CURO Summer Research Fellowships

The Center for Undergraduate Research Opportunities (CURO) awards Summer Research Fellowships to academically talented undergraduates who participate in research during the summer term at the University of Georgia. The number of Summer Research Fellowships varies from year to year, based on funding. Successful applicants receive a financial award of $3,000 and present their research at the CURO undergraduate research symposium. (Those students who receive $3,000 must use $500 toward presenting their research at a regional or national conference.)

In order to be selected for a Summer Research Fellowship, interested students must have at least a 3.4 GPA, thirty hours of UGA credit, and must commit to the following:

1. Enrolling in two sequential Honors undergraduate research courses: HONS 4960H and HONS 4970H or HONS 4970H and HONS 4980H. Students who wish to complete a thesis during the summer should check with Dr. Kleiber and their faculty research mentor. If approval is granted, the student will register for HONS 4980H and HONS 4990H. Students who are awarded the fellowship must register for these classes for the regular summer session before they are eligible to receive fellowship monies. If, during the course of the fellowship, the student withdraws from these classes for any reason, the stipend must be returned in full. CURO Fellows must resign from any other UGA employment to be eligible for funding and may not be enrolled in any other courses. CURO will create 6 hours of Honors research courses for the student in OASIS.

2. Submitting an abstract of the summer research to Dr. Pamela Kleiber by the last day of finals of the summer semester, for possible presentation at the annual CURO Symposium the following spring. Fellowship recipients are required to attend the upcoming Symposium, even if their abstract is not selected for presentation.

3. Participating in panel discussions with the Associate Director throughout the year to encourage an appreciation for undergraduate research at UGA.

Students who will be traveling internationally as part of their research must complete additional paperwork through CURO and the Office of International Education and are required to purchase travel insurance (approximately $1 per day) through the Office of International Education for their time abroad.
CURO 2009 Summer Research Fellowships

2009 Selection Committee

Dr. Wyatt Anderson Alumni Foundation Distinguished Research Professor, Genetics
Dr. E. M. Beck Meigs Professor, Sociology
Dr. Katarzyna Jerzak Associate Professor, Comparative Literature
Dr. Michael Roden Professor and Department Head, Geology
Dr. Regina Smith Associate Vice President, Office of Vice President for Research
Dr. Frances Teague Meigs Professor, English
Dr. Juergen Weigel Professor, Microbiology
Chair: Dr. Pamela Kleiber Associate Director, Honors Program

Special thanks to the sponsors of the 2009 Summer Research Fellowships

Honors Program
Office of the Vice President for Research
Office of the Vice President for Instruction
Interdisciplinary Toxicology Program
UGA Alumni Association
The Jane and Bill Young Scholarship
May 4, 2009

Dear UGA Faculty and Students:

We are delighted and honored to name 26 CURO Summer Research Fellows for 2009, each of whom is featured in this handbook with a summary of his or her faculty-mentored research project. The goal of the CURO Summer Research Fellowships is to provide opportunities for intensive, immersive, faculty-guided research experiences for academically talented undergraduates. The program advances the students’ knowledge and abilities to think critically, solve problems, and contribute to greater understanding of the world.

The CURO 2009 Summer Research Fellowships are funded through the Honors Program, the Office of the Vice President for Research, the Biomedical and Health Sciences Institute, the Interdisciplinary Toxicology Program, the Franklin College of Arts and Sciences, the UGA Alumni Association, and the Jane & Bill Young Scholarship. In addition, a Howard Hughes Medical Institute’s Exceptional Research Opportunities Program (EXROP) participant will join the CURO Summer Fellowship this year.

We are exceptionally proud of the quality of the contributions of present and past CURO Summer Fellows and with the mentorship of faculty researchers and their graduate students. The Summer Fellowship program has contributed to building a culture of undergraduate inquiry at the University of Georgia, and the CURO Summer Fellows serve as ambassadors, sharing their enthusiasm and expertise in a variety of professional forums on campus as well as at regional, national, and international meetings.

Please join us in congratulating these young scholars on the occasion of being awarded these prestigious fellowships. Please join us also in thanking the faculty research mentors whose support and guidance are crucial to the CURO Summer Fellows’ success.

Sincerely yours,

David S. Williams
Director, Honors Program

Pamela B. Kleiber
Associate Director, Honors Program
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Effect of Mono and Divalent Cations On Biofilm Formation In a Prolific Biofilm Forming Strain of *Listeria monocytogenes* Cultured In a Chemically Defined Medium

**CURO-OVPR Summer Research Fellow: Christine C. Akoh**

**Introduction**

Background: *Listeria monocytogenes* is a pathogen of extreme importance to both public health and the food industry. *L. monocytogenes* causes human listeriosis and generally affects pregnant women, the elderly, infants and the immunocompromised (Cohen et al, 1983 and Ostolaza et al, 1995). *L. monocytogenes* forms biofilms on surfaces commonly found in food processing plants (Beresford et al, 2001). Biofilms are surface-associated microbial communities surrounded by an extracellular matrix that consists of polysaccharides, nucleic acids and proteins (Whitchurch et al, 2002). Microorganisms within biofilms are protected from sanitizers and antimicrobials thus increasing the likelihood of survival and the subsequent contamination of food. Cations are thought to be required for bacterial growth and stability (Ordal, 1976); however, there is conflicting information on the effect of cations on bacterial biofilm formation (Phanh-Tanh et al, 1997 and Turakhia et al, 1983). Previous studies have suggested that the presence of cations may contribute to effective biofilm formation in some bacteria strains (Turakhia et al, 1983). To date, the role of cations in *L. monocytogenes* attachment and biofilm formation has not been studied.

**Objectives:** The objectives of this study will be to: 1) determine the mono and divalent cation requirements of a prolific biofilm forming strain of *L. monocytogenes* (strain 311) and 2) determine the effect of metal chelators as well as mono and divalent cations on biofilm formation *L. monocytogenes* strain 311.

**Methods:** Biofilms of *L. monocytogenes* strain 311 will be grown on stainless steel chips in a full strength tryptic soy broth (TSB) versus a dilute TSB (1:10). Metal chelators and cations will be added to the media at varying concentrations. Biofilms will be grown overnight at 25°C. Biofilm growth of *L. monocytogenes* strain 311 in the presence of metal chelators and metal cations will be assessed by fluorescent microscopy and the bacterial spread plate method.

**Significance:** This study proposes that cations play a major role in biofilm formation in *L. monocytogenes* and likely will improve the biofilm forming ability of this pathogen. The information obtained from this study will provide insight into the external factors that enable effective and efficient biofilm formation in *L. monocytogenes*. This information can then be used as a tool to formulate effective intervention strategies against this pathogen of extreme importance.

*Research Faculty Mentor, Dr. Joseph Frank, Department of Foods and Nutrition*
Protein-linked Glycoconjugates as Biomarkers for Cancer or Other Physiological Processes

CURO-Jane and Bill Young Scholarship Summer Fellow: Sambita Basu

The objective of the research undertaken is to identify protein-linked glycoconjugates as biomarkers for cancer or other physiological processes such as cell development. The identification of these glycobiomarkers will allow for a better understanding of the role of protein glycosylation in disease progression. The techniques that are currently employed by the student will be continued; optimization of these techniques will be attempted.

Biological samples that consist of cell pellets or organ tissues that are diseased or non-diseased will be obtained from collaborators at the Medical College of Georgia. These colon cancer tissue samples will undergo testing; glycoproteins will be extracted after lipid removal with organic solvents. Two strategies will be followed for the glycomic analysis:

1) Solubilized glycoproteins will be mixed with biotinylated carbohydrate binding molecules (lectins or antibodies) and the bound glycoconjugates will be precipitated with avidin-conjugated beads. Bound glycocoproins will be eluted, then digested with trypsin and subjected to proteomic analysis by LC-MS/MS. Bioinformatic tools such as those developed at the Center for Biological Sequence Analysis (Denmark) or BioInquire Inc (Athens, GA) will be used to identify disease-specific glycobiomarkers.

2) Solubilized glycoproteins will be proteolyzed with trypsin; then the glycopeptides will be subjected to lectin affinity chromatography and the lectin bound glycopeptides will be treated with N-glycanase (for N-linked glycopeptides) or β-elimination coupled to Michael addition (BEMAD) for the analysis of O-linked glycopeptides. The resulting deglycosylated peptides will be analyzed by LC-MS/MS in order to identify the glycosylation sites.

Faculty Research Mentor: Dr. Gerardo Alvarez-Manilla, Biochemistry and Molecular Biology, Complex Carbohydrate Research Center
Harry Eugene Crews was born to sharecroppers in Bacon County, Georgia in 1935. He has since become one of the South’s most influential writers, having published 18 novels, an autobiography, numerous essays, and several short stories.

In his introduction to *Classic Crews*, he wrote, “My compulsive need to look for the edge and live on it has marked me in more ways than I would want to know or try to explain.” Usually styled as the South’s answer to such hard-living authors as Hunter S. Thompson, Charles Bukowski, or Jack Kerouac, Crews has lived on the edge in more senses than one. As an undergraduate, he left the University of Florida after two years, “choking and gasping from Truth and Beauty,” thus inaugurating his uneasy relationship with higher education. Though he would return to complete his bachelor’s degree, earn a master’s in creative writing, and finally to teach, his work initially received little attention from literary scholars. Only in the past two decades has his writing begun to accumulate a significant body of criticism.

Fortunately, the Main Library at the University of Georgia not only houses multiple copies of his books, but the Hargrett Rare Book and Manuscript Library purchased, in 2006, his complete archive of manuscripts, correspondence, interview transcripts, business and legal records, audio/visual media, and other miscellany.

This summer, I plan to read nearly all of Crews’s work and to conduct intensive research in the Harry Crews Collection. I will also read a selection of both his predecessors and contemporaries, focusing, on one hand, upon the authors of the Southern Renaissance, and on the other, upon those producing so-called “grit lit,” fiction that centers upon the daily lives of the poor in the rural and small-town South. My goal will be to put Crews in conversation (literally, in some cases, via his correspondence) with these authors in order to gauge their impact upon his writing as well as the impact of his writing upon a new generation of Southern writers.

I am particularly interested in Crews’s relationship to the Agrarian tradition of Southern literature, specifically the Vanderbilt Agrarians or Fugitives. Crews studied creative writing under Andrew Lytle at Florida, and the Collection contains extensive correspondence between the two. William Faulkner, whom I am currently studying, provides another point of departure. Other potentially influential authors I will read include Robert Penn Warren, Flannery O’Connor, Erskine Caldwell, Carson McCullers, and Eudora Welty. Of Crews’s contemporaries, I plan to read James Agee, Fred Chappell, James Dickey, Larry Brown, Walker Percy, Dorothy Allison, Barry Hannah, and Randall Kenan, though these names may change as I intend to allow my research to guide my reading. By exploring both ends of Crews’s timeline, I hope to better understand his role in the transition of Southern fiction from Agrarian and Modern to Postcolonial, Postmodern, even “Postsouthern.”

In addition to participating in CURO forums and the symposium, I plan to explore in detail one aspect of my study through a thesis to be written this coming fall.

Southern literature takes as its inspiration the gritty and beautiful, backward and progressive, disturbing and serene milieu beneath the Mason Dixon, but its concerns are universal and its innovations remarkable. I hope to contribute to this ever-expanding discourse and to the scholarship that seeks to elucidate the work of one of its foremost practitioners.

*Faculty Research mentor: Dr. Hugh Ruppersburg, English*
“Fashion photography has made an indispensable contribution to the vitality of modern photographic tradition.” -- Glenn D. Lowry, Director, Museum of Modern Art

In 2004, the Museum of Modern Art mounted an exhibition of photographs with arguably humble origins: editorials in fashion magazines or mass marketed advertisement campaigns. Entitled *Fashioning Fiction in Photography since 1990*, the exhibit was comprised of over ninety photographs taken by thirteen different photographers. About half of these photographers are typically identified as fine artists, whereas the other are generally described as “commercial professionals.” Provocatively, the visual evidence mounted in the exhibition failed to bear out this distinction. (Kismaric 12)

Curators Susan Kismaric and Eva Respini of the Museum of Modern Art explain that 1990 was the right moment for this exhibit because “the saturation of imagery in contemporary life has become a preoccupation of art. Contemporary commercial imagery is ubiquitous, and the visual strategies used by every kind of photographer have been nurtured by images from countless magazines and newspapers” (Kismaric 12). As many newspaper articles and reviews attested at the time, *Fashioning Fiction* was a groundbreaking exhibition in the recognition of fashion photography as art. Indeed, in the aftermath of this exhibition, the difference between high and low art, between artistic and commercial is negligible, or even nonexistent. As a result, fashion photography is now being subjected to the kinds of analysis previously reserved for high art, with increasing but still limited numbers of books and articles published on the subject of fashion photographers and their work.

My research will focus on furthering this discussion by focusing on the photography of menswear in both fashion spreads and advertisements. I plan on focusing on designers such as Dolce and Gabbana, John Galliano, and Diesel. These designers are representative of the wide spectrum of men’s fashion including luxury fashion, avant-garde fashion, and street fashion. They consistently develop narratives in their work, and frequently they are daring, controversial, and shocking. The fashion spreads and advertisements created by photographers such as Steve Meisel and Steven Klein regularly question, satirize, and critique traditional values of masculine virility. Androgyny, sadism, and masochism are all tropes that male fashion photography seems to foreground. I plan on focusing on advertisements and editorial spreads that cast male models in effeminate, inhuman, or victimized roles. Ultimately, I will write a paper that discusses the photographer’s challenge of objectifying males and why using tropes that are contrary to mainstream perceptions of masculinity aid the photographer in his/her goal of provoking lust for both the lifestyle and the clothing of men.

With the recognition that this is an emerging area of study with few resources devoted to the topic of fashion photography, and even fewer that focus specifically on menswear. I plan on embarking upon an interdisciplinary study that draws on the fields of queer studies, gender studies, and the history of sexuality. I will, however, always maintain focus on the theories and philosophies of contemporary art history. I will also be able to simultaneously reflect upon the art of an earlier generation of fashion photographers such as Irving Penn, Helmut Newton, Guy Bourdin, and Cindy Sherman. By incorporating a wide variety of studies, I hope to gain an understanding of the objectification and materiality of male in an art form that is based upon selling a lifestyle.


