Welcome to the twelfth annual Summer Scholars Dinner at Saint Joseph’s University. We are very pleased to have the opportunity to bring together so many different people, friends of SJU and representatives of area businesses and corporations, SJU administrators, faculty, staff, and the Summer Scholars students. This book contains brief descriptions of some of the many ongoing projects involving students here at Saint Joseph’s. We hope that you will take a few minutes to talk with some of the students and let them tell you something about their work.

This year marks the seventh in which the Summer Scholars Program has been open to students and faculty in all areas of the university, and the second in which students from nearby Lincoln University have also been able to participate. We are very pleased that students engaged in creative scholarly work and independent research projects with faculty mentors from 24 different academic departments and programs. We especially wish to thank the faculty mentors who have so generously given of their time, talent and abilities to work with these scholars of tomorrow. Their generosity makes this program possible.

Thank you for taking the time to join us as we recognize the work of these young men and women. We would also like to thank the many people, funding agencies, and corporations whose support continues to make student research and creative scholarly activity at SJU a reality.

Sincerely,

Joseph DiAngelo, MBA, Ed.D.  
Professor of Management  
Dean, Haub School of Business

William Madges, Ph.D.  
Professor of Theology  
Dean, College of Arts and Sciences

Brice Wachterhauser, Ph.D.  
Professor of Philosophy  
Provost, Saint Joseph’s University
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The McGroddy Frontiers in Science Seminar Series
IBM
The Office of the Dean, CA&S,
The Office of the Provost
In what has become a synthesis of the practical and the theoretical, my primary research stream focuses on music marketing. It seems a bit ironic to me that I spent twenty years in radio (and continue to consult radio stations and record labels) researching the music around the commercials and I now research music in the commercials and in general (including the music and radio industries). In any case, it has been the perfect extension of my past into my present and provides me the opportunity to bridge my professional with my academic career to inspire and prepare my students for the future.

My primary research focuses on advertising cues and effects especially popular music. I have the unpopular opinion that the combination of popular music and advertising actually creates a new cultural product and is, therefore, the perfect marriage of art and commerce. I have looked at popular music and advertising both quantitatively (attention, memory, and amount in primetime television) and qualitatively (in theory, popular culture, retail and social marketing). I incorporate my research into my music marketing, media management and marketing communications classes with my students not only learning from the results but often participating in the exploration.

My past and current radio and record relationships also afford me the opportunity to not only place my students in industry internships, independent scholarship and employment but to facilitate my advising of the SJU internet radio station (Radio 1851) and the record label (1851 Records) as well as the American Marketing Association (AMA).
Attitudes that Affect the Intention to Illegally Download Music
Michael Bukowski,’12

Faculty Mentor: David Allan
Department of Marketing

Supported by the SJU Summer Scholars Program and the Department of Marketing

At the beginning of last summer, I started to research music piracy and its influence on the record industry. After extensive research on the adverse effects it was creating within the record industry, I felt it was important to uncover why people were downloading music illegally. If we can understand the consumer’s attitudes concerning illegal downloading of music, we may be able to implement a plan to change their attitudes. The attitudes of the consumer were heavily influenced by constant availability of music on the internet over the last 2 decades.

The internet has provided people to obtain music in ways that weren’t imagined 20 years ago. New music services like Apple iTunes, Amazon Music Store, and other digital music stores have provided constant access to music. However, for all the good the internet has done for the music industry, it has also caused harm. Digital music piracy has been a growing threat since Sean Fanning started the P2P file-sharing service Napster in his Northeastern University dorm room in 1999. With the construction of this P2P service, digital piracy spread like wildfire. These P2Ps have caused a free-for-all in terms of illegal downloading. This free-for-all for digital music only hurts the record industry, artists, and eventually the consumer.

The IFPI Digital Music Report claims that music piracy has been a major factor in the demise of world music sales for last 10 years. According to their 2011 Digital Music report, piracy is hitting jobs and investments across the globe. Increasing action has been taken over the last year to help curtail the problem of music piracy. Action was taken against Internet Service Providers (ISPs) in France, Ireland, and South Korea to stop massive music piracy. Continued action is expected in other countries as well in the coming years. Limewire, one the biggest sources for illegal downloading, and Mininova, a major BitTorrent, were declared illegal and their services were shutdown. The recent developments in the battle against music piracy have proven to be somewhat successful, as opposed to past actions. However, according to IFPI reports the future still looks relatively gloomy, even with digital revenue up 6 percent in the last year. With the continued threat of music piracy, it is important to understand the behavior involved with illegal downloading of music files.

My research has provided valuable insight on the attitudes that affect the intention to illegally download music. The statistics have proven that people view authority as ineffective when prohibiting them from illegal downloading and they feel as if they are in a community when on the computer. This group mentality coupled with the ineffectiveness of law has allowed for the consumer to download in excess. To slow down illegal downloading of music, the record industry should focus on containing this group mentality and meeting the consumer’s needs more efficiently.
Jesuit Universities are committed to educating students for a life dedicated to a faith that does justice. Although promoting social justice is not the primary responsibility of our Jesuit Universities, educating our students, and the greater campus community, to make personal and professional choices that foster the dignity and well-being of others is fundamental to the Jesuit mission. During my service in the Jesuit Volunteer Corps, I was exposed to the poverty experienced by people not receiving a living wage in both Jersey City, New Jersey and in Honduras. I heard the stories of several Honduran parents who had to make the difficult decision to buy either food or medicine for their children because their wages did not allow them to purchase both. Hearing these stories while wearing clothing made in the very sweatshops they described transformed my commitment to working for economic justice.

Working for social justice is about working with people, not issues, in a culturally responsible and empathetic manner. Ashley Wilson and I examined this principle in relation to the poverty experienced by individuals receiving unjust wages. We also considered our responsibility in promoting the awareness of the Saint Joseph’s University student community through a method and model that fostered their own personal development within the Jesuit, Catholic tradition. Ashley’s project focused on how student groups advocating for just wages locally and globally can intentionally practice the values they are promoting within their interpersonal relationships and organizational structure. Her project also outlined a continuum for the students’ acquired skill set and activism in social justice work. I was very fortunate to work with a Summer Scholar as passionate and dedicated as Ashley Wilson. I look forward to the implementation of her research and student manual with the Students for Workers’ Rights Group at Saint Joseph’s University.
Fair Trade & The Ignatian Imagination: Striving for Justice through Student Organizing
Ashley Wilson,’12

Faculty Mentor: Jill Amitrani-Welsh
Faith Justice Institute

Supported by the SJU Summer Scholars Program

Many student organizations on Jesuit campuses face similar problems concerning organizational structure and the incorporation of the Jesuit mission into social justice work. From my experience as the President of Saint Joseph's University Students for Workers’ Rights, I have realized that the best way to inform and inspire others is through the Jesuit charism that is universal across campus. These teachings: being men and women with and for others, finding God in all things, *cura personalis*, *magis*, and *ad majorem Dei gloriam* serve to motivate all the actions at Jesuit institutions such as Saint Joseph’s University.

My initial focus was the broad research of the economic injustices that result from unfair wages and working conditions for many people around the world. One popular approach to combating these injustices is the Fair Trade model. Fair Trade takes a collaborative approach to community development- it pays fair wages to farmers and artisans within cooperatives in an effort to provide adequate funding for education, clean water, and other basic needs. My research inspired an analysis of the values of Fair Trade in comparison to the Jesuit charism and Catholic Social Teaching. I explored why Fair Trade is a relevant movement for a student organization that directly aligns with the mission of Jesuit schools.

The second component of my project took a more activist approach- I constructed an organization manual that focused on student development and leadership in a student-run organization. My continuum of student development detailed how an individual member of an organization on a Jesuit campus should progress and evolve throughout his or her years involved. This manual outlined meeting plans to promote a community dynamic, education about the Jesuits, and a passion for social justice activism in individual students within an organization.

I am hopeful that my research and my student organization manual can be used to instill social change on not only the campus of Saint Joseph's University- but also other Jesuit campuses across the country. It is vital for students to contribute to the mission and identity of a Jesuit Catholic university by supporting social justice campaigns on their campus- and whether that campaign be Fair Trade or anything else, I believe my project can help any organization achieve its goals.
Mary’s research has focused on the relationship between a child’s ability to respond thoughtfully to reading and intrinsic motivation to read. With the emergence of federal No Child Left Behind legislation, teachers in basic education are forced to respond to the pressures of high-stakes testing. Research suggests that they are resorting to extensive use of rote learning through skill and drill instruction. Mary’s most recent publications, *A Study of Thoughtful Literacy and the Motivation to Read*” investigated the relationship between students’ value of reading and their performance on a reading measure assessing higher-level reading. Two previous investigations, *She’s my best reader: she just can’t comprehend*” and “*Why the states don’t measure up*” were published in the number one literacy journal devoted to research in elementary schools. Their scores on the National Assessment of Educational Progress (NAEP), a measure that makes extensive use of higher level thinking, suggest a very different story. Mary’s future research will focus on the impact of rote learning as it impacts student motivation to read, and the ability to react thoughtfully to text. *The Critical Reading Inventory*, an assessment measure she has co-authored, will be used as a means of showing the relationship between criterion-related measures of thoughtful literacy and norm-referenced measures.
The Impact of Highly Motivating and Engaging Learning Experiences for Struggling Readers
Jessica Cedor,’12

Faculty Mentor: Mary DeKonty Applegate
Department of Teacher Education

Supported by the SJU Summer Scholars Program

Currently, most remedial reading program designs and research on program effectiveness ignore the impact of motivation on struggling readers. However, during my Reading Literature II class I was introduced to engaged learning, which fosters motivation and a love for learning in struggling readers. In this class, I learned that the basis for motivating struggling readers is to mediate the predictable cycle of frustration, failure and avoidance in order to provide these students with the necessary tools to allow them to succeed.

For in the classroom, resistant and struggling readers are those students who pull away from reading opportunities because they are fearful of failure, or simply have no incentive to try. For struggling readers, reading has become a tedious chore instead of a pleasurable experience. In order to close the gap between struggling readers and their grade level peers, researchers such as John T. Guthrie claim that motivation is the key to enabling struggling readers to become fully engaged with literature. In part, by increasing a child’s motivation a teacher is really helping struggling readers to see their full potential by increasing their self-efficacy, outcome attributions, and task value. For as soon as struggling readers believe that they are capable, are unafraid of physical or psychological harm, and are learning a beneficial activity they will become more engaged in reading. Thus, as educators it is our responsibility to involve struggling readers in highly engaging activities that will motivate readers and will result in improving their reading achievement.

