sacrifice modern comforts and appealing features.

Since early 2008, UK’s team worked hard at designing and constructing the S•KY BLUE House. The 20 teams chosen to compete were asked to create and send an 800-square-foot or less solar-powered house, built by students on their home campus, to the National Mall. Each team’s house was evaluated in the competition in 10 specific areas: architecture, engineering, market viability, lighting design, communications, comfort, appliances, hot water, energy balance and home entertainment.

UK’s team members not only designed their house, but fabricated many of its custom elements including the building’s structure, which presented students with the unique opportunity to work alongside metal fabricators at the AMRL (Agriculture Machinery Research Laboratory).

The UK design presents an optimized living and learning environment that engages the landscape through an integrated design approach that demonstrates a range of site-flexible and contextual solutions for living under the sun today. The house makes strong reference to Kentucky’s passive architectural roots and integrates forward-thinking innovations into a design based upon an open and porous loft concept anchored by the home’s hearth, the kitchen core, and a series of outdoor spaces that envelope the house. A breezeway design blends the beauty, simplicity and passivity of various elements of Kentucky vernacular architecture with modern elements ranging from its furniture to Shaker-style built-in cabinetry, wall-integrated folding tables and chairs to active energy-efficient systems and technologies including an LED illuminated perforated cladding system.

The S•KY BLUE House structure is designed to allow for very quick setup and occupancy. Several unique features include: rainwater harvesting systems, fixed and single-axis tracking arrays, PV cooling, electronically tintable glass in non-shaded areas, super high-efficient appliances, a reverse cycle heat pump, demand controlled ventilation for indoor air quality control, and an Automatic Weather Adaptive Response (AWARE) control system, which optimizes the energy flows in the house based upon zip-code-specific weather forecasts.

The University of Kentucky S•KY BLUE solar house team is an interdisciplinary group comprised of students, faculty and staff from six colleges and 16 centers and departments within UK. The team has been led by two principal investigators, Donald Colliver, professor of biosystems and agricultural engineering at the College of Agriculture, and Gregory Luhan, associate dean for research at the College of Design, as well as faculty from the College of Communications and Information Studies and College of Engineering.

The UK S•KY BLUE House took ninth place overall in the competition. After the competition, the UK S•KY BLUE House returned to the Commonwealth to be exhibited at the 2010 FEI World Equestrian Games, scheduled to begin Sept. 25, 2010, in Lexington, Ky. The house will serve as the Visitor’s Center and the entry threshold to the Kentucky Experience exhibitions at the events.
**Weightless Wildcats**

The University of Kentucky Weightless Wildcats is an independent student organization that does research as part of NASA's Microgravity University Program. This program allows student groups the opportunity to test various scientific experiments in a reduced gravity environment. This year, the Weightless Wildcats are examining the movement of air bubbles within syringes in zero gravity. Specifically, we are testing specialized ‘dual-piston’ syringes. These syringes are made with two plungers, one located inside the other. The first plunger is attached to a mesh sieve that, when depressed, uses the surface tension of any air bubbles to push them to the top of the syringe. The second plunger is used to eject the air bubble and then to inject the fluid.

The purpose of this experiment is to test the effectiveness of the dual-piston syringes in removing air bubbles from the syringe. This is necessary so that astronauts can inject themselves with medication in outer space without the danger of injecting air bubbles into their systems, which can prove fatal. We are testing our experiment aboard the Weightless Wonder, a specialized Boeing 727 (Formerly known by its affectionate nickname, the ‘Vomit Comet’). The Weightless Wonder flies in parabolic curves to simulate zero gravity conditions.

NASA’s Microgravity University promotes the combination and cooperation of many disciplines of engineering; also known as systems engineering. UK’s Weightless Wildcats are comprised of Mechanical, Chemical, Electrical and Computer Engineering students. The Weightless Wildcats travelled to the Johnson Space Center for the Microgravity University program from April 8th- 17th, 2010.