*Faculty Research Mentor: Dr. Isabelle Loring Wallace, Art*
Canine distemper virus (CDV) causes multisystemic disease in dogs, as well as other carnivorous mammals, worldwide. Canine distemper virus is a member of the genus *Morbillivirus* in the *Paramyxoviridae* family; it is closely related to the measles virus in humans and rinderpest virus in cattle. Similar to these other morbillviruses, CDV is highly infectious and is associated with high morbidity and mortality, particularly in young dogs. Viral transmission occurs through inhalation of aerosolized viral particles or through contact with infected nasal and ocular secretions, feces and urine. Initially the virus replicates in lymphoid tissue of the upper respiratory tract followed by spread to the respiratory, alimentary, urogenital, and central nervous systems (CNS). Central nervous system infection leads to inflammation of the brain and spinal cord and demyelination is often a prominent feature. Encephalomyelitis is a common cause of death in naturally occurring CDV infections (Summers and Appel 1994). The introduction of modified live vaccines in the 1960’s significantly decreased the incidence of CDV; however, several cases of vaccine-associated encephalomyelitis have been reported. From 1968 to 1970, two separate episodes of encephalomyelitis occurred in fourteen dogs of varying breeds after administration of CDV/hepatitis virus combined vaccines (Hartley 1974). Although histopathological evidence for CDV existed in those cases, accelerated onset of clinical disease and a unique lesion distribution were suggestive of post-vaccinal versus wild-type disease. Suspected cases of post-vaccinal disease seemingly are associated with minimal viral replication in lymphoid and epithelial tissue, an absence of visceral viral inclusion bodies, and a unique brainstem tropism with a marked number of CNS viral inclusions compared to the typical wild-type infections (Hartley 1974; Cornwell, Thompson et al. 1988). Suspected post-vaccinal infections also have been shown to be limited to the affected host without spread to other susceptible animals in close proximity (Cornwell, Thompson et al. 1988; McCandlish, Cornwell et al. 1992). Although evidence exists for vaccine-induced CDV, it remains impossible to definitively rule out a natural infection acquired in temporal proximity to vaccination. Moreover, molecular evidence that post-vaccinal CDV is a true clinical entity has not been demonstrated conclusively.

Definitive differentiation between vaccine-induced and wild-type CDV infection is important for vaccine development, management of future outbreaks and therapeutic intervention. My research will utilize genetic differences between the wild-type and vaccinal distemper virus to determine the origin of disease in previous cases of CDV infection. Phylogenetic analysis of the hemagglutinin (H), fusion (F) and phosphoprotein (P) genes of CDV typically is utilized to identify and characterize genetically distinct strains of CDV and to differentiate them from vaccine strains (Maes, Wise et al. 2003; Pardo, Johnson et al. 2005). Such analyses have been utilized to distinguish several wild-type strains from the three most common vaccine strains of CDV (Onderstepoort, Rockborn and Snyder Hill), but they have not been utilized to confirm the presence of vaccinal nucleic acids in clinical cases of CDV. In this study, reverse transcriptase (RT) PCR will be used to amplify several small fragments (<150 base pairs) from each of the H, F and P genes from seven commercially available vaccines and culture isolates of wild-type and vaccine strains of CDV.

At the University of Georgia College of Veterinary Medicine, formalin fixed, paraffin embedded brain and spinal cord tissues are available from cases of suspected wild-type (> 30 cases) and vaccine-associated CDV encephalomyelitis (15 cases). RNA will be extracted from these neural tissues and the developed RT PCR assays for the H, F, and P gene fragments will be applied. Sequence alignment and phylogenetic analysis will be used to compare the amplified gene segments, which also will be compared to known published sequences. These analyses should identify regions of genetic variability between wild and vaccinal CDV strains that should allow for definitive discrimination between natural and post-vaccinal CDV encephalomyelitis.


Faculty Research Mentor: Dr. Scott Schatzberg, Veterinary Medicine

*CURO 2009 Summer Research Fellowships*

Differentiation of Natural and Post-vaccinal Canine Distemper Virus Encephalomyelitis

*CURO-OVPR Summer Fellow: Kelly Cummings*

Creating a Culture of Undergraduate Inquiry
Charting the Oppression of Minority Groups through Southern Gothic Literature
CURO Summer Fellow: Charles Ginn

The southern gothic movement in American literature is a movement characterized by its heightened sense of reality and grotesque characters, who are subjected to the stifling atmosphere of life in the south. The crumbling landscape of the post Civil War era provides the setting for readers to vicariously experience horrifying realities. However, at its core, the genre contains progressive social commentary that explores the injustices that minorities such as African Americans, women, and homosexuals fell victim to during this period. The portrayal of such marginalized groups illustrates the intense struggle that these minorities experienced during a time of racial and social prejudice. Therefore, this project will endeavor to determine the role that southern gothic literature had on exploring and exposing the oppression of African Americans, women, and homosexuals in the south. Furthermore, this research will investigate how reactions to these fictional works are manifested, throughout the south, in relation to these minority groups. As a result, this research will provide further knowledge of the role that literature of the southern gothic movement had in exposing the struggles that African Americans, women, and homosexuals experienced, respectively.

Throughout this research, the significance of oppression in southern gothic literature will be the central focus. Early southern gothic fiction provides us with rich insight because it presents illustrations of oppression prior to revolutionary civil rights movements. This research will draw on diverse reactions to authors of the southern gothic movement, and to the marginalized groups portrayed in their works. In *The Heart is a Lonely Hunter* by Carson McCullers, Dr. Copeland, Mick, and John Singer represent three characters whose ambitions and desires are crushed by societal implications. Their experiences of oppression typify the struggles that African Americans, women, and homosexuals experienced throughout the south. In turn, this research will charter the correlation between fiction and actual historical accounts. Consequently, this research will provide for a greater understanding in regards to how southern gothic literature highlighted the inequitable treatment that minority groups in the south received.

This research project will take a literary and historical approach in order to become well versed with the works of southern gothic fiction, and to possess a thorough understanding of the societal implications during the early twentieth century. This research will involve an exhaustive examination of southern gothic fiction by a wide variety of authors who comprise the genre. The works of Carson McCullers, Flannery O’Connor, William Faulkner, and Tennessee Williams, as well as others, will be the focus of a thorough survey of the southern gothic movement. In addition, this research will conduct an analysis of both primary and secondary sources in order to determine the reactions to these works. Through this process, the research will view the southern gothic movement through different perspectives in order to ascertain a greater comprehension of the realities of oppressed groups in the south.

Faculty Research mentor: Dr. Hugh Ruppersburg, English
Patients with schizophrenia often have difficulty with behaviors requiring executive functioning, such as inhibition, planning, and certain types of memory. These symptoms are thought to be due to the fact that schizophrenics have decreased prefrontal cortex activity (hypofrontality). The goal of the project that I would be working on in Dr. Jennifer McDowell’s laboratory in the Department of Psychology is to understand the changes in behavioral performance and brain activity in schizophrenic and normal subjects alter practice of eye movement tasks. In this study, subjects will be performing two types of eye movement tasks: prosaccades (rapid redirections of gaze from a center fixation to a peripheral stimulus) and antisaccades (rapid redirections of gaze from a center fixation to a mirror image location of a peripheral stimulus after inhibition of a glance to the cue itself). Similar brain areas are activated during these tasks, but prefrontal cortex activity is greatly increased during antisaccades. This increase is likely due to the fact that the prefrontal cortex is required for participants to be able to inhibit glancing towards the stimulus.

During the study, the participants’ eye movement performance will be tested in the fMRI three different times (at the beginning of the trial, after one week of practice, and after two weeks of practice). Between brain scan sessions, participants will be assigned to practice either prosaccades or antisaccades daily.

Previous research has shown that practicing a task improves performance on that task (i.e. practicing prosaccades improves prosaccade performance), but practicing the opposite task worsens performance (i.e. practicing antisaccades worsens prosaccade performance). These changes in performance also coincide with changes in neuronal circuitry. This study will examine these changes and compare them across the two groups.

One hypothesis of this study is that the participants who practice antisaccades should show improvement on the antisaccade task itself and on related measures of inhibition as assessed by an eye movement version of a spatial delayed-response task (ODRT) and by the Wisconsin Card Sorting Task (WCST). These participants should also show increased prefrontal cortex activity. Another hypothesis is that if the participants with schizophrenia show an increase in prefrontal cortex activity, then some of the symptoms associated with hypofrontality should decrease. If the data supports these hypotheses, then the results could be used to develop new treatment options for patients with schizophrenia.

As a Summer Research Fellow, I would continue to collect, score, and analyze eye movement data for the study, as well as analyze the results of the ODRT and WCST. In addition, since the project is nearing its completion, I will help with the statistical analyses of the pre-, mid-, and post-test behavioral data. Importantly, the uninterrupted time that I could allot during the summer would allow me to learn how to work with the fMRI data. Although I have been trained to help with data collection in the fMRI environment, working with the analysis of that data requires a commitment at a different level than can be met by the 12 hours that I expend during my 4960H. The Summer Research Fellowship would allow me to concentrate my efforts on this process for an extended period, thus providing one of the few ways possible to gain this interesting experience.

Faculty Research Mentor: Dr. Jennifer E. McDowell, Psychology
The Development and Implications of Predictive Modes of Thought from the Renaissance to Modernity

CURO-OVPI Summer Fellow: Dillon Horne

In high school, I was involved in a debate as to whether certain words act as “gate-keepers” to an esoteric body of knowledge, and at what point could entry to this field be granted. Extrinsic factors showed me that knowledge is ambiguous and there is a limit to the faith that can be placed in its convictions. Furthermore, debate revolves around causal relations. I was constantly presented with a series of predictions grounded in different epistemological backgrounds. In a world so guided by these numbers, what is their credibility? This project stems from the skepticism resulting from my experience with debate. I seek to examine the history of mathematics and philosophy behind modern probability theory.

The human obsession with planning, and hence, order, has driven the development of predictive modes of thought. The demand for coherence and subsequent refusal of a non-causal universe implies that human beings find necessity in space free of chance. From the introduction of astrology, in which the positions of the stars dictated daily fortunes to what day death’s shadow will be cast, to modern day statisticians, in which numbers guide recommendations, individuals have used these systems to structure an otherwise random existence. The institutionalization of these methods, backed by figures of authority, has added reinforcement to these ideologies.

I shall focus on the development of predictive modes of thought, from the astrology of the Renaissance to modern probability theory, and the implications of these two schools of thought. I will begin with a focus on the 16th century figures of Gerolamo Cardano and Giordano Bruno and their respective contributions to scientific knowledge. Cardano in particular holds special significance in this dialogue due to his early dealings with game theory, giving rise to key precursors of modern concepts of probability. Moreover, the esoteric nature of the topic at hand demands an introspective analysis into what constitutes ‘secret’ information and how the dichotomy between esoteric and exoteric knowledge can be bridged. For this question, I will turn again to Cardano and his attempt to solve the ‘cubed-problem.’ His perspective concerning knowledge arose from an inter-disciplinary focus, in particular with game theory, medicine, philosophy, and astrology, thus giving him the necessary language to disseminate knowledge on a large-scale. Concerning Bruno, I intend to highlight his involvement with the hermetic tradition and how that involvement led to his death sentence by the Catholic Church. Essentially, it was due to the esoteric society he was a part of that placed renewed interest on Gnosticism and mysticism. This story shows the sharp divide between the esoteric and exoteric world, and how the two can violently come into contact with each other.

From there I shall move on to a brief overview of the correspondence between Fermat and Pascal, but with a larger emphasis on Ian Hacking’s concept of probability as an emergent concept rather than an epochal shift. The importance of this correspondence is that it made possible the idea of statistically predicting the future. The two scholars deal with the ‘problem of the points,’ that is, how to determine the most likely outcome of a chance game. This ties back into Cardano’s earlier work with game theory. With Hacking, I will focus on his work concerning the ‘signs’ of the low sciences that served to make predictions reliable, shifting from there to Pascal’s wager and how that signaled the introduction of probability-based decision making. This leads into modern studies of economics, governmental policy, etc.

This project will build upon other works of history of philosophy and mathematics by providing a more comprehensive focus on what exactly is probability and how it came to be. In a world so caught up in numbers, the significance of an encompassing study on the development of probability will serve to provide a basis of credibility for acting on predictions.

Faculty Research Mentor: Dr. Thomas Cerbu, Comparative Literature
Re-examine Alternative Editing and Understanding the Protein Diversity in *T. brucei*

**CURO Summer Fellow: Tiffany Hu**

*Trypanosoma brucei* (*T. brucei*) is the causative agent of African trypanosomiasis, a tropical disease that affects humans (Human African trypanosomiasis) and non-primate mammals (Nangana). This disease is spread by a bite from the insect vector tsetse fly (*Glossina sp.).* Human African trypanosomiasis, also known as African sleeping sickness, develops in two stages. The parasite crosses the blood-brain barrier into the central nervous system in the second stage, with symptoms involving confusion, poor coordination, and the characterizing disturbance of the sleep cycle, for which the disease is named. Trypanocidal drugs have been developed to combat the disease, but most are becoming less effective, outdated, highly toxic and scarce. Efforts toward understanding trypanosome biology and developing new drugs must be made to fight this disease.

The *T. brucei* life cycle alternates between mammalian and insect hosts. Energy metabolism is developmentally regulated to cope with the demands of the two drastically different environments. Cytochrome-mediated respiration occurs in the insect (procyclic) developmental stage while the mammalian-form (bloodstream) is restricted to glycolysis [1]. Some components of the electron transport chain are encoded by the kinetoplast, which is housed in the organism’s mitochondria. This highly ordered structure is a catenated network of DNA maxi- and minicircles [2]. The coding information for the maxicircle genes is often incomplete and mostly undergoes post-transcriptional modification to produce functional mRNAs [3]. *T. brucei* mitochondrial mRNA editing, which is guided by the minicircle encoded guide RNAs (gRNAs), is a process where the cryptic mRNAs are made functional by uridine insertion and deletion [4]. A prime example of this is the cytochrome oxidase subunit III (COXIII) mRNAs. These transcripts are abundant and extensively edited in both forms and suggest an alternative function of COXIII mRNA editing in *T. brucei* [5]. More recently, the Hajduk lab has identified an alternatively edited transcript from this diverse pool of COXIII mRNAs which contained a long reading frame and coded for a protein that contained a unique hydrophilic amino-terminal domain and a carboxyl terminus that is identical to COXIII [6]. Alternatively edited protein-1 (AEP-1) is a 49kDa protein that localizes to the mitochondria of bloodstream-form *T. brucei*. Immunofluorescence microscopy reveals that AEP-1 also stably associates with the tripartite attachment complex (TAC), which is a structural linkage between flagellum basal bodies and the kinetoplast [7]. Dominant negative mutation of the protein results in abnormalities in kinetoplast segregation and structure and also a decrease in cell growth. Based on this data, RNA editing not only allows for the translation of conventional mitochondrial proteins, but also generates diverse mRNA sequences that code for proteins with novel functions in trypanosomes.