Over the summer I was given the opportunity to work alongside graduate students at Saint Joseph’s University’s Summer Reading Program. Here, I worked to provide struggling readers with additional intervention strategies for pre, during and post reading activities to help enhance their learning experiences. The interventions I used, such as Underlying Theme Lesson Plans, Concept Maps and Retellings follow Guthrie’s set of principles to optimize reading engagement which include: providing motivated purposes for reading such as authentic, and real world experiences, creating personal connections with text, granting students responsibility by offering choices of topic, text, and task, by using interesting texts, and by fostering collaborative learning. By assessing my pre and post testing evaluations it is apparent that motivation and engagement are key factors in enhancing students reading capabilities. When motivation and engagement are factored into the equation of fostering a love for reading, students become not only extrinsically motivated to learn, but also learn the value of intrinsic motivation as well.
Bacteria are my passion. I am fascinated by the sophisticated mechanisms that bacteria use to control their gene expression, and I focus most of my research in studying them. For example, some bacteria are able to “choose” the most energetically favorable carbon source when there is more than one available in the environment. They won’t utilize the other carbon sources until the preferred one is exhausted. This behavior, called catabolite repression, is the result of an intricate interaction of proteins and other molecules, where some sense the presence of the preferred carbon source and others communicate the signal to specific genes that are turned on or off. Although the players (proteins and such) are similar in different bacteria, the role they play may be very different! One of the projects in my lab is looking at the occurrence of catabolite repression in bacteria from isolated environments, such as deep caves, and trying to find out if the proteins involved are similar to the ones found in well-studied bacteria.

One of the subjects of my research is the bacterium Sinorhizobium meliloti, which has the ability to live in symbiosis with alfalfa and a few other plants, supplying the plant with nitrogen forms that it can use, and obtaining carbon sources (food) and nutrients in return. S.meliloti can also live freely in the soil, where it can attach to particles, as well as to the roots of plants. The ability to attach may play an important part in symbiosis, and is also critical for formation of biofilms, which are communities of bacteria that live attached to a surface while embedded in a matrix of bacterial origin. Another project in the Arango lab is trying to uncover genes in S. meliloti that are important in formation of biofilms. Our hope is that this quest will reveal genes with both structural and regulatory roles, allowing us to explore another regulatory pathway in S. meliloti.
The effects of Carbon Dioxide on nodulation in Alfalfa Plants by the plant symbiont Sinorhizobium meliloti
Jahbria Geddy,’12  Lincoln University

Faculty Mentor: Catalina Arango
Department of Biology

Supported by the SJU Summer Scholars Program and Howard Hughes Medical Institute

This summer I was given the opportunity to study the effects of carbon dioxide on nodulation in Alfalfa plants induced by the bacterium Sinorhizobium meliloti. The bacteria studied in this experiment is part of the Rhizobiaceae family. Bacteria from the Sinorhizobium genus allow plants, specifically alfalfa and a few other legumes to live in soil that is poor in nitrogen. The bacteria can live freely in soil as well as in symbiosis with alfalfa. When in plants, the bacteria are housed in a small organ known as the nodule. In the nodules, bacteria take the nitrogen gas from the air and transform it into a form of nitrogen for the plant to use, in a process called nitrogen fixation. In recent studies it has been shown that plant growth under elevated carbon dioxide results in a higher number of nodules. It has been hypothesized that increased photosynthesis elicited by higher concentrations of CO\textsubscript{2} and the higher nitrogen demand it causes are responsible for the increase in nodule numbers. In our project we are studying and measuring how high and low concentration of carbon dioxide affect nodulation induced by Sinorhizobium meliloti wild type 1021 and different mutant strains that have altered nodulation abilities. For each experiment the nodules are counted weekly and after thirty days the plants are cut, dried and the shoot weight is obtained. The plant weight is an indication of how much nitrogen fixation actually occurred. So far we have obtained results that do not agree with reported research. For example, when alfalfa plants were inoculated mutant DG3155 and with the wild type, the inoculated plants weigh more than the control and plants under elevated CO\textsubscript{2} weigh more then those under the normal concentration of CO\textsubscript{2}, as expected (Fig 1). However, plants under normal control of CO\textsubscript{2} exhibited more nodules than plants under elevated CO\textsubscript{2} (Fig 2). We are investigating if this result is due to bacterial stress, and if so, what the cause of the stress is, or if elevated levels of CO\textsubscript{2} do not result in a larger nodule biomass, as has been observed in other plants.
Detection of Carbon Catabolite Repression and of PTS Genes in Bacterial Cave Isolates
Bryan Hennessy,’12

Faculty Mentor: Catalina Arango
Department of Biology

Supported by a gift from Nick Nicolaides,’87 and the SJU Summer Scholars Program

Carbon catabolite repression (CCR) is a regulatory mechanism that enables bacteria to utilize a carbon source over other carbon sources, when both are present together in the environment. The phosphoenolpyruvate–carbohydrate phosphotransferase system (PTS) couples membrane transport of carbohydrates into the cell with the phosphorylation of the carbohydrates. The proteins EI, HPr, and EIIA are components of the phosphorelay system which leads to the phosphorylation of an incoming carbohydrate (the primary carbon source). The presence of a primary carbon source changes the phosphoryl states of EIIA and HPr which are the critical signaling molecules of the CCR mechanisms in *Escherichia coli* and *Bacillus subtilis*, respectively. This change in the phosphoryl states of EIIA and HPr leads to the repression of genes required for the use of secondary carbon sources.

We hypothesized that the presence of genes for the PTS proteins correlates with the occurrence of catabolite repression in bacterial cave isolates. The cave isolates persist in an environment with minimal nutrient resources, thus CCR could potentially result in the optimal use of the limited resources available in this particular environment. Eight isolates from the Lechuguilla Cave, including *Brevibacterium casei*, *Streptomyces flavus*, *Rhodococcus erythropolis*, *Sphingomonas pseudosanguinis*, *Paenibacillus lautus*, *Pseudomonas stutzeri*, *Achromobacter sp SY8*, and *Ensifer adhaerens*, are being examined for the occurrence of CCR and the presence of the genes encoding for the specified PTS proteins.

This summer, we have identified the extent at which the isolates grow in varying media, carbon sources, and temperature. Using this information, we have detected CCR in two of the eight isolates. We found that utilization of lactose by LC14 (*E. adhaerens*) exhibits a short catabolite repression lag with either glucose or succinate as the primary carbon source. A long repression lag is observed when LC371 (*P. stutzeri*) grows on succinate with either lactose or galactose as the secondary carbon source.

We will continue to evaluate for the occurrence of CCR using both analysis of broth culture growth curves and plates designed to detect the expression of β-galactosidase (involved in the catabolism of lactose). We are also beginning the detection of PTS genes by the use of primers specific for these genes.

![Figure 1. Occurrence of CCR in *P. Stutzeri*. Succinate is the primary carbon source and lactose is the secondary carbon source which is utilized only after a long repression lag.](image_url)
Identification of genes involved in biofilm formation for *Sinorhizobium meliloti*
Dan Pennell, ’13

Faculty Mentor: Catalina Arango
Department of Biology

Supported by a gift from Nick Nicolaides,’87 and the SJU Summer Scholars Program

A biofilm is a complex three dimensional matrix created by bacteria to shelter from the environment. Multiple different species can participate in the same biofilm, and it will help protect them from predation, desiccation, antibiotics, osmotic stress, and numerous other environmental hazards. Biofilms also help bacteria adhere to surfaces both organic and non-organic, and they can be found everywhere from the lining of your intestines and the surface of your teeth, to the inside of your pipes and the tiles in your bathroom. Despite the abundance of biofilms in the environment, science has only identified a few of the genes involved in biofilm formation, so my research focuses on finding genes used by *Sinorhizobium meliloti* in biofilm formation.

I create random mutations in *S. meliloti* cells using a piece of DNA called a transposon. It’s a gene that can randomly insert itself into a bacterial chromosome, interrupting a gene already there. This creates a mutation, because the interrupted gene no longer works properly, and so the bacteria will now be deficient in some function. Since this process is random, eventually one of the mutations will disrupt a gene necessary for biofilm formation, and the gene that was interrupted can be sequenced. The sequence of the interrupted gene is compared to genes from other species known to be involved in biofilm formation, using a BLAST analysis. Finally, a copy of the interrupted gene is reinserted into the mutant bacteria to see if this reverses the effect of the mutation. I mainly work on two different strains of *S. meliloti*, Rm 1021 and Rm 8530, since Rm 1021 produces significantly less biofilm than Rm 8530. In addition, I work on optimizing the procedure so that the bacteria produce more biofilm, since this will make it easier to see when a mutant strain produces less biofilm than normal. Testing so far has revealed that *S. meliloti* consistently produces more biofilm on minimal media with less nutrients, as seen below.
Gerald J. Beyer, Ph.D.
Department of Theology
Saint Joseph’s University

Ph.D. Boston College
M.A.R. Yale University Divinity School

Area of Research: The Idea of Solidarity and its Application to Contemporary Ethical Issues

All of my research fits within the general rubric of Christian social ethics, a sub-field within theology. Most of my work is rooted in the Catholic social tradition, a branch of Christian social ethics. My scholarship entails either exploring the theoretical underpinnings of the Catholic social tradition and/or applying the principles and values of the tradition to concrete social issues, such as economic justice, human rights, war and peace, political responsibility, access to higher education and racism. Essentially, all of my research and writing has taken this approach, using both Poland and the United States as contexts to demonstrate how the ideals of the Catholic social tradition can shape the formation of institutions and social policies. For example, my book Recovering Solidarity: Lessons from Poland’s Unfinished Revolution (Univ. of Notre Dame Press, 2010) uses the context of contemporary Poland to both expound the idea of solidarity, a central theme of the Catholic social tradition, and explore the possibility of reviving solidarity in contemporary Poland. While much of my writing has applied Catholic social thought to the Polish context, my research has more recently applied the norms and values of the Catholic social tradition to the American political, social, and economic spheres. I have also begun to probe the field of evolutionary studies of morality to discern the degree to which solidarity is possible on a global scale, given what fields like evolutionary biology and primatology tell us about human nature.

My scholarly articles have appeared in journals such as Journal of Catholic Social Thought, Journal of Religious Ethics, Notre Dame Journal of Law, Ethics, and Public Policy, Human Rights Review and Irish Theological Quarterly. I have also published pieces in America and Commonweal magazine, which are two of the best venues for communicating theological scholarship to thoughtful, non-specialist readers. In addition, I regularly lecture in parish and educational settings on contemporary ethical issues. Currently, I am working on a second book tentatively titled Solidarity or Status Quo? U.S. Catholic Universities in the Light of Catholic Social Teaching. This book discusses the ways in which Catholic universities have succeeded and failed in embodying Catholic social teaching in their institutional policies. For example, I analyze the degree to which Catholic universities make education possible for economically disadvantaged students. Another chapter considers whether university endowments exemplify socially responsible investment. I also examine whether all workers on our campuses are treated in accordance with Catholic teaching on worker rights, such as the right to a just wage. As a steering committee member of Catholic Scholars for Worker Justice, I am committed to promoting the rights and dignity of workers on Catholic campuses. As Pope John Paul II put it, “fidelity to Christ,” who “was a man of work, a craftsman like Joseph of Nazareth” requires doing so. My book argues that Catholic universities need to devote more attention to these issues as they are integral to the identity and mission of any Catholic university.
The History and Future of the Laity in Fulfilling the Jesuit Mission in Higher Education
Matthew Bender,’13

Faculty Mentors: Gerald Beyer
Department of Theology
Rev. Dan Joyce, S.J.
Office of Mission

Supported by the SJU Summer Scholars Program

From its foundation in Rome in 1540, the Society of Jesus has spread out to every corner of the globe. For more than 450 years, the revolutionary vision of Saint Ignatius Loyola has been faithfully carried out by his followers, the Jesuits. As we move into the 20th century, the Society faces a grave challenge that threatens the continuance of Ignatius’ vision. Over the past 45 years the number of Jesuits has dropped significantly, from a high of 36,038 in 1965 down to 18,266 in 2010. The situation is even more serious here in the United States. In less than 30 years the number of Jesuits has dropped by nearly 3,000. There does not appear to be any indication that these circumstances will change any time soon. They most likely will worsen, as the United States has the highest average age of Jesuit priests, compared to the rest of the world, at nearly 70.

Given this striking reality, preparations must be made to ensure that the Ignatian vision can be continued into the future. At no place is this more urgent than in the Jesuit’s main ministry—education. Although it may not occur for many years, the assumption is that at some point in the future there will be no Jesuits on college campuses. My research attempts to look at American Jesuit Higher Education through the lens of this inevitability. Specifically, I attempt to examine the ever-increasing role of the Laity in Jesuit Higher Education. Through the examination of three separate historical situations, I attempt to show that the decrease in the presence of Jesuits on campus will not result in the collapse of the centuries old tradition that is Jesuit education, but rather that we stand on the verge of a new threshold. We are poised at a moment where we can either bemoan the lack of vocations to the Society or recognize and embrace this as an invitation by the Spirit to breathe new life into Ignatius’ vision.

My examination first focuses on the Jesuits in the time of Ignatius. I hope to prove that the direction we are now heading can lead us closer to the original conception of the Society. I believe that there is much to learn, even today, from that Spanish soldier and his college roommates. I then move on to our own experiences of the Society of Jesus here in Philadelphia. The history of the Jesuits in the City of Brotherly Love stretches back nearly 280 years. This rich history is bursting with cooperation with the Laity from the very beginning. I then move into the present day and the vast array of actions that are being taken to address this issue. Informed by our rich history, both locally and globally, I conclude with some comments as to what I believe should be done moving forward.
Dr. Elizabeth Bloch-Smith  
(back row, 4th from left)  
Department of Theology and  
Religious Studies,  
St. Joseph’s University  
PhD University of Chicago  

Research Interests: Bible and  
Archaeology

Archaeological excavations in modern-day Israel provide the realia of both the biblical texts and of the cultures that produced the Bible. Whereas the Hebrew Bible has been repeatedly edited over centuries (Iron Age to Hellenistic periods) to provide royal, priestly, prophetic, and scribal versions of ancient Israel’s history, archaeology offers an alternative, unedited version of events. Excavations attest to textually attested events and cultural facets but they also reveal elements of ancient culture not explicitly treated in the biblical text, from details such as diet or dress to economic (e.g., coinage, weights, international trade, taxation mechanisms) and political systems (e.g., royal palaces, administrative centers). Excavations also contribute to our understanding of the evolution of ancient Israelite religious beliefs. For example, admonitions against worshiping other gods were necessary precisely because people worshiped foreign deities, as evident from inscriptions and idols found in excavations.

Participation in an excavation shifts the way one considers history. First, the physical aspects take on new significance, such as the topography (for instance of the battle ground), climate, and realia (Goliath’s armor and weapons). Second, one city physically atop its predecessor, giving rise to the archaeological mound/tell, presents the synchronic and diachronic history of the site. This physical display of the constants and vicissitudes in site use through the periods highlights regional and local historical factors. Third, the physicality of the dig breathes life into ancient near eastern literary texts, including the Bible.

Work at the site of Tel Dor (on the northern coast of Israel) entails the excavation of Iron Age through Roman remains (12th c. BC to 3rd c. AD), processing and analysis of finds, and preparation of excavated remains for storage and publication. Students and staff participate in all aspects of the process. In addition, at the site of Tel Dor, dig participants work in the local museum, the Center of Nautical and Regional Archaeology, on the conservation and presentation of site finds to the public.
Tel Dor Excavation Project
J. Rose Neufeld’12

Faculty Mentor: Elizabeth Bloch-Smith
Department of Theology

Supported by the SJU Summer Scholars Program

I was proud to be part of the 2011 season at the Tel Dor Excavation Project through The Haifa University Field School this summer. Tel Dor is one of the most extensively excavated sites in Israel, providing an enormous array of historical evidence over its 3000 year history. Its periods of occupation began with the Middle Bronze Age and continued through to the Crusades. Dor was even occupied by Napoleon Bonaparte in 1799! Working at Dor has given me the opportunity to learn from archaeologists, museum staff, data recorders, conservators and architectural staff. I’ve gained valuable exposure to the field of archaeology through a wonderful mix of hands-on excavation, pottery washings and readings, lectures, field trips, and museum work.

Under the supervision of Dr. Elizabeth Bloch-Smith, I worked in the southern harbor of the excavation site, termed Area D2, as well as in the Tel Dor Museum. Within D2, we have made discoveries relating to the Persian, Hellenistic, and Roman Ages. The tel is the result of strati-graphic accumulation through the ages. These strata are very evident in the D2 section thanks to years of excavation that has revealed the tiered area layers. Our lowest area (not worked), contains Iron Age remains on bedrock. In the lowest area we work in, the “porch” area, we have excavated a Persian wall in conjunction with bone. In the upper sections, we uncovered a potential Roman bath with a hypocaust floor system that produces heat to warm water. These discoveries help us understand the different industries of and cultural influences on the people who lived on the tel throughout the centuries.

While working in the museum I helped to organize past finds to log in the museum database. This database is a system where students and archeologists can find information for research and dating purposes. Each piece is divided by type i.e. lamp, bone, pipe, important finds, etc. and has uniquely coded numbers inscribed onto them. As archaeology is a destructive exercise, it is important to carefully record what we find so that the information that has been preserved in the ground for so long is not also destroyed! I also spent time sifting and sorting through the smaller materials such as beads, charcoal, bones and flint while working in the museum. Since a lot of these small materials are found deep below the surface, it is the museum’s job to identify these smaller objects so to help recognize the use of the objects as well as the date.

Ultimately, my experience at Dor has invigorated me to reevaluate the ways I see history and culture and also prompted me to consider graduate studies in Anthropology. Working and traveling here was a fascinating way to explore the changes in cultures and lifestyles that people underwent all while living in one specific area. I especially enjoyed learning about the influences one civilization had upon another, observing in material form the way things become fashionable and culturally valuable, such as the popularity of Attic pottery from Athens in Hellenistic period Dor. And so, I hope to be able to continue studying how and why people and cultures change in the future.
My lab in Science Center 109 is brand new, and 2011 was my first summer at SJU. So I was very excited for the first summer of research activity on the part of three excellent SSP students. Besides putting the finishing touches on our lab, getting and setting up equipment, supplies, and reagents, the focus was evolutionary genetics. We worked on plants and viruses. The basic scientific question unifying research on this diverse organisms is: “What explains their genetic variation?”

For one project, to acquire genetic sequence data we used the enormous public databases containing the results of genome projects and other sequencing projects. In this way, we were able to answer our question without any “wet” laboratory experiments. One SSP student obtained the plant DNA sequences we needed from the databases. The analysis required some custom computer scripts or programs. The result: support for the “generation time hypothesis,” an alternative to Darwin’s theory of natural selection!

The other source we used for our raw materials was the bounty of viruses found in soil. The dirt all around us on the SJU campus and near our homes contains a virus called Bacteriophage. A special freshman biology lab called Phage Safari had already collected and purified some virus DNA with which we started our research. Then one SSP student designed a protocol for soil sampling, which picked locales for sampling at random. Both SSP students on this project tested several methods for obtaining viruses from soil. We also developed the techniques needed to obtain DNA sequences from viruses. Some preliminary DNA sequences were obtained. Much of the summer research involved the basic computer work needed to identify two genes for our project. Stay tuned to find out, again, what explains the differences among different sequences. For example, does Darwin’s theory of natural selection explain the variation we see in virus DNA sequences? Or is it merely a result of viruses being from isolated geographical locales?

Answering these questions about evolution at the DNA sequence level is not easy. Fortunately, I had excellent SSP students! Also, we made progress by using fast computers and new bioinformatics software, complimented by “wet” lab experiments.
Exploring the Tape Measure Protein Gene of Mycobacteriophages
Bernadette Eichman,’14

Faculty Mentor: John Braverman,S.J.
Department of Biology

Supported by the SJU Summer Scholars Program and the Howard Hughes Medical Institute

Mycobacteriophages, viruses that infect bacteria, are found in a variety of soil samples. Classified into clusters and subclusters based on genomic similarities these viruses are found to have genomes up to almost 200,000 base pairs in length. Within these genomes, unique genes are found, some vital for all phages. One such gene, the tape measure protein gene is the longest gene in phages ranging from 2,000-6,000 base pairs. Since the tail is a fundamental aspect of all phages and involved in the infection of bacteria, I chose this gene to explore its evolutionary history by studying variation within the gene sequences and the role of the geographical origin from which the phage was collected. The objective of my research was to explore the variation in the sequences for the tape measure protein genes of phages collected from the Philadelphia and Lower Merion sides of campus and surrounding towns, as well as the phages previously isolated in the Phage Safari Lab of 2009 and 2010.