Further analysis of this COXIII mRNA transcript revealed another alternatively edited region that codes for alternatively edited protein-2 (AEP-2). Antibodies were raised against N-terminal region of the protein. The goal of my research is to identify the function of AEP-2 in *T. brucei* mitochondria. To assess if AEP-2 localizes in a similar fashion as AEP-1 in *T. brucei*, mitochondria will be hypotonically isolated and the membrane proteins will be extracted using a tandem nonionic detergent treatment. These proteins will be fractionated by SDS-PAGE and further analyzed by Western Blot. Immunofluorescence will also be used to analyze the distribution of AEP-2 in the cell. Blue Native PAGE (BN-PAGE) fractionation and Western Blot analysis of mitochondrial membrane proteins will be used to determine if AEP-2 assembles into an integral membrane complex. The proteins run on SDS- and BN-PAGE will be further analyzed by tandem mass spectrometry for the identification of AEP-2 and interacting members of the complex. The overall goal of this project is to re-examine alternative editing and to bring us closer to understanding the protein diversity in *T. brucei*. Dr. Hajduk’s lab is currently researching various basic molecular pathways in African trypanosomes and my work would contribute to the larger investigation of RNA editing. Understanding the function of novel proteins may eventually lead to the discovery of new drug targets that will aid in the fight of African sleeping sickness.


Faculty Research Mentor: **Dr. Stephen L. Hajduk**, Biochemistry and Molecular Biology

*Creating a Culture of Undergraduate Inquiry*
As our world becomes more populated and technologically savvy, people tend to underestimate the impact of waste and pollutants produced from factories, cars, and other people. Pollutants known as Volatile Organic Compounds (VOCs) pose an inevitable hazard for human health and for the environment (Ma et al., 2009). However, recent developments in photocatalytic technologies provide hope in irradiating VOCs in an efficient manner. The materials known as photocatalysts are proving to be more than just an effective material for water-electrolysis. Photocatalysts are materials that accelerate photo-chemical reactions in the presence of light. One of the most intriguing applications of photocatalysts is its capability to decompose most organic compounds. Ideally, any pollutant could be decomposed by photocatalyst with light as the only energy source. Some of the feasible applications of photocatalysts are the self purification of water and air (Smith & Zhao, 2008). Previous research indicates titanium dioxide (TiO$_2$) as one of the most effective and promising photocatalyst due to its high effectiveness and chemical stability.

(Syoufan & Nakashima, 2007). TiO$_2$, which reacts under wavelengths of UV light at or below 388nm, champions in photocatalytic activity when compared to most other photocatalysts. However, the photodegradation of the semiconductor lacks the speed necessary to decompose VOCs in considerable timing. Alone this semiconductor can only reach a certain level of efficiency due to the quick recombination of the photogenerated electron-hole pairs (Smith & Zhao, 2008). There are several different avenues for increasing the photocatalytic activity of TiO$_2$. By heating TiO$_2$ above 200°C, defects in the crystallized structure of TiO$_2$ are reduced significantly and photocatalytic behavior is increased. Because reactions take place on the surface of the material, structural composition can also affect photocatalytic abilities. Another means to increase photodegradation capacity is by doping TiO$_2$ with another semiconductor or metal with a similar band gap as TiO$_2$. During the process of photodegradation, electrons become excited leaving behind a highly oxidative positively charged hole. The positively charged hole creates oxidative radicals from water that can break down VOCs; however, this process mitigates as the electron and positive hole recombine. Adding a semiconductor or metal with a similar band gap as TiO$_2$ lengthens the charge separation time in TiO$_2$, increasing the degradation ability of TiO$_2$. Since the summer of 2008, I have been working with Dr. Yiping Zhao and graduate student Wilson Smith in their pioneering research to increase the photocatalytic efficiency of TiO$_2$. Their innovative approach to the fabrication of TiO$_2$ nanostructures have produced some of the highest levels of efficiency seen in the field of TiO$_2$ photodegradation. These structures called nanorods are fabricated by a custom built electron deposition machine using a procedure known as the Oblique Angle Deposition (OAD) method. This method proves more efficient than other nanostructure fabrication, such as ball-milling, hydrothermal synthesis, and sol-gel, which produce a random nature in the structure of the nanoparticles. The OAD method gives control on the height and thickness of the nanorods by simply adjusting the angle of the substrates. Accompanying these new nanostructures are a variety of questions. During the summer I will undertake several projects to investigate the degradation characteristics of the nanorods created by the OAD method. These projects include a height dependent study on the photocatalytic degradation of TiO$_2$ nanorods, the effect of Ag-coatings on nanorods on photocatalytic degradation, and the height dependent study of TiO$_2$/WO$_3$(Titanium Dioxide/Tungsten Oxide), which from previous research proves to be ten times more effective than TiO$_2$ alone, dual layer structure fabricated by OAD and their photocatalytic ability. The goal of this research is to gain an understanding of how TiO$_2$‘s photocatalytic abilities can be optimized via TiO$_2$ nanorod structures. I am ecstatic to be part of a project that is paving the way for other physicists to follow and expand upon the experience that I have gained and contributed while working under Dr. Zhao and Mr. Smith.


Faculty Research Mentor: Dr. Yiping Zhao, Physics
German Sustainable Farming as a Model for Resource Stewardship  
CURO Summer Fellow: Daniel Jordan

As hyped and far-reaching as notions such as environmental friendliness, sustainability, local food, and “going green” are, each manifests a central value: resource stewardship.

Resource stewardship movements have been in effect since the advent of recycling at the latest, but only recently have they shifted from espousing a worldwide “save our planet” sentiment to a local or community-based one, especially in the way of agriculture. The past decade or so has seen the boom of local food movements, such as the phenomenon of community supported agriculture (CSA), whereby a farmer opens his crop to local “subscribers” who pay each season to receive a basket of produce every week. According to localharvest.org, “the number of CSAs in the United States was estimated at 50 in 1990, and has since grown to over 2200.” Time captured this sentiment with a March 2007 cover: “Forget Organic. Eat Local.”

Of the many strands of local/sustainable agriculture, one of the most prominent is biodynamics, conceived in the 20’s and 30’s by Austrian philosopher Rudolph Steiner. In addition to being in practice on individual farms, Steiner’s ideas have laid groundwork for institutions as well, such as Demeter, an international certification agent for biodynamic farms. Given that Germany has the largest organic food market in the European Union, the subject matter of my study will be bilingual German farmers who show awareness of this ideal of resource stewardship, whether Demeter-certified or not. Because the crucial element of practicing resource stewardship is attention to the input and output of a system, my subjects should give this attention, even if only implicitly, to their own private eco-systems.

Just as any cultural movement does in its infant stages, the local/sustainable food movement currently relies on slogans, pamphlets, small-time periodicals, and feature stories in mass media for the dissemination of its knowledge into the public sphere of the U.S. I intend to approach the movement from a different angle: through organizations such as Worldwide Opportunities on Organic Farms and Help Exchange, as well as through personal connections, I will stay with four farmers in south Germany who are looking for temporary farmhands and who would consent to being my subject matter. As a participant observer within their lives, I will employ ethnographic methods as I observe, talk, write, photograph, plant, plow, sweat, and eat.

The end product of this project will be a book of writing and color photographs written for any reasonably intelligent reader. I like to think that what I give the reader in writing will be what the farmer gives those who eat his food: instead of condensed, dehydrated, simplified material whose nutrition can be summarized and digested quickly, I aim to provide an organic, holistic compilation that portrays the material life of its object, a kind of synchronic biography. The role of photography in this project should not be underestimated. I believe that one appeal of resource stewardship is an aesthetic one found in the life of this farmer, a kind of harmony with innate sensibilities that sustainable living supplies through a return to nature. This sensibility accounts for, for example, why we find landscapes beautiful. Experience tells me that photography appeals to this sensibility more effectively than writing does.

My task will be to manifest the ideal of resource stewardship by giving it faces (and dirty fingernails, bronzed forearms, and fresh wheelbarrows full of carrots). If these farmers are who they say they are, then this ideal should make itself apparent in that which I aim to portray: their everyday material lives.

Faculty Research Mentor: Dr. Betty Jean Craige, Comparative Literature
Human immunodeficiency virus (HIV) infection and acquired immunodeficiency syndrome (AIDS) continue to be the leading infectious cause of death worldwide and constitute a major global health emergency. In 2006 the World Health Organization (WHO) estimated that 39.5 million adults and children are living with HIV worldwide, with close to 3 million deaths due to AIDS. Although the implementation of Highly Active Antiretroviral Therapy (HAART) has led to a significant decline in AIDS-related morbidity and mortality, an associated higher risk of cardiovascular disease (CVD) in HIV patients taking HAART has been documented. In particular, one class of antiretroviral drugs called protease inhibitors (PIs) has been implicated in contributing to the development of several adverse effects related to the metabolic syndrome, including insulin resistance, hyperglycemia, hyperlipidemia, and lipodystrophy. In fact, a 26% relative increase in the myocardial infarction rate per year of exposure with combination antiretrovirals was reported in HIV patients. Since people with HIV are generally living longer as a result of effective viral suppression, the intersection of an increased CVD risk due to antiretroviral treatment with the risk of developing AIDS in these patients represents a serious issue concerning the long term management for HIV infection.

One strategy employed to treat elevated lipid levels in patients currently taking PIs is to co-administer lipid lowering drugs such as HMG-CoA reductase inhibitors, also known as statins. Co-administration of statins with PIs can result in increased blood levels and reduced clearance of statins, potentially leading to toxicity. In fact, several case reports have been described which link the co-administration of PIs with statins, resulting in severe toxicity and even death. This significant drug interaction has led to several statins being contraindicated with PI-containing HAART regimens. However, the increased risk of CVD necessitates the use of lipid-lowering drugs in these patients. The leading hypothesis behind this potentially life-threatening drug-drug interaction (DDI) is via the shared hepatic metabolism of both compounds by the cytoplasmic isoenzyme cytochrome P450 3A4 (CYP3A4), leading to increased plasma levels of statins. Recently, statins have been characterized to undergo transporter-mediated uptake by members of the solute carrier (SLC) superfamily into hepatocytes prior to CYP3A4-mediated metabolism. In addition, there is growing evidence to suggest that PIs are substrates for SLC transporters found in hepatocytes, such as OATP1B3 and OATP2B1. Therefore, we hypothesize that DDIs between statins and PIs are in part mediated through drug transporters expressed in hepatocytes. Understanding the mechanisms involved in antiretroviral DDIs at the site of cellular membrane transport will not only help indentify interactions of therapeutic or toxic importance, but will also provide useful guidelines on optimal combinations of antiretroviral drugs and co-administered medications. This knowledge will be of benefit to all clinicians and people living with HIV.

Substrate and inhibitor properties of the PIs atazanavir, nelfinavir, and ritonavir will be assessed using OATP2B1 and OATP1B3 overexpressing cell systems. Comparison between the PIs’ cellular accumulation using an overexpressing system with the wild type cell line will allow for direct assessment of substrate properties. Additionally, PI interactions with OATP2B1 and OATP1B3 will be evaluated using estrone-3-sulfate, a known ligand for both transporters. Similarly, the transport of pravastatin and simvastatin will be determined using the transporter overexpressing cell systems. Combinations of PIs and statins will then be evaluated for effects on the cellular accumulation of each other.

1.UNAIDS/WHO

Faculty Research Mentor: Dr. Jason Zastre, Pharmacy
The proposed research for this summer fellowship will entail the generation of additional zebrafish models for lysosomal disorders. We aim to first characterize the expression and activity of several lysosomal enzymes that are associated with human diseases across a developmental timeline in zebrafish. To do so, we will monitor the activity of these enzymes in embryo lysates and also localize the expression of enzyme transcripts using in situ hybridization techniques. These experiments, currently underway in the lab, will help to better understand how these enzymes are regulated in this organism (something that is currently not known) and guide our selection of candidates for new disease models. Based on preliminary findings, we will also aim to target the knockdown of the lysosomal enzyme aspartylglucosaminidase (AGA), which is essential in the final steps of asparagine-linked oligosaccharide breakdown. AGA is specifically responsible for cleaving a N-acetylglucosamine from asparagine residues on glycoproteins and mutations in this enzyme caused aspartylglucosaminuria (AGU). Clinically, AGU is very similar to ML-II. Therefore, investigation of an AGU zebrafish model has the potential to yield new insight into the pathogenesis of both disorders. Towards the proposed aims, I have already successfully measured AGA enzyme activity in zebrafish embryos and demonstrated that no AGA activity is deposited in the eggs. Our plan is to knockdown the expression of AGA using antisense morpholinos, modified oligonucleotides that can inhibit translation of AGA in the developing embryo. We will undertake a biochemical and phenotypical analysis of the mutant embryos that is highly parallel to the approach the lab has used successfully to characterize the ML-II zebrafish model. With the lack of economical animal models for such LSDs as aspartylglucosaminuria, there is an inherent barrier to developing new therapies; however, creating an effective AGA knockdown zebrafish model will be a groundbreaking step in opening many doors for therapeutic possibility.


*Faculty Research Mentor: Dr. Richard Steet, Biochemistry and Molecular Biology Complex Carbohydrate Research Center*
Seizure disorders, including epilepsy, affect over 3 million people in the United States, and more than 10% of the population will experience a seizure in their lifetime. Seizures are a symptom of abnormal, excessive or synchronous neuronal activity in the brain that can last for only a few seconds or, in some cases, indefinitely. The mechanisms underlying seizure generation and propagation remain poorly understood despite intensive study. Because seizures are often a systems-level phenomenon, our understanding of seizure mechanisms would benefit greatly if seizure-related changes in neuronal activity could be imaged throughout the brain. In my summer research project, I plan to study seizure mechanisms by optically imaging seizure-induced changes in neural activity in the zebrafish.

This semester I have been using confocal laser scanning microscopy to image brain activity in larval zebrafish induced to seize with pentylenetetrazol (PTZ), a GABA-A receptor antagonist. Brain activity is monitored by imaging the emitted fluorescence from a genetically encoded calcium indicator called cameleon. At the neuronal level, electrical activity is known to result in a rapid transient increase in the concentration of intracellular calcium. The cameleon fluorescence “signature” changes depending on intracellular calcium concentration. This allows me to map seizure-induced changes in neural activity over large regions of the developing zebrafish brain. In zebrafish, the larval period begins at 3 days post fertilization (dpf), when the fish are nearly free-swimming, and extends until about 27 dpf. Larval fish ranging from 3 dpf to 10 dpf exhibit significantly different seizure patterns indicating that mechanisms involved in seizure induction and propagation change as a function of neural development.

Seizures in adult zebrafish have not yet been imaged. The adult stage serves as an important fiducial point for comparison to larval seizures. This summer I plan to expand my imaging to adult zebrafish. We recently found that adult fish are much more susceptible to PTZ. In a behavior assay, adult fish lost consciousness within a few minutes of exposure to PTZ at a dose that minimally affected larvae. I will test the hypothesis that seizures in adult zebrafish brains are qualitatively different from those in larval brains. I will test this by imaging the pattern of PTZ-induced seizure activity in the adult brain and compare to the pattern observed in larvae. As part of this study, I will also test other chemoconvulsants that act on different receptors in the brain. Because this project involves quantitative imaging methods to address a neurobiological problem, I will conduct my summer research under the direction of Drs. Andrew Sornborger (Dept. Mathematics and Faculty of Engineering) and Jim Lauderdale (Dept. Cellular Biology).