Using the sequenced phages Daisy and BPBiebs31 from the Phage Safari Lab, the tape measure protein gene was located and served as a template for designing primers to target the gene on a non-sequenced phage. The DNA sequences were amplified using the Polymerase Chain Reaction (PCR). This process involves denaturing DNA in a tube containing primers and DNA polymerase to make a copy of the sequence of the tape measure protein gene. Once a copy of the gene from the sequenced phage’s DNA was obtained, the same procedure followed, using this copy as a template to locate the gene on the other non-sequenced phages. After the genes for the tape measure protein were isolated, a comparison of sequences and a map were made based on the geographical location of the phage.

Aligning the tape measure protein gene of phages that were already classified on the Mycobacteriophage Database, provided evidence for conserved regions among subclusters of phages. Phylogenetic trees were made to see the branch pattern of divergence within a subcluster. Generally, subclusters containing more classified phages showed more divergence. Primers were designed for subclusters A1, B3, and C1 with PCR results indicating KOGaga and Alberto11 to be potential A1 phages and Crouton to be a potential C1 phage. The PCR products of KOGaga, Alberto11, and Crouton were sent for sequencing and these results were compared to the sequences that were already known. The gene of the tape measure protein is over a thousands base pairs long; consequently, internal sequencing primers were designed to cover the region of the whole tape measure protein gene. Once the gene sequence for KOGaga was obtained, A1 internal primers based off of BPBiebs31 were virtually tested and resulted in 4 out of the 6 internal primers aligned. This further suggests conserved regions between subclusters.

Past studies of phages incorporated the whole genome for analysis, whereas this research focuses on a minute region. Because millions of phages are found within soil samples, it will be interesting to see the variation within the tape measure protein gene of the phages collected within relative distance to one another.
Genetic Variation Within and Among Subclusters of Mycobacteriophage
Kelsea Henderson,’13

Faculty Mentor: John Braverman, S.J.
Department of Biology

Supported by the SJU Summer Scholars Research Program and the SJU Barbelin Scholars Program

Mycobacteriophages are viruses that infect mycobacteria, using a tail to inject their viral DNA into the host. There are several clusters and subclusters of mycobacteriophage, ranging from cluster A to O. The objective of this experiment was to study the genetic variation of mycobacteriophages, focusing on subclusters A1 and B3. We chose to focus on these subclusters because the previously isolated and purified phages BPBiies31 and Daisy, from the Phage Safari classes of 2009 and 2010, are known to be in subclusters A1 and B3, respectively. We also wanted to conduct the study on a smaller scale, rather than taking the approach of examining the entire genome. We therefore decided to focus on one gene, which would be amplified, sequenced, and compared to other sequences using bioinformatics software.

The gene I chose to study was the major tail protein, which is involved with the formation of the tail of the phage and is variable across clusters. It is also a relatively short gene, meaning that it would be easier to amplify using PCR. Phage genome sequences were first obtained off of the Mycobacteriophage Database, phagesdb.org, which were then used to create primers for PCR. The major tail gene was already identified for Daisy; however, some discovered phages did not have fully annotated genes, meaning that the gene location had to be found with the use of BLAST or MegAlign, both of which are computer programs that align DNA nucleotide sequences. PrimerSelect was then used to create primers specific to the major tail gene that would amplify the gene fragment with the use of PCR. After the primers were made, they were tested on other phages in that subcluster using virtual PCR to confirm their effectiveness.

The most significant PCR results included the amplification of KOGaga’s major tail gene, using the A1 major tail gene primers. KOGaga was isolated and purified by a student in the 2010 Phage Safari class, but was never sent out for sequencing, meaning that the subcluster had not yet been identified. After amplifying the major tail gene using the A1 major tail gene primers, it was found that the amplified fragment matched that of BPBiels31; this result suggests that KOGaGa is an A1 phage. The amplified fragments of both BPBiels31 and KOGaGa were then sent to Genewiz for sequencing. According to the sequencing report, each sequence was of high quality, meaning that we can use them for further genetic variation experiments.

A phage from the 2009 Phage Safari class, BabyPhage, appeared to be in the subcluster B3, when comparing restriction digest photographs. The major tail gene of BabyPhage was amplified using the B3 major tail gene primers and it was found that the fragment matches that of Daisy. This fragment was also sent for sequencing and came back with a report of high quality. All these results described here advanced the methods and provided initial findings which lead us closer to the final goal, to, they will be compared to determine whether phages from the same geographic location are genetically similar, or if the genetic variation is completely random.
The Generation Time Hypothesis
Ashley Timko,’12

Research Mentor: John Braverman, S.J.
Department: Biology

Supported by a gift from Nick Nicolaides,’87 and the SJU Summer Scholars Program

My research this summer consisted of testing the Generation Time Hypothesis, or GTH, which is an alternative to natural selection. To test the hypothesis we used DNA sequences from an annual plant, \textit{Arabidopsis thaliana}; a perennial plant, \textit{Arabidopsis lyrata}; and an outgroup. The null hypothesis of the GTH is that the annual (A) and perennial (P) will have equal branch lengths (d1 = d2), shown on the null phylogenetic tree below. The alternative hypothesis is that because an annual plant reproduces more than a perennial, it will have more mutations, and therefore a longer branch length or evolutionary distance to the outgroup (d2 > d1), shown on the alternative tree below.

The outgroup was another plant in the same family as Arabidopsis (Brassicaceae) that could be used to determine evolutionary distances of the annual and perennial. We used three outgroups for this research: \textit{Capsella grandiflora}, \textit{Neslia paniculata}, and \textit{Brassica rapa}. It was necessary to test the hypothesis with multiple outgroups to see if the distance from the annual and perennial to the outgroup made an impact on the results, but we have found no evidence suggesting it does. The outgroups chosen were based on what was available on NCBI.

DNA sequences from the plants selected were obtained using a public database, The National Center for Biotechnology Information (NCBI), which has DNA and amino acid sequences deposited by researchers, and a search site, Basic Local Alignment Search Tool (BLAST), where a user can input a sequence and the output would be closely related sequences from other species of your choice. We found 95 sequences to test for each outgroup. Testing involved using programs such as Clustalw, MEGA, PAUP, and ModelTest. Clustalw was used to align the sequences, which needed to be done before any analyses. MEGA and PAUP performed likelihood ratio tests. Some of the programs used were scripts made in Bash and Perl that I wrote with the help of my mentor. The scripts automated the process of running the other programs or even ran tests themselves. They made analyzing the three sets of 95 sequences much easier and they also helped put the sequences into the many different formats needed for the programs being used, such as FASTA files, nexus, or mega.

In support of the GTH, the annual plant had a longer branch length than the perennial for the majority of the sequences for all three outgroups. Other tests we performed, such as the likelihood ratio test, gave results inconsistent with the branch length results. We also ran a sign test in which the null hypothesis is that the annual or perennial would be equally likely to be longer, and got significant results ($p < 0.05$) for all three outgroups providing evidence for the alternative, meaning the annual was longer, and also providing evidence for the GTH.
Janée N. Burkhalter
Department of Marketing
Haub School of Business
Saint Joseph’s University

Ph.D., Marketing, Georgia State University
M.B.A., Florida A&M University
B.S., Business Administration, Florida A&M University

Research Interests: Marketing communications, niche markets of consumers, corporate social responsibility and business education

I have been able to engage in research that focuses on higher education and consumer behavior. In line with my scholarly interest in higher education, my colleagues and I have published in the Journal of Entrepreneurship Education and Business Education Digest. Consistent with my interests in niche markets of consumers, I have also co-authored work focused on elderly consumers which was published in the Journal of Financial Services Marketing. My focal research, however, melds my concentration on niche markets with my interest in marketing communications and investigates how the embedding of brands in music videos may influence the consumption behaviors of musical subcultures. I believe this field is ripe for inquiry because scholars tend to focus on music as a background element to marketing communications as opposed to looking at music as the marketing vehicle itself. Currently, I am working on several projects in this area including a few which employ the use of psychophysiological measures such as EEG, GSR and eye-tracking mechanisms.

Prior to pursuing my doctorate, I worked as a marketing manager and marketing consultant in the financial services field where I focused on niche markets of customers including affluent consumers and Fortune 500 businesses.
Effecting Marketing Strategies in the Children Apparel Industry
Lauren Bogen,’13

Faculty Mentor: Janee Burkhalter
Department of Marketing

Supported by the SJU Summer Scholars Program

Children apparel has proved to be one of the most resilient industries in times of economic uncertainty. During the recession in 2009, the children apparel industry lost a mere .1% of sales while the adult apparel industry lost 6 times much. In response to the trend of stringent spending, many parents and grandparents curbed their individual expenses. However, apparel expenses for children have remained high because of their constant growth. Thus, the children apparel market has been desirable to many entrepreneurs.

One entrepreneur and recent mother of two, Saunde Briggs, founded her own children’s apparel company, The Ellie Rose. Founded on being simple, sweet, and handmade, The Ellie Rose soon attained a happy and loyal customer base in stores and online. Since the induction of her company, her main goal has been to maintain her current customers and acquire new ones. However, with small marketing budget of only 8.15% of total expenses, this is a challenge.

My role is to develop marketing strategies that will keep her current customers while obtaining new ones for relatively low cost. Thanks to the prevalence of social media, a company can easily reach new customers and keep in contact with existing customers. Since her main clientele are mothers and grandmothers, I learned the most effective ways of reaching them through social media sites. I discovered that for mothers, Facebook, Twitter, Youtube, Email, and Blogs are integral parts of their daily lives. For example, an astounding 93% of moms communicate via Facebook. For grandmothers Email is the most popular form of social media currently, but females aged 55 and above are the largest growing demographic on Facebook. Combining this information with research on how women perceive advertising, I concluded that the most effective way to reach more customers is from positive reviews and suggestions of fellow mothers via social media sites.

By monitoring these sites, I have also discovered popular trends in children clothing. For example, there is a significant interest among mothers and grandmothers for organic cotton clothing and stain repellent clothing. By focusing on what factors influence a purchase I can better distinguish The Ellie Rose from competitors.

Since the internet allow us to access thousands of companies that provide children’s clothing, it is vital to maintain a uniquely desirable product line and create a marketing strategy that revolves around what the customer is saying. With my help, I hope that The Ellie Rose sees a 10% jump in the following years sales.
Product Placement: Reaching Consumers Through Music Videos
Elizabeth Caletka,’12

Faculty Mentor: Janée Burkhalter
Department of Marketing

Supported by the SJU Summer Scholars Program

In recent years, marketers have begun to turn increasingly towards television shows, movies, music videos, and other forms of entertainment to reach consumers. The practice of incorporating products in these mediums as a way to advertise is called product or brand placement. I am interested in studying a variety of these placements in order to determine their effectiveness.

My research was split into two parts: the first of which was qualitative and the second of which was quantitative. In the first part I performed 10 interviews in which I showed 3 clips from 3 different music videos and asked interviewees questions on topics such as their musical preferences, their music video viewing habits, and their opinions towards a number of products, along with their opinions on the placements within the videos they were shown. From these interviews I determined that the videos in which the product was shown in a negative light tended to lead to more negative views in the product used.

Using the information I found in the first part of my research, I moved into the second part in which I developed an online survey which I distributed to participants. I developed two surveys, both using songs by Eminem, but one with the product in a negative light and one without the product in a negative light. I then used this information to determine qualitative information, such as the relationship between the viewer’s opinions on Eminem and their opinion of the products placed in his video.

In my study I chose videos with easily identifiable placements, in which the product is the main focus on the screen in at least on instance during the video. In both cases, I used two criteria to determine the effectiveness of the placements. The first criterion was development of brand identity, which the reputation consumers associate with certain products. Here, I determined whether or not the placement had a positive or negative effect on the brand’s identity and considered the development of a positive identity as a successful placement. The second criterion I used was recall. I included both aided and unaided recall as a measurement of the effectiveness of the product placements. Unaided recall in when the consumer is able to identify the product after viewing the videos without being shown or reminded of the placement, which would be considered aided recall. I considered both aided and unaided recall a successful placement because as long as the consumer recognizes the placements, regardless of their consciousness of the recognition, I believe that the placement has had the desired impact. Using this criterion, an unsuccessful would have been on in which the viewer was reminded of the placement yet could not remember having seen it.

By studying this topic, I hope to learn more about the nature of consumers in relationship to product placements and how they respond to certain types of placements. Inside the process of product placement I am looking to determine which types of placements are the best for advertisers, meaning they will create a positive image for the brand and a positive brand identity.
Jose F. Cerda
Department of Chemistry
Saint Joseph’s University

Ph.D. Michigan State University

Research Interest:
Spectroscopic and
Electrochemical Studies of
Redox Proteins and Cofactors

My main research objective is the study of the electrochemical properties of redox proteins and redox cofactors. During the summer of 2011 my lab mainly focused on two studies: one involving a heme protein and the other on a heme cofactor. Heme cofactors are found in various types of heme proteins, which perform a wide range of key biological functions. Remarkably, these proteins have the ability to utilize the same cofactor for various activities. Heme \( b \) can serve in roles such as oxygen storage and transport, electron transfer, oxygenase, catalase, peroxidase, and gas sensing. While heme \( a \) is a cofactor that is found in cytochrome \( c \) oxidase and is involved in the conversion of oxygen to water. Although a vast amount of studies have been made in the investigation of heme proteins, the question remains as to how protein-heme interactions define the functions of a heme protein.

An approach in understanding these protein-cofactor interactions is to compare the electrochemical properties between the free cofactor in solution and the same redox cofactor in the protein or synthetic protein. During this summer Emily Amendola and Jackie Castorino studied the electrochemical behavior of myoglobin. The main technique that was employed in this study was UV/Vis spectrotelectrochemistry. This consists of the acquisition of a UV/Vis spectrum at a specific applied potential. A series of spectra of the redox protein is obtained as a function of the electrochemical cell potential and a value of the midpoint potential (\( E_{m} \)) is calculated based on the fit.

On the other hand, Michael Gallagher studied the effects of pyridine on the electrochemical properties of a heme model compound. In this particular research, we are searching for the optimum solvent conditions for obtaining a soluble heme with minimum heme-heme interactions.
Electrochemical Method Used for Probing the Distal Residues and Interactions between a Heme Bound Fluoride
Emily Amendola,’12

Faculty Mentor: Jose Cerda
Department of Chemistry

Supported by the SJU Summer Scholars Program

The oxidized state of myoglobin contains a water-bound molecule, coordinated to the heme iron. Thus, the measured midpoint potential \( (E_m) \) of myoglobin is affected by its initial water-bound state. However, what is the effect on the midpoint potential of myoglobin if the water-bound molecule is replaced? Since it is known that fluoride ion can bind to myoglobin by coordination to the heme iron, we studied the spectroelectrochemical properties of the fluoride-bound myoglobin and compared it to those of myoglobin without fluoride.

Although in very small amounts, in our research we utilized redox mediators to perform the UV/Vis spectroelectrochemical studies of myoglobin. We examined the effects of pH on the midpoint potential of myoglobin and fluoro-myoglobin. From pH=4.5 to 8.5, the midpoint potential of Myoglobin without fluoride shows a decrease of about 60 mV. After pH 8.0, the decrease in the midpoint potential can be attributed to the binding of the hydroxide ion (OH\(^{-}\)). On the other hand, when fluoride is coordinated to the heme, the midpoint potential is maintained at about -196mV (vs Ag-AgCl) from pH=6.0 to 8.0. However, at lower pH, the midpoint potential drops sharply to a limiting value of -226 mV (vs Ag-AgCl) at pH=4.5. This can be attributed to the protonation of the distal histidine that interacts with the heme-bound fluoride. Above pH=6.0, the distal histidine is unprotonated and there is minimum interaction with the fluoride ion. However, below pH=4.5, the histidine is completely protonated and interacts with the heme bound fluoride stabilizing the oxidative state over the ferrous state, relative to the ferric/ferrous states at pH=6.0. Based on the difference in midpoint potentials at pH=4.5 and pH=6.0, the energy value of this hydrogen bond can be calculated and is 2.4 kcal. This electrochemical method can be used to study other heme proteins in order to probe protein-heme interactions.
A Comparison between the Respective pH Dependence of Fluoride Binding in Myoglobin and in Microperoxidase-11
Jackie Castorino, ’12

Faculty Mentor: Jose Cerda
Department of Chemistry

Supported by the SJU Summer Scholars Program and the William J. Gross, ’38 Memorial Research Fellowship

Myoglobin has a heme pocket that is affected by the pH of the solution. Under acidic solutions, a water molecule coordinates to the heme iron. While in basic solutions, a hydroxide ion replaces the water molecule and coordinates to the heme iron in myoglobin. Spectroelectrochemical data from our lab demonstrates this pH dependence. Such dependence is modified when water is replaced by a fluoride ion which can bind to the heme iron in heme proteins. To understand the mechanism of fluoride binding in heme proteins, we measured the dissociation constant ($K_d$) between fluoride and myoglobin and compared these values to the measurements performed between fluoride and a truncated protein, microperoxidase-11 (MP-11) which is an eleven-residue heme fragment of cytochrome $c$ molecule with amino acids 11-21 still attached.

The dissociation constant ($K_d$) between fluoride and myoglobin is less than 0.1 from pH 4.5 through pH 7.5. At pH 8.0 and above, the $K_d$ increases dramatically due to the binding of the stronger hydroxide ion ligand that easily displaces the coordinated water molecule. Below pH 7.5, there is a slight decrease in the dissociation constant as the pH is decreased. This is due to protonation of the distal histidine-64 which stabilizes the heme-bound fluoride ion.

Measurements of fluoride binding to the truncated protein, MP-11, showed weak binding only at pH below 6.0. This preliminary result indicates a necessity for key amino acid residues that can stabilize the heme-bound fluoride such as in myoglobin.
An electrochemical study of heme-pyridine interactions  
Michael Gallagher,’12

Faculty Mentor: Jose Cerda  
Department of Chemistry

Supported by the SJU Summer Scholars Program

The heme porphyrin ring has a number of peripheral groups which may interact with molecules in biologically relevant ways in solution. For example, heme $a$ has a formyl group that can hydrogen bond at ring position 8, whereas heme $o$ has a methyl at the same position. Electrochemical methods such as cyclic voltammetry can be used to determine the difference between interactions occurring at the heme $a$ formyl and the comparatively less reactive heme $o$ methyl group. However, in order to guarantee the interaction observed was strictly an interaction at the ring position 8, heme in solution needs to be “free” and non-aggregated. This means that the heme must be in six-coordinate form, where ligands bound at the iron can be easily displaced to observe the interaction of interest and only that interaction.

This summer, we have focused on using a compound called hemin to model the interactions creating free heme. Hemin is an iron-porphyrin ring with a chloride ion bound to the iron and tends to aggregate in solution, and so an organic solvent that can help dissolve and displace aggregated heme would be best for creating six-coordinate heme. For our purposes, we chose to use pyridine.

In order to measure the effects of pyridine on hemin solutions, we began using cyclic voltammetry. Cyclic voltammetry involves a linear change in voltage over time, during which the instrument measures current through the sample. The peak currents at the cathode and anode can be measured to determine a diffusion coefficient, which is essentially a measure of how readily a species diffuses throughout a solution. The coefficient changes for each solvent and concentration of solvent. As hemin becomes free, the diffusion constant should increase because it is less bulky in the non-aggregated form.

For the first phase of our study, we varied the concentration in pyridine to see if there was an optimal concentration for free hemin. Diffusion coefficients at each concentration were determined. A run using ferrocene and the same concentrations of pyridine was done to compare with hemin. Ferrocene is a very stable, unreactive molecule, so if ferrocene produced the same results as hemin, it would indicate that pyridine was producing a solvent effect, not an actual reaction. The same trend was seen in both hemin and ferrocene, indicating it was likely that pyridine diluted the hemin in solution rather than reacted with the heme iron to produce a six-coordinate porphyrin.

Current studies involve varying to concentration of hemin at a constant volume of pyridine in order to see how the molecule aggregates. Research will continue into the academic year.
The ‘self’ is an organized system of thoughts and feelings that impacts how we perceive and respond to the world around us. Our ideas about the self motivate our actions and direct our behaviors. The self, therefore, is a motivational force underlying our decisions and behavioral choices. Broadly defined, my research interests have been centered on aspects of the self that impact the regulation of behavior.

Our ideas of self contribute to the needs we experience and express. Some of these needs are universal (e.g., the need to belong), but experienced differently by different individuals. Other needs are an expression of cultural influences and differential life experiences (e.g., the need for self-esteem). My current interests are focused on basic needs that are related to the level of motivation we experience for an activity. These needs have been identified (Self-Determination Theory; Deci & Ryan, 2002) as the needs for autonomy (self-directed behavior), competence (perceptions of self-efficacy), and relatedness (reflecting the need to belong).