Faculty Research Mentors: Dr. Jim Lauderdale, Cellular Biology and
Dr. Andrew Sornborger, Mathematics and Engineering
The ICC and the US: How have the Actions of the US Affected the ICC in the Past and how will they Affect the ICC in the Future?

CURO Summer Fellow: Bridget Mailley

Through this research project, I will examine the motives and resulting effects of one of the greatest obstacles to the International Criminal Court (ICC) – the United States. I want to determine whether the United States will help or continue to impede this Court and this channel for justice; what the United States’ actions should be; and how that could affect the ICC. First of all, why does the US seem to support regional courts such as the ICTY and the ICTR, but rejects a truly international court such as the ICC? I am also interested in whether or not the Obama Administration has any plans to alter or reverse the Bush Administration’s policies toward the ICC. Some of these policies include the American Service Members’ Protection Act and the unorthodox “un-signing” of the Rome Statute. This is a particularly interesting point considering Vice President Joseph Biden’s adamant support of the United States in its rejection of the Rome Statute. If the Obama Administration does indeed intend to change US policy toward the ICC, how will this affect the ICC? Finally, I would conclude with recommendations as to how the current administration should proceed with their treatment of the ICC in such a way that is beneficial, not only for the US, but for the future of international humanitarian law and for the rest of the world.

In order to get sufficient answers to all of my questions, I will use a few different methods of information gathering. First of all, I will utilize the published research that is already available concerning why the US has behaved as it has, and I would take into account the opinions of authors who have been following this field since the ICC became an issue. Second of all, I will interview people who are currently working with the ICC and the Coalition of the International Criminal Court (a coalition of NGOs that work for and monitor the ICC) about what they know concerning the situation between the US and the ICC, and how they think the US should act toward the ICC. I will also interview people from the US State Department to learn the United States’ current position, and how they view the United States’ position with regard to the ICC, and whether or not they think it should or will change. By conducting interviews with people who are currently involved with the ICC, CICC, and State Department I will be able to rectify the gap between published information and what is currently happening.

Along with my personal interest in the topic, there will be several benefits of this project. First of all, with this project, I would take a subject that is usually the concern of professionals and offer a well-founded, solidly researched addition to the undergraduate catalog. Second of all, the issues surrounding the ICC are current and important issues and this research project would offer a fresh view point on evolving field of study that affects the United States and the rest of the world, especially those areas in conflict. Lastly, this project could be the primary step in developing a set of scholarly recommendations for the actions of the United States concerning the ICC. The ICC is still young and growing, and the actions of countries now will heavily determine whether or not this court will be able to act independently in the future or if this court will be another puppet of the powerful.

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3 Ibid. 27.
5 Ibid., 90.

Faculty Mentor: Dr. Amy Ross, Geography
Development of Ferrofluid Based Platform for Particles and Cellular Manipulation

CURO Summer Fellow: Francisco Marrero

Ferrofluids are colloidal mixtures of nano-size magnetic particles (either single domain or superparamagnetic), covered by a surfactant and suspended in a compatible liquid medium [1]. A non-magnetic object placed inside a ferrofluid acts as a “magnetic hole”, in a manner analogous to an electronic hole in a semiconductor. An applied magnetic field gradient attracts magnetic nanoparticles, which end up displacing and effectively pushing the magnetic hole away. As such, any non-magnetic object inside a ferrofluid can potentially be manipulated and directed towards a given direction. Researchers have applied this principle to move and separate non-magnetic micro-beads within ferrofluids in microfluidic channels [2, 3].

Specific shape of a “magnetic hole” matters. An elongated particle in a ferrofluid turns to align its long axis with the applied magnetic field. For instance, the swimming direction of live Escherichia coli bacteria in bio-compatible ferrofluids can be controlled easily via external magnetic fields. Interestingly, magnetic holes act “magnetic” as well – attracting each other and forming clusters and chains in the presence of a field. Particle manipulation within ferrofluids works as long as what is being manipulated is much larger than the magnetic nanoparticles and the average spacing between them.

This proposal presents a truly universal, versatile, cost-effective and label-free particle and cellular manipulation scheme within bio-compatible ferrofluids, directly impacting health industry, biomedical research and homeland security. We have experimentally observed that larger microbeads can be moved faster under traveling magnetic field excitation within ferro-microfluidic devices. This is expected, since magnetic forces scale with the volume of the beads, whereas hydrodynamic drag (as approximated through Stokes flow around a sphere) scales with the bead radius. We will design, fabricate and test a microbead sorting device based on this observation. Separation efficiency will be characterized as a function of bead size and excitation parameters. Non-spherical micro-particles (available from Sigma Aldrich, St. Louis, MO) will also be studied. It is expected that elongated particles will orient their long axes parallel to the excitation electrodes and move by “log rolling” along their shorter axes. Once fully characterized, the particle sorter will be tested with live cells in bio-compatible ferrofluids. We will demonstrate bacterial sorting with both motile (K-12) and non-motile (YK4116 fla- and YK4183 mot-) strains of fluorescently-labeled Escherichia coli.

The same field gradients that help move cells inside ferrofluids would end up stretching them. If the device is not optimized, the stretching forces may severely and permanently damage the cell being manipulated in the long run. Therefore, even though the eventual goal is to demonstrate a cellular sorting and separation scheme valid for animal and human cells in general, these cells are left out of the scope of this proposal. Sorting and manipulation capabilities will be demonstrated with microbeads and live E. coli – these gram-negative cells possess a cell wall, and structurally, they are more rigid than most mammalian cells. The physics of particle manipulation will be clearly understood during the course of this work before specific animal and human cell protocols are developed for the next phase.

References:

Research Faculty Mentor: Dr. Leidong Mao, Engineering
Today researchers predominantly use genome sequencing technologies to identify cancer causing mutations in tyrosine kinases. However, to design novel drugs for these mutated kinases, a clear understanding of how these mutations alter the structure and function of the protein is necessary. Despite the availability of many tyrosine kinase structures, there is no clear understanding of how cancer mutations alter tyrosine kinase structure and function. This is due, in large part, to the complex network of atomic interactions observed in their crystal structures and our inability to pinpoint key interactions that contribute to tyrosine kinase function.

My research this past semester has focused on using powerful visualization tools such as PyMol to understand the combinatorial complexity of atomic interactions observed in tyrosine kinase structures. Three-dimensional protein visualization has become a powerful new tool in the field of bioinformatics which promises to revolutionize the way we study proteins. The strength of visually analyzing proteins is that it uses computer processing power to overcome the obstacles of protein complexity which plague other forms of study. Using these tools, I have been able to pinpoint key residues in tyrosine kinases that contribute to their function. This analysis has lead to several interesting hypotheses, which our lab is currently following up experimentally.

Since I have gained the experience in using computational tools to study tyrosine kinase structures, my goal this summer is to understand how mutations in tyrosine kinases alter their function. For this, I will first catalogue all the known somatic mutations identified in tyrosine kinases through genome sequencing studies. Then, I will map and analyze these mutations in the context of available structures to understand how these mutations alter tyrosine kinase structure and function. For this, I will primarily be using the visualization tools that I used in my previous semester as well as other computational tools that our lab is currently developing. The information gained from this study will directly contribute to our understanding of human cancers and provide clues for designing novel therapeutic strategies.

Faculty Research Mentor: Dr. Natraj Kannan, BCMB
Empirical Examination of Child Emotion Assessments: A Comparison of Child, Parent, and Behavioral Observation Methods

CURO-OVPR Research Fellow: Cody Nichol

Since emotion may be comprised of both physiological and bodily indicators, multiple methods of assessment should be employed. Adrian and Zeman (2007) reported that 44% of children emotion regulation (ER) research relied on only one method of inquiry while 31.5% used two methods of inquiry. This study will empirically examine three methods of emotion assessment in youth ages 7-12 years: self-report, other-report, and observation. In self-report, children are often administered a questionnaire and asked to account subjective and internal emotional experiences. In other-report, an individual who knows the child well, such as a parent, is asked to account the child’s ER capabilities. In observation, a trained researcher or research assistant objectively codes particular aspects of the child’s emotional experience. A criticism of observation is that it does not take into consideration the reasoning that motivates a particular behavior. In an effort to bring together the different ways of assessing emotion, one theory suggest that these methods each contribute to understanding a particular aspect of child emotion (Hubbard & Dearing, in press). There are advantages and disadvantages of each method, so in this context, one of the most argued questions in child psychology revolves around who is the best reporter of child ER; parents, children, or observers. In this research project, I will examine correlations among each assessment method and relate the reports to other indices of the child’s emotional functioning. Such knowledge has various implications in the context of clinical diagnosis, treatment evaluation, and research methods. An enhancement in diagnosis capabilities could result in improved treatment outcomes. In the context of scientific inquiry, researchers will be more aware of which emotion assessment methods to use so that erroneous and misleading data is not collected. In this research initiative, I will examine a community sample of 42 children (21 male and 21 female) and their mother and fathers. For the child self report data, I will analyze the Children’s Emotion Management Scale (CEMS; Zeman et al., 2001) and Positive and Negative Effect Scale for Children (PANAS-C, Laurent et al., 1999). For the parent report data I will analyze the Emotion Regulation Checklist (ERC, Shields & Cicchetti, 1997). For the observation data, I will code a behavioral interaction task in which the parents and child discussed emotions. Indices of the child’s emotional functioning will also be related to symptoms of psychopathology. Data will be analyzed using SPSS, one of the most prevalent programs for statistical analysis in social science. Analyses will allow me to identify any significant relationships among variables in the self-report, observation, and other report data sets. I hypothesize that there will be a significant relationship between the behavioral observations and the child self-report measures, indicating that children in the specified age group are reliable reporters of emotion regulation processes.


Faculty Research Mentor: Dr. Cynthia Suveg, Psychology
Genetic Alteration of the Soybean to Promote Astaxanthin Production  
CURO Research Fellow: Emily Pierce

Carotenoids, a group of natural pigments, are found in a variety of bacteria, plants, animals, and fungi. These pigments create coloration ranging from yellow to red. Carotenoids not only provide characteristic colors to certain organisms, but some are also important in the human diet as precursors of vitamin A or as powerful antioxidants. Additionally, they are used in a number of different industries, including pharmaceuticals and cosmetics.

Moreover, carotenoids are an important component in animal feed. Unlike photosynthetic organisms and some bacteria and fungi, animals cannot independently synthesize carotenoids, and thus they must obtain these compounds from dietary sources. Because animals raised for commercial use do not have access to the same diet that they would have in the wild, it is important that these pigments be added to their feed. For example, carotenoids are responsible for the characteristic pink color of salmon and shrimp. In the natural environment of salmon, astaxanthin, a specific carotenoid, is produced by marine bacteria and algae and then passed on to the salmon that consume these organisms. Astaxanthin is therefore added to the feed of salmon grown in aquaculture in order to give them the color that consumers desire and expect (Mann et al. 2000). The cost of producing astaxanthin and incorporating it in animal feed is rather high, and accounts for about fifteen to twenty percent of food costs (Rajasingh et al. 2006). Carotenoids are also used to give desirable colors to chicken egg yolks (Karadas et al. 2006).

My proposed research for the CURO summer research fellowship, which would be a continuation of research from the spring of 2009, would involve the genetic alteration of soybean plants in order to incorporate genes that would promote the production of astaxanthin. Soybean is an important ingredient in animal feed due to its high protein content and its relatively low price (Sørensen et al. 2009). Soybean that already contains astaxanthin would eliminate the cost of having to add carotenoids to animal feed.

Two genes, \textit{crtW} and \textit{crtZ}, are involved in the conversion of \(\beta\)-carotene to astaxanthin through a two-step process with a canthaxanthin intermediate. It may also be possible that a single gene, \textit{crtS}, has the ability to convert \(\beta\)-carotene to astaxanthin in a single step. For this project, both pathways will be attempted in order to determine which is the most efficient in the production of astaxanthin in soybean. The first step in this project was the creation of a synthetic \textit{crtS} gene which has been optimized for expression in soybean. Once a vector has been created, the plasmid will undergo enzymatic digestion and analysis using gel electrophoresis as well as DNA sequencing in order to ensure that the vector was correctly assembled and that the desired components are present. Once the plasmid is ready, soybean somatic embryos will be shot with the plasmid using a gene gun. The transformed embryos will be allowed to recover and will then undergo selection and maintenance in selection medium. DNA can then be extracted from the embryos in order to perform a polymerase chain reaction and Southern blot analysis to make sure that the plasmid was integrated into the genome of the plant tissue.

Once the soybean somatic embryos have been transformed, they will need to be regenerated into plants. After undergoing differentiation and maturation in liquid medium, they will be allowed to desiccate and then returned to solid medium for their germination into plants. The goal of this project is to eventually create a transformed plant that will possess the necessary gene or genes for the production of astaxanthin in its seed. This would be a valuable product for use in aquaculture and other industries, and would be extremely marketable as a component of animal feed. A sufficient amount of work has been done to engineer the production of carotenoids in other plants to suggest that there are no obvious impediments to this work.

Develop an Efficient Method to Create Marked and Unmarked Mutations in the Human Genome

CURO Research Fellow: Akanksha Rajeurs

My summer project will be to develop an efficient method to create marked and unmarked mutations in the human pathogen *Mycobacterium tuberculosis*. This bacterium is the causative agent of tuberculosis which kills almost 2 million people each year. To create a vaccine, the bacterium must be attenuated. This can be accomplished by deleting multiple chromosomally-located genes that are important for survival of the bacteria inside the host. To delete specific genes, systems have been developed that take advantage of homologous recombination.

Currently, two homologous recombination approaches exist to delete genes from the *M. tuberculosis* chromosome. The first employs a plasmid system (1, 3). Because transformation of plasmid DNA into *M. tuberculosis* is inefficient, separate genetic selections must be performed sequentially to isolate bacteria in which the targeted chromosomal gene is replaced. The second method uses a specialized transducing phage (2). In this case, regions of homology flanking the gene to be replaced are cloned onto a cosmid (a plasmid containing the cosA bacteriophage packaging site) such that they instead flank an antibiotic resistance gene. The cosmid is ultimately packaged into phages. As infection of *M. tuberculosis* by the specialized transducing phage is extremely efficient, bacteria having undergone separate recombination events in each of the flanking regions can be obtained by selecting for antibiotic resistance. The problem with the latter method is that a different antibiotic resistance gene would be required to replace another targeted chromosomal gene.

The goal of my CURO summer research project will be to combine features of the two recombination systems. Basically, I will be creating two types of cosmids. Each will have convenient cloning sites. In one of the cosmids, cosmid A, the cloning sites will flank a cassette of genes: a hygromycin resistance gene (*hyg*), a gene encoding green fluorescent protein (*gfp*), and a sucrose counter-selectable gene (*sacB*). The second cosmid, cosmid B, will not flank any genes. To delete a specific chromosomal gene, 500-1000 base pair regions of DNA flanking the targeted gene will be cloned into both of these cosmids. This will allow two different specialized transducing phages to be created. Transducing phages derived from cosmid A will allow for replacement of the targeted chromosomal gene with the gene cassette by selecting for resistance to hygromycin. The *gfp* gene on the cassette will facilitate study of the mutant as the bacteria should fluoresce green. Transducing phages derived from cosmid B can then be used on the cassette-containing mutants to select for only those bacteria that have lost the cassette. This is accomplished by plating the bacteria on medium containing sucrose. Sucrose is toxic to *M. tuberculosis* if the *sacB* gene is present.

Creation of the modified recombination system requires several steps. Since starting in Dr. Karls’s lab, I have made a couple of plasmids. The first one replaced the kanamycin resistance gene with the *hyg* gene on a plasmid that also contains an origin for replication in *E. coli* (oriE), the element for packaging DNA into bacteriophage lambda (cosA), and a unique *PacI* restriction enzyme site (for joining with mycobacteriophage DNA). This plasmid has been designated cosmid B. I have also removed a polylinker sequence from a plasmid that contains the *gfp* gene. Additional steps will involve introducing a restriction enzyme linker and the *sacB* gene into my *gfp*-containing plasmid. From the resulting plasmid, I will excise a fragment containing the *sacB* and *gfp* genes and transfer it into cosmid B to create cosmid A. I plan to complete cosmid B by the end of the summer. If I finish earlier, I will test the system by targeting a gene in the nonpathogenic species *Mycobacterium smegmatis*.


Research Faculty Mentor: Dr. Russell Karls, Veterinary Medicine
Salmonella outbreaks of unknown origin have plagued both humans and non-domestic bird species in the Southeastern United States. These outbreaks have devastating environmental and public health implications. Although we know about the epidemiology of salmonella in avian species, we have not isolated possible locations where the disease may be transmitted from bird to bird. There may also be some relationship between the current occurrences of salmonella outbreaks in humans and non-domestic birds via cross-species infection by contaminated peanut butter. Earlier research has found a correlation between the high incidences of infection of the strain *Salmonella enterica* serovar Typhimurium DT104 and the congregation of birds around bird feeders.1 The goal of this research is to observe non-domestic bird populations plagued with Salmonella and determine if the transmission of the Salmonella occurs at bird feeders. I would also like to determine if the Salmonella outbreak in the peanut butter may have any relation to the Salmonella strain, *Salmonella enterica* serovar Typhimurium DT104, in the nondomestic bird population. Furthermore, I want to determine if the *Salmonella enterica* serovar Typhimurium DT104 can be introduced into the human population and cause infection.

Bird feeders will be observed and studied to locate any possible transmittance of salmonella between feeding birds and, if infection does occur at bird feeders, salmonella isolates will be harvested from infected birds for further testing. I will be using polymerase chain reaction (PCR) and Pulse-field gel electrophoresis (PFGE) to amplify and compare the Salmonella isolates. *S. enteric* serovar Typhimurium SR11 and *Escherichia coli* HB101 will be used in PCR as positive and negative controls. Salmonella isolates from human populations and avian populations will be compared and analyzed to determine if they reside in the same family of bacterium. Upon determining the strain of salmonella in each population and comparing them, I will be able to tell whether cross-contamination via peanut butter introduced into the bird population could be the connection between the two salmonella epidemics. The completion of this project will help to better understand the origins and implications of the Salmonella epidemic and the extent to which the two concurrent plague of infections, of birds and humans, are related. If so, it will also help determine what precautions should be taken to minimize cross-species infection.


*Faculty Mentor: Susan Sanchez, Small Animal Veterinary Medicine*
Within my proposed research, I intend to analyze the nature of the individual and the notion of his happiness, as put forth by several traditions. I shall take an inter-disciplinary approach, using the work of Plato as a comparison point, in examining the traditions of Neo-Platonism, early and medieval Christianity, Tibetan Buddhism, and Psychology. Working to identify underlying similarities, I shall emphasize similar notions within each tradition, with the hope that a thorough analysis may highlight specific principles that, if taken to heart by the individual, shall help to elevate his happiness, and thus his well-being. Characterizing the individual and describing both what happiness is and how to arrive at it has been a key focus for past historical writers, and the proposed research intends to build on these understandings. Rather than simply defining the individual and happiness within each culture, this research shall emphasize how each tradition suggests the individual should behave and live. Happiness is essential to living well, therefore, serious consideration must be given to how the individual can and should act in order to increase his well-being.

Rather than directly comparing ideas of happiness within each tradition, I intend to emphasize the way the individual is represented and, specifically, highlight how the individual is suggested to live and develop himself, hence the emphasis and continual comparison with the Platonic notion of education. By approaching the research in this manner, a definition of happiness may be arrived at, and instead of merely providing an ending definition, reasons why this happiness is achieved shall be provided, as well as methods for obtaining it. Thus, I shall initially begin my research with Plato’s definition of the individual, and argue for his conception of happiness being directly related to his notion of education. This definition of the individual and idea of education shall then be compared to the remaining traditions mentioned above, and similarities and differences shall be noted.

The significance of this proposed research lies in providing the individual with practical suggestions on how to live and behave, suggestions that are aimed to increase his happiness and overall well-being. Rather than comparing the traditions simply for noting fundamental differences, emphasis shall be placed on understanding how these differences actually surface in the suggested behavior of the individual, and in this manner the research is unique. Although a great deal of work has already been completed on happiness, the importance of my research lies in the comparison and culmination of different traditions, and this would not have been possible if I had not already completed previous research within each tradition.

Furthermore, in tracing the thought of Plato throughout history, the proposed research will highlight the modern day importance of the Platonic notion of education, as well as its relevance to Christian, Buddhist, and current thought in Psychology. Most notably, those ideas dealing with man’s relationship to God, fundamental concepts within Tibetan Buddhism, and current Psychological work on the individual and his well-being shall be stressed. The research shall act as a connection between the traditions. While there are limits on the proposed research, and no secret combination of words or principle shall ever bring about true happiness, the goal of the proposed research is to emphasize at least a few principles that, if taken to heart, can and hopefully will make a positive change in the life of the individual.

Faculty Research Mentor: Dr. Frank R. Harrison, III, Philosophy
Finding God in the Poetry of Robert Penn Warren

CURO Research Fellow: Matthew Sellers

With a body of poetry devoted to the human struggle with spiritual transcendence, Robert Penn Warren’s metaphysical confusion deserves attention for its variety and depth and for its pertinence to understanding the poet’s struggle. If awarded a CURO Summer Fellowship, I propose an interdisciplinary study which includes an intense reading of Warren’s later poetry (circa 1965 onward) and evaluates it in terms of psychology, contemporary history, biography, religion, and literary analysis to catalogue and describe the spiritual struggle and comment on its importance to the development of the poet, to the poet’s commentary on his society, and to understanding the moral system Warren creates. In addition, key critical pieces on selected poems will be studied to comprehend the critical response to Warren’s spirituality.

Associated most often with All the King’s Men, literary giant Robert Penn Warren contributed far more to American literature than a single novel. In fact, he produced countless poems, essays, short stories and textbooks, a literary oeuvre of which great authors would be envious. Called by R.W.B. Lewis “the most complete man of letters in our time,” Warren’s life spans the Great Depression, two World Wars and the civil rights movement; his work grapples with Southern identity, human consciousness, and the inevitability of spirituality. Particularly in his later pieces, Warren vacillates between confident acceptance of spirituality and fretful anxiety about such blind faith. In Can I See Arcturus From Where I Stand (1975), for example, “Evening Hawk” describes a spiritual experience that must inevitably end, whereas in “Youth Stares at a Minoan Sunset” from Now and Then: Poems (1976-1978) the tone tends toward the melancholy. The speaker’s nostalgia for innocence goes beyond a mere remembrance of youth, it communicates a longing for the same spiritual connection the young man embraces even as the speaker’s bitterness questions the validity of such openness to a transcendental moment. The two poems were written in close temporal proximity, yet they offer very different outlooks on transcendence. Warren’s inability to settle this spiritual crisis in his poetry captures a personal struggle that raises many fundamental yet very pertinent questions about the nature of spirituality and humanity’s definition of its place in the world. In the proposed study, the emotional response of the reader and speaker to such questions will be explored to delineate Warren’s take on the nature of modern spirituality.

Though acknowledging its spiritual nature, the majority of criticism directed at Warren’s poetry focuses on the American consciousness and Southern morality communicated in the work. Yet, outside the context of moral democracy or traditional virtue, the spirituality that Warren’s speakers seek or experience suggests the need for some sort of defining morality beyond simply devotion to the ideology of the state. A.L. Clements argues in his essay “Sacramental Vision: The Poetry of Robert Penn Warren” for the growth of Warren’s poetry, that it begins “in pain, makes its progress through to darkness and death, and then…ends in rebirth, truth, selfhood, even joy.” This outlook is a positive one, yet the element of pain Clements claims vanishes never disappears entirely from the poetry, rather it lingers in the form of doubt. Biography would be an easy way to evaluate Warren’s spirituality, yet to say that his Southern heritage creates the struggle between rural faith and world-class education would be an oversimplification of a complex internal debate. More, to suggest that an old man would be more willing than a young man to accept some form of belief insults the carefully constructed narrative. Therefore, I suggest a compilation of the critical body of writing on Warren’s poetry to compare the analytical takes on his spirituality. Only then, by juxtaposing the critical works and the insight gained into Warren’s spiritual world, can the sublime nature of the poetry be contextualized in terms of Warren’s American consciousness and Southern heritage.

Faculty Research Mentor: Dr. Hugh Ruppersburg, English
Implicit System of Rational Thought Analogous to Modern First-Order and Modal Logics in Plato’s Late Dialogues

**CURO Research Fellow: Michael Slade**

Through this study, I hope to find in Plato’s late dialogues an implicit system of rational thought analogous to modern first-order and modal logics. If a working “rules of inference” can be found, the second stage of my project will be finding the axiomatic assumptions lying at the heart of Plato’s philosophy. Though the importance of Plato’s writings to western thought has become a bit of an axiom in the history of ideas, the exact manner in which he was revolutionary is a topic of disagreement. Some cite his “doctrine of the forms,” while others speak vaguely of his literary genius or mythological power. Historically, however, it was his concern for developing a philosophical methodology that established him as truly innovative. This concern for the rational process motivated Plato’s definition of philosophy not as a set of propositions or doctrines to be believed, but instead a practice to be engaged in. He called this practice διαλεκτική, the dialectic.

Unfortunately, the concept of “dialectic” has been abused by modern scholars. If one were to read, for example, Gustav Mueller’s *Plato, The Founder of Philosophy as Dialectic*, one gains the distinct impression that dialectic is mainly a literary device, where two distinct forces create a tension towards a single goal. While such attempts provide legitimate scholarly insight, they do not capture Plato’s intention of dialectic for two reasons. First, by leaping into the metaphorical abyss they bypass the very obvious relation of διαλεκτική to διαλέγομαι, a straightforward Greek verb meaning “to converse with (a person).” The dialectic is a *conversation*, not a process of formal witticism. Second, to characterize the fundamental philosophical activity as something pertaining to either reading or writing is clearly misguided in light of Plato’s critique of the written word in *Phaedrus* and *The Seventh Letter*. Far closer to Plato is Christopher Gill’s definition of dialectic as “philosophical dialogue conducted through systematic, one-to-one, question and answer.” This still leads, however, to a very obvious question: “What is methodological system underlying Plato’s dialectic?”

My research will attempt to address this question through an intensive study of logical form in a considerable segment of Plato’s “late” dialogues: *Theaetetus, Statesman, Sophist* and *Parmenides*. While relevant passages on the dialectical process appear in many of Plato’s other works (*The Republic, Gorgias* and *Meno*, for example), Plato’s “trilogy” (*Theaetetus, Sophist* and *Statesman*) plus *Parmenides* are attractive as the focus of my study for several reasons. First, they are far more self-conscious about the dialectical process than most of Plato’s other dialogues, providing detailed analysis of the methods they are employing to address a particular question. Second, while every Platonic dialogue is an instance of dialectic, flawed interlocutors often interfere with the smooth workings of the philosophical process. In *Parmenides* and the trilogy, the speakers tend to be both cooperative and intelligent, producing ideal circumstances for the study of the dialectic. Third, these dialogues tend to be neglected, especially at the undergraduate level, because of their notorious difficulty. It is, however, precisely the highly technical, dialectical machinery of the dialogues that make them both difficult and fertile for study.

If the formalization I’m proposing is possible, it will revitalize the argumentative framework which many contemporary philosophers consider an artifact of only historical interest and motivate a reevaluation of Plato in terms of his fundamental assumptions. Judgments can then be made concerning Plato’s presuppositions and the rigor of his entailments, instead of simply rejecting the conclusions of arguments solely because they are unattractive. Any such system would also contribute meaningfully to the ongoing debate over the “periodization” of Plato by attempting to provide an objective standard to measure the level of philosophical disparity between the “early,” “middle” and “late” dialogues.

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6 “Afterword: Dialectic and the Dialogue Form in Late Plato” in *Form and Argument in Late Plato* ed. Christopher Gill and Margaret McCabe (New York: Oxford University Press 1996), 285

**Faculty Research Mentor:** Dr. Frank R. Harrison, III, Philosophy
This EXROP project is designed for students who are interested in a career in academics that combines both research and innovative teaching. It is an offshoot of Dr. Wessler’s HHMI Professor Program (see http://www.hhmi.org/research/professors/wessler.html for more details) entitled: The Dynamic Genome: Introducing Evolution to Undergraduates.

At the heart of Dr. Wessler’s HHMI program is a laboratory classroom that was designed to replicate the Wessler research laboratory with both computational and experimental facilities. Courses are taught year-round in this facility. In addition, a unique feature of course content is the focus on transposable elements (TEs), mobile genetic elements that comprise a staggering 50% of the human genome and over 90% of some plant genomes. As such, one outcome of the courses taught as part of the larger program is that students experience the excitement of scientific discovery, as they are often the first to analyze significant portions of a genome. In doing so, students learn that the genome is more than an instruction manual for making an organism; it is also an historical record of how species evolve.

The summer experience will begin with a short training period with personnel from the research laboratory with a focus on genome analysis including both computational and experimental protocols. These skills will then be applied in two ways. These experiences occur first, by working with lab personnel to teach a short genome analysis “boot camp” for incoming college freshman; and, second, by working independently to design a laboratory module or assessment tool(s) for future courses.
Photoactivation of gene expression is an invaluable technology that enables the study of intracellular physiology.\textsuperscript{1-3} Using light to activate or inactivate specific genes enables precise control of cell mechanisms in an endeavor to further understand biological systems. One reason to induce gene expression is to explore the establishment of neural circuits in the central nervous system (CNS) of developing vertebrates. Specifically, the role of \textit{Pax6}, a highly conserved transcription factor in vertebrates pertinent to the development of the CNS, can be investigated in zebrafish.\textsuperscript{4-7} Experiments utilizing high-resolution optical imaging allow the functional study of neural activity, but are inadequate for studying the timing of expression in single cells.\textsuperscript{8-10} Photoactivation of a small-molecule inducer gene expression can alleviate these spatiotemporal limitations. Eventually, target genes like \textit{Pax6} can be manipulated in other vertebrates, including humans, to avoid various genetic disorders.