An interesting application of these ideas is to behavior in virtual worlds. The popularity of massive multiplayer online games (e.g., World of Warcraft) and social network games (e.g., Farmville) is growing exponentially, and these games provide virtual environments in which individuals can create identities and, essentially, redefine the self. Is behavior in a virtual world motivated similarly to behavior in the “real” world? Are the basic motives that direct behavior in the real world also directing behavior in the virtual world? These are the current questions we are pursuing in my lab.
Spending Real Money in the Virtual World
Meghan Calavano,’12

Faculty Mentor: Judith Chapman
Department of Psychology

Supported by the SJU Summer Scholars Program

Social psychologists study the real, imagined, and implied influence of others on the thoughts, feelings, and behavior of the individual. However, as the individual is increasingly spending more time in the virtual world, social psychologists ought to follow individuals into the virtual world. Today, a multibillion-dollar industry currently on the rise involves selling virtual goods. Virtual goods exist in online communities and games where individuals can spend their real money on items that are not real.

Many gamers in the virtual world as well as persons interested in marketing schemes hypothesize the motivations for this phenomenon. However, I was interested in understanding this from a psychological perspective; what drives people to spend real money on things that do not exist in the real world?

After extensively reviewing the literature on virtual goods, hypothesized by gamers and psychologists alike, I decided that basic humans’ motivations ought to be assessed in understanding why people purchase virtual goods. The three basic needs driving motivation (Self-Determination Theory; Deci & Ryan 2002) are the needs for autonomy (self-directed behavior), competence (perceptions of self-efficacy), and relatedness (reflecting the need to belong). I am creating a survey to assess gamers’ feelings of autonomy, competence and relatedness in the real world versus those feelings in the virtual world. Are behaviors in the virtual world motivated by different needs than behaviors in the real world? Do behaviors in the virtual world satisfy needs that are not satisfied in the real world? I believe these data will be the basis for further understanding the psychology of buying goods that are not real.
The rules and regulations that govern approval of pharmaceutical prescription drugs are draconian at best and enterprise-prohibitive at worst. In contrast, the pathway for approval of a medical device is dramatically different, for usually, very good reasons. However, medical devices have become increasingly invasive, embedded sometimes for life in the human body. The rules of engagement, however, have not changed fast enough to reflect these dramatic milestones of improvement in medical devices, ranging from complex pace makers and mini computers in the brain or retina akin to science fiction, to almost miracle “glue” that can now hold a skeletal frame together.

To that end, David Zola, investigated one of these new products, a miracle “glue” called INFUSE, a product approved by the FDA March 9, 2009. This miracle product has since been used in thousands of patients worldwide with some significant and often permanent side effects.

The two key areas that David focused on was trying to speak directly to orthopedic surgeons about their general practice and therapeutic approach to bone graft in the spine, and secondarily, their experience positive or negative to use of Infuse, a recombinant human protein rhBMP-2, combined with an absorbable collagen sponge.

The first part of the research—fielding the questionnaire was very challenging—and is ongoing beyond the scope of this summer project. Orthopedic surgeons are notoriously busy and while very cordial and cooperative, it was difficult to get a consistent time and allotment of time to complete the questionnaires. The issue of Infuse, which has been quietly under investigation, also became trickier when over this summer, it suddenly came to the forefront of major press channels such as Business Week and the New York Times when Medtronic, succumbing to increasing scrutiny (from researchers such as ourselves) agreed to provide Yale University a $2.5 million grant to create, centralize and gather all the data on Infuse. This third-party grant gesture to provide “unbiased review” is highly unusual in the pharmaceutical and medical device industry, virtually unprecedented.

Unfortunately, this put a pall on many physicians’ desire to participate in filling in the questionnaire since the category is top of mind, and no physician wants to be inadvertantly misquoted or make the front page of the New York Times in a category embroiled in an investigation.

Nonetheless, we are plugging away at trying to finish this investigation because in all fairness, the product appears to have provided patients who did not experience short or long-term side effects with considerable benefit. The bigger issue we are trying to answer is to understand the approval process the FDA uses and the standards they apply for medical devices. In understanding how Infuse could have been approved with certain restrictions and thus avoided some of its current challenges, we are hoping to provide a template for a better, alternative way to approve medical devices.
We’ve all seen or heard the commercials before. “If you or a loved one experienced adverse effects from drug x, drug y, or drug z, you may qualify for financial compensation.” This is usually because researchers missed or were not expecting these outcomes following the drug’s approval into the public market. Just because the FDA approves a drug/device does not mean it is necessarily safe.

Infuse is a spinal fusion medical device, produced by the company Medtronic, that was approved by the FDA in 2002. It was thought to be a revolutionary change as to how spinal fusion surgeries were performed because instead of the patient taken a bone graft from their own hip, Infuse was placed in the area between the two vertebrae, and the protein inside would form bone in that void. Years later, after some patients experienced adverse effects from using the device, it was discovered that nine of the doctors that submitted research to the FDA panel had a financial stake with Medtronic as did the doctor who designed the cage that holds Infuse, Dr. Zdeblick.

My mentor and I decided to do some investigating of our own through the Summer Scholars Program. Our research wanted to uncover if Infuse was necessary for the spinal surgery landscape, or if it had a little help being passed into the public market. To do this we would have to perform preliminary market research surveying doctors and surgeons relevant to the spinal surgery field. The process of designing a questionnaire started with phone calls and meetings with professionals to get a better understanding of how a patient started and ended the information about the different steps, it was time to form a questionnaire that not only asked the right questions, but also had all the best possible answers we could use in our research. Our questionnaire is currently still being fielded.
Research Interests: I had two research projects this summer. The first project focused on exploring the possibility of a bridge between modern medicine and traditional medicine. Traditional medicine heals the body, heart and mind, whereas modern medicine focuses on curing the body’s ills. In traditional medicine, the whole person is addressed: his or her environment, relationships, mind, and spirit, as well as the body. Traditional medicine also recognizes that the disease itself has a spirit as well: What does the disease need? Why did it come? What is it teaching the person? These are some of the questions that traditional healers ask. It is known that traditional healers around the world share the same secrets. These secrets come from nature and from the awareness of the integrity of all life and the interdependence of body, mind and spirit. In traditional medicine the goal is to heal, whereas in modern medicine the goal is to cure. Curing aims to make the disease go away, but the goal of healing is to return the patient to “wholeness” by restoring or enhancing harmony and well-being. Prayer and ceremony are an integral part of traditional healing methods and help patients feel a strong connection to their family or sources of support and also to a power greater than themselves. The measure of success in modern medicine is the cure, whereas healing in traditional medicine is the measure of a patient’s well-being. Unfortunately, a cure can be measured scientifically, but the effects of healing cannot, because healing involves Spirit as much as science.

To explore the possibility of a connection between modern medicine and traditional medicine, I spent time this summer on the Navajo Indian Reservation in New Mexico working with Medicine Men/Women. I used the paradigm of the Gallup Indian Hospital that offers both modern medicine inside the hospital and traditional medicine in the Hogan outside the hospital. What became clear is that the bridge that can connect these two entities is the sense of spirituality.

The second research project focused on a slow-sand water filter that has been designed and constructed by the research fellows in the Institute of Catholic Bioethics. Today, more than 1.1 billion people, mostly in low and middle-income countries, lack access to safe water sources within a reasonable distance (1 kilometer) and reasonable quantities (20 L a day) from their home. The lack of clean and safe drinking water has significant medical and economic implications, especially towards women and children. There are an estimated 400 million children in the world that do not have access to safe drinking water. Water-related diseases account for 5 million lives each year, and for children under the age of 5, water-related diseases are the leading causes of death, responsible for 80% of deaths for children under the age of 5. Every year over 8 million children under the age of 5 die from malnutrition and preventable diseases. The Institute’s water filter is being tested throughout the summer to verify its effectiveness in filtering-out numerous types of bacteria such as typhoid, salmonella, etc. In addition, we are working with Global Alliance for Africa, a non-profit organization, in regards to setting up a micro-financing fund in either Kenya or Tanzania to make these water filters not only accessible but sustainable.
The Empowerment of Microfinancing in Developing Nations
Brendan Bryant, ’12

Faculty Mentor: Peter Clark, S.J.
Institute for Catholic Bioethics

Supported by the SJU Summer Scholars Program and the Institute for Catholic Bioethics

Over the last century the need for water has increased at twice the rate of the world’s population growth while accessibility has declined. Approximately 1.1 billion people across the developing world lack access to safe water sources. Due to improper sanitation, water-related diseases such as typhoid and yellow fever account for 3.5 million deaths annually, predominately in women and children. Unsafe water is the cause for 88% of cases of diarrhea worldwide; accordingly, diarrhea remains the second leading cause of child mortality under the age of 5, killing more children than AIDS, malaria, and measles combined.

The impact of the global water crisis affects the social and economic progress of developing nations. Nearly 200 million hours a day are consumed collecting water, often from polluted sources, for domestic use by women and children. Clean drinking water and sanitation would free time for education and increase productivity in the labor force. The World Health Organization (WHO) estimates earnings of $3 - $34 for every $1 invested into safe water and sanitation. Thus the correlation between safe water and gross domestic product spurs economic advancement in developing nations.

The filtration and purification of water through a slow-sand filter is the simplest way to attain potable water. However, due to the lack of technology and financial services to the poor this treatment of raw water can be unattainable. The Institute of Catholic Bioethics is conducting a study on water purification using the slow-sand filter model. The goal of the water filter system is to eliminate coliform bacteria from water sources in order to manage and ultimately prevent the spread of typhoid in developing nations. The focus of the project is to design and implement the filters throughout the developing world through the integration of a sustainable microenterprise model made possible by microfinancing.

The purpose of my research was to examine the origins and evolution of microfinancing. Microfinancing is the procurement of financial services to low-income clients who lack access to basic banking services such as loans, savings, and money transactions. I collaborated with the Global Alliance for Africa (GAA), a Chicago based non-governmental organization, to create an accessible and sustainable microenterprise model to implement the slow-sand filter.
An Analysis of Medical Marijuana from Health, Legal, and Ethical Perspectives
Cameron Fick,’12

Faculty Mentor: Peter A. Clark, SJ, PhD
Institute for Catholic Bioethics

Supported by the SJU Summer Scholars Program and the Institute for Catholic Bioethics

In the current climate of the medical community, there is pressing debate about the benefits of increasingly popular and available choices in alternative medicine. One such treatment that is garnering attention and prompting hot debate is the medical use of marijuana. Proponents argue that medical marijuana can be used effectively to treat not only pain, nausea, and vomiting associated with chemotherapy, but also the severe weight loss associated with AIDS. In contrast, opponents voice criticism that alternative therapies like medical marijuana have not been scientifically tested, leading to questions about their safety and efficacy.