I will synthesize and test the photochemical properties of a photoactivatable activator of gene expression, BHQ-dithiol-MFP, which is comprised of 8-bromo-7-hydroxyquinolinyl-dithiol (BHQ-dithiol), a photoremovable protecting group (PPG) that is hydrolytically robust and sensitive to two-photon excitation (2PE) conjugated to mifepristone (MFP), which activates gene expression through Invitrogen’s GeneSwitch\textsuperscript{TM}.\textsuperscript{11}

\begin{enumerate}
\item Kim, J.; Lauderdale, J. D. Analysis of Pax6 expression using a BAC transgene reveals the presence of a paired-less isoform of Pax6 in the eye and olfactory bulb. \textit{Dev. Biol.} 2006, 292, 486-505.
\item Lakowski, J.; Majumder, A.; Lauderdale, J. D. Mechanisms controlling Pax6 isoform expression in the retina have been conserved between teleosts and mammals. \textit{Dev. Biol.} 2007, 307, 498-520.
\end{enumerate}

Faculty Research Mentor: \textit{Dr. Timothy Dore}, Chemistry
Despite the importance of discovering retroviral diseases such as human immunodeficiency virus and human T-lymphotropic virus (HTLV), techniques for retroviral discovery remain limited. Currently, there are no available techniques to identify all members of the retroviral family. We propose to develop a sensitive, broadly reactive PCR assay using CODEHOPs for the identification of retroviral genomes present in all members of the family Retroviridae. The gag, pro, pol and env genes are present in all infectious retroviruses. These genes and the proteins they encode will be used to identify non-redundant amino acid sequences from all known unique retroviral species. Consensus-degenerate hybrid oligonucleotide primers will be developed from the alignment of these sequences. Highly conserved domains of 8-10 amino acids will be back-translated into degenerate nucleotide sequences that will be designed to represent all possible codons for the resultant amino acid. Once developed, the degeneracy and sensitivity of the primer pairs will be tested via reverse transcriptase PCR on retroviruses that infect a wide variety of species. The most sensitive and broadly reactive primers will be used to screen clinical specimens that may be associated with retroviral infection.

To date, retroviruses have not been identified in dogs, although several canine diseases have similarities to known retroviral disorders in other species. Degenerative myelopathy (DM) is a progressive, idiopathic neurodegenerative disorder that primarily affects the spinal cord of dogs. Several clinical and histopathological similarities exist between canine DM and retrovirus-induced myelopathies. In particular, canine DM has striking similarities to HTLV type-1 myelopathy / tropical spastic paresis. Both disorders have nearly identical cervical and thoracic spinal cord pathology, and interestingly both conditions typically spare the thoracic limbs until late in the disease processes. The broadly reactive pan-retroviral PCR assays (developed via the CODEHOP strategy) will be used to evaluate cerebrospinal fluid and spinal cord tissue of dogs with histopathologically confirmed DM for the presence of retroviruses.

Development of a broadly reactive PCR assay for the retroviral genome should prove useful in determining whether or not canine DM is associated with retroviral infection. Moreover, pan-retroviral PCR will be a powerful tool for retrovirus detection in numerous diseases of unknown etiology in dogs and other species including humans.


Faculty Research Mentor: Dr. Scott Schatzberg, Veterinary Medicine
Appendix A
CURO 2008 Summer Research Fellows

Zachary Anderson, CURO Summer Research Fellow
Dr. Peter Brosius, Department of Anthropology
Multicultural Perspectives on Landscape Change

Matthew Belcher, CURO-BHSI Summer Research Fellow
Dr. Michael Terns, Department of Biochemistry and Molecular Biology
Dr. Rebecca Terns, Department of Biochemistry and Molecular Biology
Determinants in the Localization of Telomerase to Telomeres

Mary Elizabeth Blume, CURO-OVPR Summer Research Fellow
Dr. Stefaan Van Liefferinge, Department of Art History
Uncovering Traditions of the Gothic Style in the Architectural Plans of Saint Germain-des-Pre and Saint Martin-des-Champ in Paris

Milissa Brody, CURO-OVPR Summer Research Fellow
Dr. Ron Carroll, Odum School of Ecology
Interactions of Bees and Hummingbirds with Hamelia patens

Carolyn Crist, CURO-UGA Summer Research Fellow
Dr. John Greenman, Journalism
News in the Black Belt: Teaching Journalists how to Cover Poverty in Persistently Poor Counties

M. Logan Davis, CURO-BHSI Summer Fellow
Dr. James Franklin, Department of Pharmaceutical and Biomedical Sciences
Long-Range Retrograde Transduction of Trophic and Survival Signals in Mouse Sympathetic Neurons

Caroline M. Anderson, CURO-OVPR Summer Research Fellow
Dr. Dorothy Fragaszy, Department of Psychology
Decision-Making Strategies of Wild Capuchin Monkeys

Marcus Hines, CURO-BHSI Summer Research Fellow
Dr. Michael Tiemeyer, Complex Carbohydrate Research Center
Dr. Lance Wells, Complex Carbohydrate Research Center
Analyzing the Function of O-GlcNAc in Drosophila

Haylee Humes, CURO Summer Research Fellow
Dr. Marcus Fechheimer, Department of Cellular Biology
How AICD and Fe65 are Recruited to Hirano Bodies

Lindsay Jones, CURO Summer Research Fellow
Dr. Michael Terns, Department of Biochemistry and Molecular Biology
Dr. Rebecca Terns, Department of Biochemistry and Molecular Biology
Identification and Characterization of a Nuclease that Functions in an RNA-Mediated Viral Defense Pathway (RNAi) in Prokaryotes

Tyler Kelly, CURO Summer Research Fellow
Dr. Elham Izadi, Department of Mathematics
Usage of Linear Subspaces with Varieties
Former CURO Summer Research Fellows

Jung Woong Kim, CURO Summer Research Fellow
Dr. Andrew Sorenborger, Department of Mathematics, Engineering
Dr. James Lauderdale, Department of Cellular Biology
Imaging of Endogenous Ca2+ Waves in Developing Zebrafish

Jennifer Lee, CURO-BHSI Summer Research Fellow
Dr. Ronald Blount, Department of Psychology
Understanding Pediatric Symptoms

Sharon McCoy, CURO-OVPR Summer Research Fellow
Dr. Chad Howe, Department of Romance Languages
Dialect Perceptions of Spanish Speakers in Georgia

Katherine McGlamry, CURO-Jane and Bill Young Scholarship Summer Research Fellow
Dr. Michael Tiemeyer, Complex Carbohydrate Research Center
Glycan Interactions and the Development and Spread of Cancer Cells

Alice Meagher, CURO-BHSI Summer Research Fellow
Dr. Michael Adams, Department of Biochemistry and Molecular Biology
Expression and Characterization of the Heterologously Expressed Soluble Hydrogenase I from Pyrococcus furiosus

Madison Moore, CURO-BHSI Summer Research Fellow
Dr. Jennifer McDowell, Department of Psychology
Behavioral and Neural Plasticity Following Daily Practice of Saccade Tasks in Schizophrenia

Emily Meyers, CURO-OVPR Summer Research Fellow
Dr. Patricia Sullivan, Department of International Affairs
The Advantage of Weakness: How Weak States can Overcome Military Might of Strong States

Kelly Nielsen, CURO-OVPR Summer Research Fellow
Prof. George Contini, Department of Theatre and Film Studies
Augusto Boal’s Invisible Theatre: Political Play with an Unassuming Audience

Sean O’Rourke, CURO Summer Research Fellow
Dr. Kathy Simpson, Department of Kinesiology
Neuromuscular Activation and Movement Kinematics Exhibited During the Sit-to-Stand by Multiple Sclerosis Individuals

Julie Patel, CURO Summer Research Fellow
Dr. Patricia Sullivan, Department of International Affairs
Military Interventions by Powerful States

Neil Pfister, CURO-BHSI Summer Research Fellow
Dr. Michael Terns, Department of Biochemistry and Molecular Biology
Dr. Rebecca Terns, Department of Biochemistry and Molecular Biology
Interactions that Define the Organization of RNA-Protein Complexes Involved in Prokaryotic RNA Interference

Stefann Plishka, CURO-Franklin College of Arts and Sciences Summer Research Fellow
Dr. Asen Kirin, Department of Art History
Imagining Constantinople: Imperial Houses of Worship as Symbols of State Ideology
Former CURO Summer Research Fellows

Katie Pyne, CURO Summer Research Fellow
  Dr. Jerome Legge, Department of International Affairs
  Refugees and Internally Displaced People: How Effective are the United Nations, Nongovernmental Organizations, and Subsequent Initiatives in Pacifying this Complex Humanitarian Crisis?

Joseph Rimanddo, CURO-Interdisciplinary Toxicology Program Summer Research Fellow
  Dr. Ralph Tripp, Department of Infectious Diseases
  Understanding and Preventing the Interaction between RSV’s G Protein and the CX3CR1 Cell Receptor

Aalok Sanjanwala, CURO Summer Research Fellow
  Dr. Marcus Fechheimer, Department of Cellular Biology
  Dr. Ruth Furukawa, Department of Cellular Biology
  The Effect of Hirano Bodies on Mutated Tau Protein

Neeraj Sriram, CURO Summer Research Fellow
  Dr. Mark Eiteman, Department of Biological and Agricultural Engineering
  Solving the World’s Energy Crisis – Not One Sugar at a Time

Giridhar Subramanian, CURO Summer Research Fellow
  Dr. Brock Tessman, Department of International Affairs
  Power and Influence in Southeast Asia: A Study of the Methods Used by India, China, and the United States

Aileen Thomas, CURO Summer Research Fellow
  Dr. Nicole Lazar, Department of Statistics
  How Random is Pseudorandom

Kathryn Turner, CURO Summer Research Fellow
  Dr. Shelley Hooks, Department of Pharmaceutical and Biomedical Sciences
  Comparison of RGS Regulation of LPA Signaling in Prostate Cancer and Ovarian Cancer

Manouela Valtcheva, CURO Summer Research Fellow
  Dr. Jennifer McDowell, Department of Psychology
  Antisaccade Performance and Deficit Characteristics in a Normal Population

Hunter Wilson, CURO Summer Research Fellow
  Dr. Timothy Dore, Department of Chemistry
  8-Chloro-7-hydroxyquinoline as a Biologically Useful Photoremovable Protecting Group

Laura Wynn, CURO-OVPR Summer Research Fellow
  Dr. Martin Kagel, Department of Germanic and Slavic Languages
  Issues in Current Turkish-German Literature
Appendix B
CURO 2007 Summer Research Fellows

Caroline M. Anderson, CURO-OVPR Summer Research Fellow
Dr. John Turci-Escobar, Department of Music Theory
Dr. Max Reinhart, Department of German
A Psychoanalytical Examination of Wolf and Mörike's Peregrina Songs

Joseph Burch, CURO Summer Research Fellow
Dr. Harry Dailey, Department of Microbiology and Biochemistry & Molecular Biology
Converting Ferrochelatase into a Cytochrome c Like Protein

Amy Burrell, CURO-BHSI Summer Research Fellow
Dr. Debra Mohnen, Department of Biochemistry & Molecular Biology
Analysis of the Transcriptional Expression of Arabidopsis GAUT Genes: 15 Proven and Putative Plant Cell Wall Biosynthetic Galacturonosyltransferases

Lee Ellen Carter, CURO-OVPR Summer Research Fellow
Dr. Fausto Sarmiento, Department of Geography
Ecoregional Conservation Among Indigenous Communities in Cotacachi, Ecuador

Kimberly Delisi, CURO-BHSI Summer Research Fellow
Dr. Ray Kaplan, Department of Infectious Diseases
Parameters Affecting Fecal Egg Count Data for Determining Drug Resistance in Nematode Parasites of Horses

Joshua Dunn, CURO-OVPR Summer Research Fellow
Dr. William Kretzschmar, Departments of Linguistics and English
The Youth of Roswell Voices: A Linguistic Analysis

Katie Flake, CURO-BHSI Summer Research Fellow
Dr. Maor Bar-Peled, Complex Carbohydrate Research Center
The Arabinose Kinase Project

James Gordy, CURO Summer Research Fellow
Dr. Michael Adams, Department of Biochemistry & Molecular Biology
Developing Methodologies for the Study of Small ORFs in P. furiosus

Jana Hanchett, CURO Summer Research Fellow
Dr. David Schiller, Department of Musicology/Ethnomusicology
Latino and Hispanic Musical Influences on Athens-Clarke County

Laura Harrison, CURO-BHSI Summer Research Fellow
Dr. Corrie Brown, Department of Pathology
Campylobacter in the Crypts

Clare Hatfield, CURO-OVPR Summer Research Fellow
Dr. Stephen Shellman, Department of International Affairs
Democracy and the Choice of Law: The Intersections of Shari’a, Domestic and International Law

Anna Hudson, CURO Summer Research Fellow
Dr. Richard Dluhy, Department of Chemistry
Using Surface Enhanced Raman Spectroscopy for the Detection of Pathogens
**Former CURO Summer Research Fellows**

**Andy Kragor**, CURO-Jane & Bill Young Scholarship Summer Research Fellow  
Dr. Lance Wells, Complex Carbohydrate Research Center  
Dr. Carl Bergmann, Complex Carbohydrate Research Center  
*Unbiased Isolation and Carbohydrate Mapping of Alpha-Dystroglycan*

**Brian Laughlin**, CURO-BHSI Summer Research Fellow  
Dr. Alan Darvill, Complex Carbohydrate Research Center  
*Functional Analysis of the Magnaporthe grisea Secretome*

**James MacNamara**, CURO Summer Research Fellow  
Dr. Timothy Dore, Department of Biochemistry & Molecular Biology  
*Synthesis of Quinolinol-Based Inhibitors of Rec1p*

**Prashant Monian**, CURO-Interdisciplinary Toxicology Program Summer Research Fellow  
Dr. Brian Cummings, Pharmaceutical & Biomedical Sciences  
*Molecular Inhibition of Independent Phospholipase A2 and its Effect on Prostate Cancer Growth*

**Neil Naik**, CURO-OVPR Summer Research Fellow  
Dr. Ruth Harris, Department of Food & Nutrition  
*The Effect of Antagonizing Stress Receptors in Rats During Repeated Exposure to Restraint Stress*

**Natalie Nesmith**, CURO-BHSI Summer Research Fellow  
Dr. Mary Bedell, Department of Genetics  
*Genetic Studies on the Roles of KITL in Regulating the Proliferation and Apoptosis of Primordial Germ Cells in Mice*

**Victor Orellana**, CURO Summer Research Fellow  
Dr. Nicolás Lucero, Department of Romance Languages  
*Unsung Hero: A Literary and Historical Study of Lautaro*

**Tulsi Patel**, CURO Summer Research Fellow  
Dr. Scott Gold, Department of Plant Pathology  
*Developing a Biocontrol Agent for Chinese Privet, Ligustrum sinense*

**Tomas Pickering**, CURO-OVPR Summer Research Fellow  
Dr. Dorothy M. Fragaszy, Department of Psychology  
*Manner of Hammer Stone Use in Wild Capuchin Monkeys*

**Cleveland Piggott**, CURO-BHSI Summer Research Fellow  
Dr. Marcus Fechheimer, Department of Cellular Biology  
*The Formation of Hirano Bodies*

**Purvi Sheth**, CURO Summer Research Fellow  
Dr. Russell Karls, Department of Microbiology  
*Characterization of Mycobacterium shottsii*

**Traci Tucker**, CURO Summer Research Fellow  
Dr. Dawn Robinson, Department of Sociology  
*Gender and Role Meanings: A Cross-Cultural Comparison*

**Jessica Van Parys**, CURO-UGA Alumni Association Summer Research Fellow  
Dr. David Mustard, Department of Economics  
*Does Writing Ability Signal Academic Excellence?: Evidence from the New Scholastic Aptitude Writing Section (SATW)*

**Creating a Culture of Undergraduate Inquiry**

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Delila Wilburn, CURO Summer Research Fellow
   Dr. Barbara McCaskill, Departments of African American Studies and English
   Beauty Imposed

Karen Wong, CURO Summer Research Fellow
   Dr. Andrew Whitford, Department of Political Science
Appendix C
CURO 2006 Summer Research Fellows

Sarah Breevoort, CURO-BHSI Summer Research Fellow
Dr. Walter Schmidt, Department of Biochemistry and Molecular Biology
Construction of Three Rcelp Mutant Plasmids to Aid in the Characterization of Rcelp Enzymatic Activity

Lauren Coffey, CURO Summer Research Fellow
Dr. Stephen Shellman, Department of International Affairs

Susan Fang, CURO Summer Research Fellow
Prof. Christopher Hocking, Studio Foundations

Courtney Grant, CURO-BHSI Summer Research Fellow
Dr. Julie Coffield, Department of Physiology and Pharmacology
An Investigation of Botulinum Neurotoxin Interactions on RhoA Activity Using In Vitro Assays

Erica Hall, CURO-BHSI Summer Research Fellow
Dr. Jessie Kissinger, Department of Genetics

Adele Handy, CURO-UGA Alumni Association Summer Research Fellow
Dr. Greg Robinson, Department of Chemistry

Celan Hardman, CURO Summer Research Fellow
Prof. Joe Norman, Drawing and Painting

Sana Hashmi, CURO-Jane and Bill Young Scholarship Summer Research Fellow
Dr. Lance Wells, Complex Carbohydrate Research Center
Alteration of Alpha-Dystroglycan and Cancer Progression

Brian Levy, CURO Summer Research Fellow
Dr. Larry Nackerud, School of Social Work
Courrie – Not Email: Implications for Government Regulation of a Social Phenomenon. A Case Study of Language in France

Maggie Mills, CURO-NSF/SPIA Summer Research Fellow
Dr. Stephen Shellman, Department of International Affairs

Anna-Marieta Moise, CURO-BHSI Summer Research Fellow
Dr. Andrea Hohmann, Department of Psychology
Neurochemical Basis of Social Defeat in Syrian Hamsters: Role of Endogenous Cannabinoids

Lamar Moree, CURO-BHSI Summer Research Fellow
Dr. Alan Darvill, Complex Carbohydrate Research Center

Jesse Oakley, CURO Summer Research Fellow
Dr. Laurie Fowler, Department of Ecology
Economic Incentives for Private Land Conservation and Sustainable Development: Research into Environmental Policy in Costa Rica and Georgia

Katie Orlemanski, CURO-OVPR Summer Research Fellow
Dr. Patricia Richards, Department of Sociology
Reclaiming “Development” within the Context of Low-Income Neighborhoods
Former CURO Summer Research Fellows

Danielle Pearl, CURO-OVPR Summer Research Fellow
  Dr. Keith Langston, Germanic and Slavic Languages
  *Press Freedom, E.U. Accession, and Democracy in Croatia*

Daniel Perry, CURO Summer Research Fellow
  Dr. David Landau, Department of Physics and Astronomy

Andrew Pierce, CURO Summer Research Fellow
  Dr. Thomas McNulty, Department of Sociology

Richard Piercy, CURO-OVPR Summer Research Fellow
  Dr. Cory Momany, Department of Pharmaceutical and Biomedical Sciences

Kurinji Pandiyan, CURO Summer Research Fellow
  Dr. Steven Holloway, Department of Geography
  *Understanding Public Space in a New Urbanist Development*

Mandy Redden, CURO-BHSI Summer Research Fellow
  Dr. Robert Arnold, Department of Pharmaceutical and Biomedical Sciences
  *Towards a More Effective Delivery System for Anti-Cancer Drugs*

Eva Bonney Reed, CURO-BHSI Summer Research Fellow
  Dr. Ronald Blount, Department of Psychology

Lisa Rivard, CURO-Toxicology Summer Research Fellow
  Dr. Jeff Fisher, Toxicology

Sonia Talathi, CURO-OVPR Summer Research Fellow
  Dr. Brian Cummings, Department of Pharmaceutical and Biomedical Sciences
  *Effectiveness of Ca2+-Independent Phospholipase A2 Inhibitors in the Induction of Cheomtherapeutic-Induced Cancer Cell Death*

Erika Vinson, CURO Summer Research Fellow
  Dr. Richard Siegesmund, Art Education

Joshua Watkins, CURO Summer Research Fellow
  Dr. Patricia Sullivan, Department of International Affairs
  *The Price of Victory: When Leaders Underestimate the Cost of War*

Daniel Weitz, CURO-OVPR Summer Research Fellow
  Dr. Gary Bertsch, Department of International Affairs
  *The Impact of a European Union Nuclear Weapons Free Zone on the International Non-Proliferation Regime*

Shannon Yu, CURO-BHSI Summer Research Fellow
  Dr. Nancy Manley, Department of Genetics

Creating a Culture of Undergraduate Inquiry

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Appendix D
CURO 2005 Summer Research Fellows

Grace Anglin, CURO-OVPR Summer Research Fellow
Dr. Kimberly Shipman, Department of Psychology
*Family Focused Emotion Communication Training*

Ashley Beebe, CURO Summer Research Fellow
Dr. James R. Holmes, Center for International Trade and Security
*The Influence of Media on Economic Policy in Brazil and Argentina*

Ingrid Bloom, CURO-BHSI Summer Research Fellow
Dr. Steven Stice, Department of Animal and Dairy Science
*Differentiation of Human Embryonic Stem Cells into Endothelial Progenitors*

Ian Lewis Campbell, CURO Summer Research Fellow
Dr. Glenn Wallis, Department of Religion
*Theories of Mythology and the Way That Myths Have Affected Social and Political Formation*

Kimberly Coveney, CURO-CIT Summer Research Fellow
Dr. Brian Cummings, Department of Pharmaceutical and Biomedical Sciences
*Role of iPLA2 in Phospholipid Metabolism in Chemotherapeutic-Induced Cancer Cell Death*

William Collier, CURO-OVPR Summer Research Fellow
Dr. Amy D. Rosemond, Institute of Ecology
*Analysis of an Exotic Species’ Interactions with Native Aquatic Trophic Dynamics: Quantifying the Effects of the North American Beaver (Castor canadensis) on Sub-Antarctic Stream Food Webs in the Cape Horn Archipelago, Chile*

John Crowe, CURO Summer Research Fellow
Prof. Mark Callahan, Ideas for Creative Exploration
*AUX Launch: Art, Representation, and Commerce on the Web*

Katie Griffith, CURO Summer Research Fellow
Dr. Diana Ranson, Department of Romance Languages
Dr. Judith Preissle, College of Education
*Assessing Cultural Values and Political Beliefs in a Nicaraguan Classroom: A Participant Observation*

Matthew Haney, CURO-CTEGD Summer Research Fellow
Dr. Rick Tarleton, Department of Cellular Biology
*Antibody Depletion of Highly Abundant Proteins in Trypanosoma cruzi for the Fine-Tuning of Proteomic Analysis*

Ned Hembree, CURO Summer Research Fellow
Dr. Timothy Dore, Department of Chemistry
*Rce1 and Ste24 Inhibition by Dipeptidyl Acyloxymethyl Ketones: A Potential Target for Cancer Therapeutics*

Alicia Higginbotham, CURO Summer Research Fellow
Dr. Thomas Cerbu, Department of Comparative Literature
*Christopher Logue’s Iliad: A Work in Translation*

Scott Jacques, CURO Summer Research Fellow
Dr. Mark Cooney, Department of Sociology
*The Social Reality of Young, Middle Class Drug Dealers*
Lisa Jordan, CURO Summer Research Fellow
Dr. Ruth Harris, Department of Food and Nutrition
*The Effect of Leptin on Sympathetic Nerve Activity in White Adipose Tissue*

Carey Kirk, CURO-OVPR Summer Research Fellow
Dr. David Z. Saltz, Department of Theatre and Film Studies
*The Effectiveness of Drama Techniques in Treating People Suffering from Trauma*

Andrew Leidner, CURO-CTEGD Summer Research Fellow
Dr. Pejman Rohani, Institute of Ecology
*Coevolutionary Behavior and Interference between Fatal Diseases*

Jon McGough, CURO-BHSI Summer Research Fellow
Dr. Wyatt Anderson, Department of Genetics
*The Role of Female Choice in Sexual Selection of Drosophila pseudoobscura*

Tatyana Nienow, CURO-BHSI Summer Research Fellow
Dr. Walter K. Schmidt, Department of Genetics
*Adapting Yeast for the Study of Pitrilysin and Other M16A Enzymes*

Erika Porter, CURO-BHSI Summer Research Fellow
Dr. Charles H. Keith, Department of Cellular Biology
*Intrinsic Fluorimetric Imaging of Neural Activation in Cultured Cells and Zebrafish*

Kurinji Pandiyan, CURO-CAES Summer Research Fellow
Dr. Raj Rao, Department of Animal and Dairy Science
Dr. Steven Stice, Department of Animal and Dairy Science
*Genomic Instability of Human Embryonic Stem Cells*

Kelly Proctor, CURO-OVPR Summer Research Fellow
Dr. Lee B. Becker, College of Journalism and Mass Communication
*Differences in Environmental Reporting: China and the United States*

Rebecca Trupe, CURO Summer Research Fellow
Dr. Kimberly Shipman, Department of Psychology
*Family Focused Emotion Communication Training*

Russ Richardson, CURO Summer Research Fellow
Dr. Ron Carroll, Institute of Ecology
*Sugarcane Processing Waste as a Soil Amendment on Organic, Shade-Grown Coffee under Simulated Drought Conditions for Control of Plant-Parasitic Nematodes*

Dustin Williams, CURO-BHSI Summer Research Fellow
Dr. Scott T. Dougan, Department of Cellular Biology
*Development of Transgenic Zebrafish to Understand How Activation of Hyal-2 Leads to Tumor Formation*

Fei Yang, CURO Summer Research Fellow
Dr. Janet Westpheling, Department of Genetics
*Regulation of Branched-Chain Amino Acid Catabolism in Streptomyces coelicolor: Applications for Metabolic Engineering of Polyketide Antibiotic Biosynthesis*

Stephanie Yarnell, CURO Summer Research Fellow
Dr. Carl Bergmann, Complex Carbohydrate Research Center
Appendix E
CURO 2004 Summer Research Fellows

Cara Altimus, CURO Summer Research Fellow
Dr. Jonathan Arnold, Department of Genetics
*Isolation of a Light Receptor in the Biological Clock of N. crassa*

Westin Amberge, CURO-BHSI Summer Research Fellow
Dr. Steven Stice, Department of Animal and Dairy Science
*Guided Differentiation of Human Embryonic Stem Cells into Endothelial Cells: Focusing on the Ulex Europaeus Agglutin I Lectin*

Namrata Asuri, CURO Summer Research Fellow
Dr. Sidney Kushner, Department of Genetics
*Analysis of the Role of Ribosomal S1 in the Polyadenylation Pathway of Eschericia coli*

Erin Bohan, CURO-OVPR Summer Research Fellow
Dr. Katarzyna Jerzak, Department of Comparative Literature
*The Reconciliation of Selves: The Emigrant Experience in America*

Rebecca Brantley, CURO-OVPR Summer Research Fellow
Ms. Ashley Callahan, Georgia Museum of Art
*The Early Fashion Design of Mariska Karasz and the Influence of Her Native Hungary*

Josef Broder, CURO Summer Research Fellow
Dr. Andrew Sornborger, Department of Mathematics
*Techniques in High Noise Image Analysis*

Beau Bryan, CURO-BHSI Summer Research Fellow
Dr. Michael Pierce, Department of Biochemistry and Molecular Biology
*N-Cadherin Gl*

Susannah Chapman, CURO Summer Research Fellow
Dr. Virginia Nazarea, Department of Anthropology
*Designing Sui Generis Systems for Traditional Plants and Associated Local Knowledge*

Clayton Griffith, CURO-OVPR Summer Research Fellow
Dr. Amy Rosemond, Institute of Ecology
*The Effect of the North American Beaver (Castor Canadensis), an Exotic Herbivore, on the Composition, Structure, and Regeneration of the Riparian Vegetation of Sub-Antarctic Forested Streams in Chile*

Christopher Hale, CURO-BHSI Summer Research Fellow
Dr. Thomas F. Murray, Department of Physiology and Pharmacology
*Adolescence as a Distinct Period of Vulnerability to Nicotine Addiction*

Catherine Hudson, CURO-BHSI Summer Research Fellow
Dr. Harry Dailey, Department of Microbiology and Biochemistry and Microbiology
*Negatively Affecting the Heme Biosynthetic Pathway in “Escherichia coli”*

Douglas Jackson, CURO Summer Research Fellow
Dr. Nigel Adams, Department of Chemistry
*Reactions of Protonated Carboxylic Acid Ions with Amines in the Interstellar Medium*
Former CURO Summer Research Fellows

Andrew Leidner, CURO-BHSI Summer Research Fellow
Dr. Pejman Rohani, Institute of Ecology
Parasitoid Behavior and Evolutionary Dynamics

Janel Long, CURO-OVPR Summer Research Fellow
Dr. Jean Martin-Williams, School of Music
The Partitas of Franz Krommer and Natural Horn Technique

John McWhorter, CURO-BHSI Summer Research Fellow
Dr. Daniel Colley, Department of Microbiology
Induction of the Regulatory Ligand PD-L2 and the Co-regulatory Receptor PD-1 on CD4 Lymphocytes During Early Experimental Schistosomiasis Mansoni