Marijuana is currently classified as a Schedule I drug and thereby is illegal according to Federal law. Mindful of that, but also knowing potential benefits for patients, the purpose of this study was to assess the medical, legal and ethical implications of the legalization of medical marijuana in the United States, with a view toward encouraging the reclassification of marijuana as a Schedule II drug, one with a medical purpose.

Medical marijuana can be either a stand-alone treatment for the conditions described or one taken in complement to conventional treatment, thereby assisting patients to better withstand side effects and be able to endure until the full benefit of conventional treatment is obtained – a cure or improvement of the condition. Nevertheless, the marijuana discussion is now enlarging to become a hot legal debate, as well. The Federal government has this year reaffirmed a “no tolerance” stance on the medical use of marijuana. This stance conflicts with the ones held by the 16 states and the District of Columbia that have legalized medical marijuana, leading to further debate.

The issues surrounding medical marijuana were also investigated using ethical principles. The ethical principle of double effect, which states that a human action has two distinct effects – intended good and unintended evil – applies here. The intended good here is the improvement of the person’s illness, while the unintended evil is the side effects associated with marijuana.

Another form of alternative medicine investigated this summer was the traditional healing techniques used by the Navajo Indians of New Mexico. This additional study was made possible by traveling to St. Mary’s Mission on the Navajo Reservation, where two medicine men, one Navajo and one Acoma, were interviewed. The Navajo medicine man explained the holistic nature of his practice, not just curing a person’s symptoms but treating the person as a whole – physical, mental, and spiritual. The Acoma medicine man practiced healing in a different way. His technique involved the use of a sweat, which is a purification ceremony. In this ceremony, different spirits are called upon to treat people. Overall, the most compelling aspect of these healing treatments is the sense of spirituality so powerfully operating in their practice of medicine.
Alzheimer’s Disease and Genetic Testing: a Medical, Legal and Ethical Analysis
Joseph Harrison, ’12

Faculty Mentor: Peter A. Clark, SJ
Institute for Catholic Bioethics

Supported by the SJU Summer Scholars Program, the Institute for Catholic Bioethics and Coriell Institute for Medical Research

Genetic testing has made substantial advancements in the field of preventive medicine through the idea of ‘personalized medicine’, which refers to the use of genomic information, along with assessments of family history, lifestyle and environmental factors, to create an individually tailored health management plan for the patient. Within a patient’s genome, there are certain markers that reveal the potential for future health risks, including cardiovascular diseases, neurodegenerative diseases, type I and II diabetes, various cancers and many others. However, understanding the genetic connections of certain diseases can be a complex task due to the following: first, there may be no current treatments that can eliminate the disease process, resulting in “non-actionable” diseases; second, the knowledge of possessing a risk factor for a “non-actionable” disease may have adverse behavioral impacts on the patient; and third, certain diseases are multi-factorial conditions that are not solely dependent on the genetic makeup of an individual, adding uncertainty to the genetic results. These difficulties represent the complexity that is created with assessing a patient’s genetic risks for Alzheimer’s disease.

Alzheimer’s disease is a neurodegenerative, irreversible disease that is identified by the formation of amyloid plaques and neurofibrillary tangles in the brain. There are variations to the disease, including early-onset and late-onset. The genetic evidence that supports the early detection of both early-onset and late-onset Alzheimer’s disease has been supported by the National Institute on Aging, a subdivision of the National Institute for Health. Early-onset Alzheimer’s disease, the rarer of the two classes, affects people from age 30 to 60 predominantly, while late-onset can be seen in those over the age of 60. Genetic information can be critical to the future of Alzheimer’s disease treatment as scientists work with clinicians to actively pursue preventive medicines. As expressed by the National Institute on Aging, the identified risk factors—namely apolipoprotein E (APOE)—must be researched further in order to fully determine its role in the development of Alzheimer’s. While there is much debate about the involvement of APOE in Alzheimer’s, the APOE ε4 allele of the APOE gene has been seen in about 40 percent of all late-onset Alzheimer’s disease patients. The presence of the APOE ε4 allele does not signal that a person will develop Alzheimer’s; rather, it represents an increased risk of the disease manifesting in the individual. It is medically vital that people with this increased risk be monitored, along with the accompanying environmental factors, to deduce the APOE gene’s involvement in Alzheimer’s development.

This research was conducted in conjunction with the Coriell Institute for Medical Research in Camden, NJ, an organization that specializes in personalized medicine. Coriell, in assessing a patient’s genetic risks, opts to not reveal information pertaining to “non-actionable” conditions such as Alzheimer’s. While it remains ethically imperative to not cause undue anxiety onto patients by revealing risks that may not develop into disease states, the medical significance and its potential impacts on the Common Good cannot be overlooked. The purpose of this research, through the exploration of medical, legal and ethical perspectives, was to offer support of revealing genetic risk factors to potential Alzheimer’s patients.
Over the summer, Will Opperman and Mat Verghese investigated a number of issues relating to the analysis and measurement of human intelligence. Although attempts to understand what intelligence is and how (and whether) it should be measured have a long history in the social and behavioral sciences, these issues have received substantially less attention from philosophers than narrower related topics like reasoning or the justification of beliefs. Consequently, the students identified an opportunity to make progress in understanding the underlying assumptions behind common conceptions of intelligence that inform much theoretical research (as well as practical policy).

Mat focused the majority of his research on the heuristics that individuals use to solve problems which require what people typically call “intelligence,” with a specific focus on the prominence of the role of explicit propositional knowledge and implicit “know-how” in these pursuits. His investigation included both personal interviews and reviews of the scholarly literature in areas such as problem-solving in physics, the development of new mathematical proofs, and expert chess playing.

Will focused the majority of his research on intelligence testing and cognitive training, aiming to uncover a variety of implicit assumptions about intelligence required for current intelligence tests to validly measure what they claim to measure, and to discover whether attempts to train intelligence show promise. As part of this, he conducted small pilot studies on cognitive training with the “Dual N-Back” exercise (a computer game which trains working memory) and reviewed the scholarly literature on the prospects of such training as a method of improving intelligence.
Questioning Intelligence
Will Opperman,’12

Faculty Mentor: Joe Corabi
Philosophy Department

Supported by SJU Summer Scholars Program

When undertaking the philosophical task of researching intelligence and knowledge the possibilities are endless, which poses both a great reward and a huge obstacle. We started with searching for a trait or characteristic that certain people have that allow them to intake knowledge efficiently and retain that knowledge as ‘intelligence.’ We thought that through both this research and personal interviews we would begin to get a better idea of what these traits may be. While we did find promising answers, I elected to go down a little different road. Wading through the various literatures available on intelligence can get overwhelming to say the least, but in this search I found a direction that seems both promising plausible. We found a commonly accepted indicator of intelligence that most people are probably pretty familiar with: IQ tests. While IQ tests have now been around for a while we undertook the task of trying to find scholars who had done experiments and developed hypotheses about the actual ‘usefulness’ of these IQ tests.

What I found was new and exciting, and seems to be an opening for future research. In psychological experiment by Jaeggi (2008) she and a team of researchers required participants to take an IQ test before taking part in a two week cognitive development exercises called Dual-n-Back tests. After going through these exercises the participants then retook the IQ tests and the results were recorded. While the initial findings in this experiment found that these Dual-n-Back exercises do in fact help people taking IQ tests a closer look at the procedure and set up of experiment proved the findings shaky at least, because only one test group used a widely accepted IQ test that has been around for years and that group showed almost no improvement on the second IQ test. Initially this seemed to be a bump in the road but instead provided another area to research. I began to search these types of cognitive training exercises like the Dual-n-Back test and found that many (if not most) rely upon one key ability: memorization.

The ability to memorize material has become essential in succeeding both in the ‘real world’ and in educational settings like here at SJU. The question that became glaringly obvious was thus, how does memorization (mainly through mnemonics) connect to the actual development and absorption of knowledge and thus add to intelligence? This question is yet to be answered but the search will continue. It seems plausible to me that in the ever increasingly technological world we live in the need for memorizing certain facts seems to be unneeded, I mean we’ve all heard of Google, right? The question would than stand as to how useful memorization is on both IQ tests and any educational test that uses rote methods (multiple choice, fill in the blank, true/false, progressive matrices etc) as a measurement of intelligence, and furthermore if this can even count as intelligence anymore.
Questioning Intelligence
Mat Verghese,’12

Faculty Mentor: Joe Corabi
Department of Philosophy

Supported by the SJU Summer Scholars Program
and the SJU Barbelin Scholars Program

In the Western world, one may have to take a test that claims to measure intelligence at times that are important in his or her development (i.e. attending school at any level). Whether such tests sets out to determine one’s readiness for college or general intelligence, they must be held up to a high standard because of the fact that they are assessing a dimension, namely intelligence, that can have considerable say in where one is able to go in life. We began the rather large task of looking into intelligence tests with the question: Do these tests measure what they say they do? As a companion to this question, we began to investigate how people become intelligent. We wanted to know if intelligent people have access to certain procedures or abilities that set them at a higher level somehow and whether or not those attributes are learned. Towards these ends, we explored intelligence literature and intelligence tests themselves, in addition to interviewing people in particular practices we believed to be intelligent.

In our explorations of the literature surrounding intelligence and expertise we found that there are differences between the diagnostics strategies of doctors just entering residency and those who are more or less diagnostic experts. There are also significant, performance-effecting differences in the strategies that physics experts use when compared to physics novices. One study done by Anzai (1991) documented the evolution in strategy of a subject who performed the same physics problem four times over. In essence, she became an expert at solving this problem and the evolution of her steps led her to solving the problem more like a physics expert would.