William Parker, CURO Summer Research Fellow
Dr. Marly Eidsness, Department of Chemistry
Trigger Factor

Gehres Paschal, CURO-OVPR Summer Research Fellow
Dr. J. David Puett, Department of Biochemistry and Molecular Biology
Activating Mutations of the Lutropin/Choriogonadotropin Receptor Associated with Familial Precocious Puberty, Male Pseudhermaphroditism, Hypogonadism, Amenorrhea, Leydig cell Hyperplasia, and Metastatic Thyroid Carcinoma

Kevin Patrick, CURO Summer Research Fellow
Dr. James Anderson, Department of Classics
Cicero and the Foundations of a Legal Education at Rome

Katherine Price, CURO Summer Research Fellow
Dr. Janet Westpheling, Department of Genetics
Site Specific Chromosomal Integration Mediated by Bacteriophage Integrase

Matthew Rudy, CURO Summer Research Fellow
Dr. Marly Eidsness, Department of Chemistry
Analysis of Cotranslational Protein Folding in E-coli and Determination of the Role of the Trigger Factor Gene in the Folding Process

Desiree Smith, CURO Summer Research Fellow
Dr. Roberta Fernandez, Department of Romance Languages
Projecting a Positive Educational Experience for Latina/os in the South

Christopher Stokes, CURO-OVPR Summer Research Fellow
Dr. Randy Kamphaus, School of Professional Studies
Family Health and Classroom Behavior: A Pilot Study

Shana Strickland, CURO-BHSI Summer Research Fellow
Dr. Kimberly Shipman, Department of Psychology
Emotional Regulation and Coping Skills in Maltreated Children

Adam Stroupe, CURO Summer Research Fellow
Dr. Boris Striepen, Department of Cellular Biology
Drug and Nutrient Trafficking in the Human Pathogen Cryptosporidium parvum

Creating a Culture of Undergraduate Inquiry
Former CURO Summer Research Fellows

Teerawit Supakorndej, CURO-BHSI Summer Research Fellow  
Dr. Michael Terns, Department of Biochemistry and Molecular Biology  

Tendoh Timoh, CURO Summer Research Fellow  
Dr. Marly Eidsness, Department of Chemistry  
*Fluorophore-modified Nascent Polypeptides*

Jora Vaso, CURO-OVPR Summer Research Fellow  
Dr. Katarzyna Jerzak, Department of Comparative Literature  
*The Effect of Communism on the Works of Andric, Kadare, and Szymborska*

Leslie Wolcott, CURO-OVPR Summer Research Fellow  
Dr. Betty Jean Craige, Center for Humanities and Arts  
*The Environment in Georgia’s Literature, Past and Present*
Appendix F  
CURO 2003 Summer Research Fellows

Anthony Anfuso, CURO Summer Research Fellow  
Dr. Maor Bar-Peled, Department of Biochemistry and Molecular Biology  
*Developing a Fast Plant Expression System to Identify Biosynthetic Genes Involved in Pectin Synthesis*

Tiffany Beal, CURO-BHSI Summer Research Fellow  
Dr. Debra Mohnen, Department of Biochemistry and Molecular Biology  
*Determining How Pectins Inhibit Cancer Growth and Metastasis*

Robert Brady, CURO Summer Research Fellow  
Dr. Nader Amir, Department of Psychology  
*Malleability of Interpretation Bias in Social Anxiety and General Anxiety*

Josef Broder, CURO Summer Research Fellow  
Dr. Chi N. Thai, Department of Biological and Agricultural Engineering  
*Operational Characteristics of a Mobile Spectral Imaging System for Plant Health Detection*

Martha Rose Calamaras, CURO Summer Research Fellow  
Dr. Kim Shipman, Department of Psychology  
*Emotional Understanding in Abused and Neglectful African-American Families*

Daniel del Portal, CURO-BHSI Summer Research Fellow  
Dr. Marcus Fechheimer, Department of Cellular Biology  
*The Physiological Role of Hirano Bodies*

Dustin Dyer, CURO Summer Research Fellow  
Dr. Guigen Zang, Department of Biological and Agricultural Engineering  
Dr. Michael Geller, Department of Physics and Astronomy  
*Energy Dissipation in Nanomechanical Resonators*

Sarah Fritts, CURO Summer Research Fellow  
Dr. John P. Carroll, School of Forest Resources  
*An Inventory and Assessment of Medicinal Plants and Animals Used by Makuleke Traditional Healers on the Northern Boundary of the Kruger National Park, South Africa*

Betsy Goodwin, CURO-BHSI Summer Research Fellow  
Dr. Ronald Blount, Department of Psychology  
*A Study of the Psychology of Pediatric Pain and Chronic Illness*

Patrick Gosnell, CURO Summer Research Fellow  
Prof. Ben Reynolds, Department of Photography  
*The Beautiful and the Absurd*

Paulette Andrea Greene, CURO-BHSI Summer Research Fellow  
Dr. Wyatt Anderson, Department of Genetics  
*Conspecific Sperm Precedence and Speciation in Drosophila pseudoobscura*

Andrea Haltiner, CURO-BHSI Summer Research Fellow  
Dr. Ruth Harris, Department of Foods and Nutrition  
*The Effects of Leptin on Leptin Receptor Expression in High-Fat Fed Mice*
Former CURO Summer Research Fellows

Luke Hoagland, CURO-BHSI Summer Research Fellow  
Dr. Marcus Fcheim, Department of Medical Cellular Biology  
*The Role of Myosin II in Hirano Body Development and the Impact of Hirano Bodies on Cell Viability*

Christopher “Kit” Hughes, CURO Summer Research Fellow  
Prof. Mark Callahan, School of Art  
*Tagging*

Steven Jocoy, CURO Summer Research Fellow  
Dr. Michael Bender, Department of Genetics

Leena Kukkarni, CURO Summer Research Fellow  
Dr. Maor Bar-Peled, Department of Biochemistry and Molecular Biology  
*Identification Characterization of Enzymes and Gene Products Involved in the Synthesis of Pectic Polymers Using Mucilage as Acceptors*

Valerie Marshall  
Dr. Ben Blount, Department of Anthropology

Ashley Neary  
Dr. Susan Sanchez, Department of Medical Microbiology and Parasitology  
*Sensitive and Specific Detection of Fungal Keratitis in Horses*

Ngozi Ogbuehi, CURO Summer Research Fellow  
Dr. Mary Alice Smith, Department of Environmental Health Science  
*Comparing Apoptosis During Different Stages of Limb Development in Chick Embryos*

Melissa Payton, CURO Summer Research Fellow  
Dr. Lillian Eby, Department of Psychology  
*Antecedents and Consequences of Networking Behavior for Individuals Seeking Reemployment*

John Drew Prosser, CURO Summer Research Fellow  
Dr. Wyatt Anderson, Department of Genetics  
*Kin Recognition in Drosophila paulistorum*

Ryan Rhome, CURO Summer Research Fellow  
Dr. Jan Westpheling, Department of Genetics  
*Analysis of bkdR Protein Function in Stephanomyces coelicolor and S. avermitilis*

Susan Ritger, CURO-BHSI Summer Research Fellow  
Dr. Duncan C. Ferguson, Department of Physiology and Pharmacology  
*Immunoreactivity and Bioactivity of Recombinant Thyrotropins (TSH)*

Ben Solomon, CURO Summer Research Fellow  
Dr. Kevin McCully, Department of Exercise Science  
*Measuring Age Related Changes in Muscle Compliance Using Ultrasound*

Mary Tolcher, CURO Summer Research Fellow  
Dr. Tim Hoover, Department of Microbiology  
*Identification of Developmentally Regulated Proteins in the Budding Bacterium Hyphomonas neptunium*

Meghan Wilson, CURO-BHSI Summer Research Fellow  
Dr. James Lauderdale, Department of Cellular Biology  
*Pax 6b*
Former CURO Summer Research Fellows

Ryan Wilson, CURO Summer Research Fellow
    Roger Moore, Department of Landscape Architecture

Thomas Wood, CURO Summer Research Fellow
    Dr. Walter Schmidt, Department of Biochemistry and Molecular Biology

*Analysis and Characterization of CAAX Proteases*
Appendix G  
CURO 2002 Summer Research Fellows

Nadia Behizadeh  
Dr. Tricia Lootens, Department of English

Ashley D. Chadha  
Dr. Michael McEachern, Department of Genetics  
Characterization of stn-1 M1 mutant in K. lactis

Emily DeCrescenzo  
Dr. Susan Sanchez, Department of Biochemistry and Molecular Biology  
Development of a Detection Method for TSST-1 exotoxin from Staphylococcus aureus Associated with Toxic Shock Syndrome in Horses Directly from Clinical Samples

Ivy Forkner  
Dr. Debra Mohnen, Department of Biochemistry and Molecular Biology  
Functional Expression of Putative Biosynthetic Genes for Pectin: A Plant Polysaccharide with Anti-Cancer Activity

Cory S. Gresham  
Dr. James B. Stanton, Department of Pathology  
Dr. Corrie C. Brown, Department of Pathology  
Development of a Reverse Transcriptase-Polymerase Chain Reaction Based Assay for the Detection and Differentiation of Dolphin Morbillivirus and Porpoise Morbillivirus

Nowell Hesse  
Dr. Maor Bar-Peled, Department of Plant Biology  
Identification of Nucleotide-Sugar Biosynthetic Genes Involved in Glycoconjugate Synthesis

Matt Hoffman  
Dr. Will York, Department of Biochemistry and Molecular Biology  
Comparative Structural Analysis of Xyloglucans from Plants in the Subclass Asteridea

Parker Hudson III  
Dr. Mary Bedell, Department of Genetics

Britt Johnson  
Dr. Janet Westpheling, Department of Genetics  
The Use of Generalized Transduction for Combinatorial Biosynthesis of Novel Antibiotics

LeeAnn Jones  
Dr. Massimo Palmarini, Department of Medical Microbiology  
Mechanisms of JSRV-Induced Cell Transformation InVivo

Jenna Lee  
Dr. Andrew Herod, Department of Geography  
A Study of Sustainable Economic Development in Croatia

Judson A. Lewis  
Dr. John F. McDonald, Department of Genetics  
Evolutionary Contributions of Retrotransposon Elements in the Genome of D. melanogaster
Former CURO Summer Research Fellows

Cheryl L. Maier  
Dr. Scott Pratt, Department of Animal and Dairy Science  
*Comparative Analysis of Nuclear Proteins Present in Donor Cells Used for the Nuclear Transfer Process and Cloning*

Julie Orlemanski  
Dr. Jed Rasula, Department of English  
*Sounding and Silencing: Suspended States in the Works of Thomas Pynchon*

Gautham Pandiyan  
Dr. Jacek Gaertig, Department of Cellular Biology  
*Study of Ciliary Growth Suppression Mechanism in Tetrahymena Thermophila*

Joanne Shinpoch  
Dr. Daniel Dervartanian, Department of Biological Sciences  
*Purification and Characterization of Nickel Protein(s) from Bovine Heart and Their Relationship to Heart Disease*

John Stark  
Dr. Scott Atkinson, Department of Economics  
Dr. Michael Rauscher, Department of International Economics, Rostock University  
*An Economic Labor Supply Analysis of Poland’s Planned Entry into the European Union with Regard to the German Economy*

Joshua Striker  
Dr. Thomas Cerbu, Department of Comparative Literature  
*The Human Experience of Time: Literary and Philosophical Accounts/Representations*

Nwakaso Umejiego  
Dr. Boris Striepen, Department of Cellular Biology  
*IMPDH as a Potential Target of Drugs to Treat Cryptosporidiosis*

Ben Walters  
Dr. Elizabeth Brient, Department of Philosophy  
*The Aestheticization of Text*

Lauren Watson  
Dr. Jeffery Berejikian, Department of Political Science

Katherine Williams  
Dr. Kojo Mensa-Wilmot, Department of Cellular Biology  
Dr. Anne Clark, Oxford University

Brad Wright  
Dr. Larry Nackerud, School of Social Work  
*A Comparative Healthcare Policy Analysis of the United States and Sweden*
Siobahn Beaton  
Dr. Debra Mohnen, Complex Carbohydrate Research Center  
*Progress toward the Partial Purification of a Pectin Biosynthetic Gene*

David Cureton  
Dr. Janet Westpheling, Department of Genetics  
*Development of an In Vitro Packaging System for a Streptomyces Bacteriophage*

Jon E. Davis  
Dr. Gary Bertsch, Department of Political Science  
*Identifying the Risks of China’s Nuclear Weapons Command-and-Control System in the Event of Political Crisis*

Sayan De  
Dr. Max Reinhart, Department of Germanic and Slavic Languages  
*The Progress and Modernization of Former East German Healthcare after Communism*

Lawrence Dougherty  
Dr. Daniel Promislow, Department of Genetics  
*Exploring Olfactory Response in Drosophila melanogaster and Evolutionary Theory of Aging*

Matt Edwards  
Dr. Gary Bertsch, Department of Political Science  
*Evaluating the Moscow Center for Export Control’s Role as a Non-Proliferation Epistemic Community Member*

Ben Emanuel  
Dr. Frances Teague, Department of English  
*Shakespeare on Screen: Henry in Hollywood*

Jeff Halley  
Dr. Sheng Cheng Wu, Department of Biochemistry and Molecular Biology  
*Cell Wall-Degrading Enzymes from the Fungus That Causes the Devastating Rice Blast Disease*

Peter Harri  
Dr. Kojo Mensa-Wilcot, Department of Cellular Biology  
*Gene Expression in Leishmania: Control of Protein Synthesis in Leishmania 5 ’ Untranslated Regions*

Amanda Hudson  
Dr. Michael Terns, Department of Biochemistry and Molecular Biology  
*Screening Mutant Yeast Strains for Abnormalities in the Localization of snoRNA*

Kenneth Miller  
Dr. Timothy Dore, Department of Chemistry  
*Synthesis and Use of Caged Compounds to Explore Cellular Processes*

Lorina Naci  
Professor William Paul, Jr., School of Art  
*Each morning I get up with one word in mind: plastik...*
Lynn Nguyen
  Dr. Mark Wheeler, Department of Dance
  Chinese Classical Dance

Cori Pelletier
  Dr. Roy Grant, Department of Music Therapy
  Music Therapy with Premature Infants

Kate Smith
  Dr. Kenneth S. Latimer, Department of Pathology
  Immunohistochemical (IHC) Detection of Natural Killer Cells in Fish

Buudoan V. Tran
  Dr. Karl N. Kirschner, Complex Carbohydrate Research Center
  Dr. Robert J. Woods, Complex Carbohydrate Research Center
  Parameter Development and Application of the Glycam Force Field for Sialic Acid Derivatives

John Woodruff
  Dr. Harry Dailey, Department of Microbiology
  The Generation of Mutations in the n-Terminal Region of the Protoporphyrinogen Oxidase of Bacillus subtilis to Create a Protein Capable of Mitochondrial Targeting in Mammalian Cells