Our research across our various questions led us to some partial answers, but even more questions. Some researchers would say that some general intelligence characteristic, called “g”, exists. We would like to look further into similarities across specific domains of intelligence (such as physics, mathematics, playing chess, being funny, and creativity) to see if there truly are any abilities or capacities that contribute to the level of excellence present across all of these spheres of mental functioning. There still does not seem to be a test that measures any such ability, and we would like to look more into the tests in existence to see what kinds of abilities they actually do measure. There is plenty of research available on intelligence, but not enough on the validity of intelligence testing.
This summer I had the pleasure of mentoring Andrew Stoll, now a senior Finance major, throughout his studies of the investment markets and the always changing economic landscape in which they function. It is difficult to expect to cover and understand the financial markets as a whole in only a few months, but Andrew and I were able to capture the main and most important financial events and economic indicators that occurred during the duration of our research. Moreover, the research effectively allowed Andrew an opportunity to interpret and predict market movements based on both positive and negative financial and social news and events.

From a mentoring standpoint, I was able to watch an aspiring investment analyst grow and mature as he worked to mold himself into the productive analyst he hopes to be one day. The most important thing Andrew gained from the research opportunity was his overall exposure to the markets on a daily basis. By staying in tune with and focused on economic news, he was able to proactively study the market movements with respect to financial events and economic reports. Furthermore, using investment devices and programs such as “Factset” and “Bloomberg” gave Andrew another opportunity to work hands on with the programs that real world financial analysts utilize in their daily research and analysis. Andrew’s understanding of the investment market has grown immeasurably and this opportunity was invaluable to Andrew’s growth and understanding of the investment markets.
An Economic, Financial, and Social Analysis of Investment Decisions
Andrew Stoll,’12

Faculty Mentor: Samuel Cupp
Department of Finance

Supported by the SJU Summer Scholars Program

Investing is a field that is always changing and often accurately pegged as “unpredictable.” Through financial and economic research and analysis, I was able to obtain a more complete understanding of what movements in the economy affect informed investment decisions. There are countless economic indicators investors remain on the lookout for, some obvious and some subtle. My research focused on getting a better understanding of which factors are the most important as well as placing a focus the economic factors that recently occurred in the market during my research. These factors include but are not limited to the decisions on our national debt, the possible default in Greece, and the struggle of the housing market. Furthermore, I was able to examine how measurable factors such as real and nominal GDP, unemployment, the housing market, and inflation play a role in the market’s growth and decline.

Through my research, I found that it was most precise to examine not only economic factors when making investment decisions. As a matter of fact, social factors can inherently play a big role in the stock market as a whole. We saw in tragic events of September 11, 2001, the market take a drastic hit because of a social catastrophe that soon plagued our market. During my research, I was able to examine the market’s response to the international disaster of the earthquakes and tsunamis in Japan.

Perhaps the most intriguing portion of my research came from the analysis of our economy’s continuous growth out of the recent recession. The recession has offered our market a horrific time for jobs and investing, but it presented a great situation for research. I was able to examine how different equities were affected by the drastic economic downturn as well as studied what we as investors can learn from the recession moving forward. My research offered a terrific opportunity to learn that being an “informed” investor means staying in tune with the market and events that may directly or indirectly affect its growth. But with all sorts of statistics and information readily available, I soon found out that if investing were as easy as I once thought it was, we would all be rich.
Understanding the complexities of violence, sexual violence and deviance has been my research interest since my undergraduate experience at SJU over 20 years ago. As a result, I was motivated to use my interests to engage in completing my graduate degree from Saint Joe’s, where I was able to work with men who sexually assault women and investigate the percentages and probabilities of rehabilitation once they have been apprehended, processed and sentenced for their deviant crimes.

As a professional, I have continued to engage my interests in sexual violence by working with children and their families in Philadelphia and Delaware counties, with behavioral and mental health issues. I have been able to stay connected to the many societal complexities and social problems that plague our families and our communities, including sexual violence victimizations and children who have been traumatically impacted by violence. In addition, I have had the privilege of teaching in the department of Criminal Justice and Sociology where I have been able to immerse students in both the academic and practical knowledge of the implications of sexual violence and deviance and the consequences this violence has on our society. Working with my summer scholar, Laura Matias this summer was another opportunity for me to engage my interest because her research in examining the service providers/counselors of sexual assault victims was relative to my practical experiences in the social service field. Using my academic and practical experiences in the field to mentor and assist Laura was enlightening for me, as her research will ultimately be able to identify the possible costs, both psychologically and possibly financially of those individuals working directly with victims who have been severely traumatized by their unfortunate victimizations. She was successful in her research this summer, able to find her proposed sample and is steadily working towards finalizing the outcomes of the project this semester. The opportunity to mentor and assist student research is exciting. Encouraging paramount student research and mentoring the process is significant towards effecting change in the field and promoting future practical and academic work.
“Examining the effects of being a Sexual Assault Counselor”
Laura Matias, ’12

Faculty Mentor: Gina Curry
Department of Sociology

Supported by SJU Summer Scholars Program

Working with those who have been sexually victimized can often have a negative impact on a counselor’s social and psychological well being. There is substantial research and statistics containing information on how to help and support a survivor of sexual assault. On the other hand, there is very little information on another form of survivors, a secondary survivor. For this research project, the main concern is looking at advocates as secondary survivors of sexual assault.

This project has been something I have been working on since the Fall of 2009. My goal for this research was to determine how being a sexual assault counselor could possibly lead to vicarious trauma, and burnout amongst those in the field. In the fall, I began this project with the help of Dr. Kim Logio, by studying scholarly literature and writing annotated bibliographies and a literature review. I found that there has been some pioneering work on this topic, but not much follow-up. The first pioneered article coining the term vicarious trauma in terms of counselors was written in 1990. It is believed that working with the sexually victimized disrupted a counselor’s everyday behavior, trust, and intimacy. Other researchers have used this same idea to determine if any of those facts and others could lead to the high rate of burnout and low turn around rate of sexual assault advocates. My research intends to identify the various variables that can have a negative emotional effect on counselors such as caseload, types of cases, lack of coping strategies and others. I then plan to evaluate how those variables lead to a change in an advocate’s basic schemas and can potentially lead to vicarious trauma and burnout.

Being that I had already done some initial research before the program began, I knew what questions needed to be asked. Once again, with the help of Dr. Logio I completed the protocol and obtained approval for the Institutional Review Board, the IRB, to conduct this research. I then enlisted the help of Professor Curry, being that she is a graduate of SJU, and also works in the field of social work/services. After getting approval, I began sending letters to several agencies such as Women Organized against Rape and Rape, Abuse, and Incest National Network. I also contacted some of my previous supervisors from an internship at the local Victim Services Center. My goal was to obtain a decent sample size of 20, and interview those employed as a sexual assault counselor. In order to participate in the project, the participant must have been 18 years of age or older at time of interview, female, and have worked as a sexual assault counselor for at least one year.

I was fortunate enough to reach my goal of 20 participants and beyond for the project. I spent a lot of time contacting agencies, sending out requirement scripts, and going out for the actual interviews. Unfortunately, due to time, I do not have any conclusions as of yet. Over the next semester, I plan to do an original analysis of the data collected. The goal is to determine what factors of being a sexual assault counselor can lead to vicarious trauma, and then potentially ending in burnout. The completion date of this project will be December 2011.
Over the summer of 2011, Haley Dean has undertaken a project in musical theatre choreography. This project had two distinct phases.

The first phase involved Haley landing a highly competitive choreography internship at Pittsburgh Civic Light Opera. Haley was chosen as a choreography intern for the 2011 summer season at Pittsburgh Civic Light Opera where she assisted (4) Broadway choreographers on four different professional musical productions (*Jekyll & Hyde, Love Changes Everything, The Sound of Music and Jesus Christ Superstar*).

After completion of the Civic Light Opera season, Haley returned to SJU for the second phase of the Summer Scholars project where she worked with me as Choreographer of *Jesus Christ Superstar* (the SJU Theatre Company production) which I am preparing to direct in September of 2011 at the university. Haley is responsible for the choreography in the production and will be fully choreographing (4) dance sequences/musical numbers for the production.

The information she gained at Pittsburgh Civic Light Opera as well as her collaboration with me as director is an invaluable professional collaboration experience which she will be able to build upon as she launches her career as an actress/singer/dancer/choreographer.
In the realm of theatre, there are an extraordinary number of components that collaborate together to create one production. Summer seasons at professional regional theatres are some of the most demanding divisions of theatre performance, wherein a show is rehearsed for ten hours a day, eight days in a row, provided one day of technical rehearsal, and then thrown in front of an audience (with fingers crossed). It is a whirlwind of a process that is both nerve-wracking and thrilling in its progression. This summer, I was awarded the opportunity to work with one of the most prestigious regional theatres on the east coast and experience firsthand everything a professional musical theatre production process consists of.

The Pittsburgh Civic Light Opera is a well-renowned professional theatre in the heart of downtown’s cultural district. In addition to producing a number of high-caliber musicals during its summer season, the PCLO also provides a valuable and unique internship opportunity for multiple aspects of theatrical production, including internships in public relations, company management, sound design, directing, etc.

As the resident choreography intern for the summer, my job consisted of many components. Primarily, I worked with each of the various choreographers brought in for the four musicals the PCLO produced while I was there. Each musical, company, and production team provided an incredible experience and environment. My involvement was unique to what the individual choreographer required, whether it be a great deal of assistance creating the choreography for the musical numbers, working primarily as a record keeper to be referenced by the choreographer and the company, or serving as a human demonstrator/springboard for the choreographer’s ideas. The various ways of choreographing that I observed in each individual I worked under allowed me to gain multiple perspectives of how a choreographer operates in the professional theatre.

Through these very different methods I observed in each choreographer, I was able to gain a lot of experience through examination and participation that will greatly assist me in the second component of my Summer Scholars project: choreographing the Fall production of Jesus Christ Superstar at Saint Joseph’s University (Department of Music, Theatre & Film). I will be able to use what I have learned at the PCLO, both positive and negative, to effectively work alongside my Summer Scholars mentor, Renee Dobson, who is directing the production. Through constant contact with Professor Dobson over the summer, I was able to take a lot of what I was observing in these professional choreographers to start collaborating on our own production for the Fall. I hope to bring the work ethic and professionalism I have witnessed and partaken in this summer to the University and cast of Jesus Christ Superstar, and to use all I have learned in the field of choreography to co-create what will be a fantastic piece of theatre.
Jonathan Fingerut  
Department of Biology  
Saint Joseph’s University  
Ph.D. University of California  

**Research interests:** Organism-Flow Interactions in a Freshwater Stream

The larvae of black flies, the ubiquitous bane of campers and outdoors enthusiasts throughout most of North America are an important component of many freshwater stream ecosystems. Feeding via filtering fans on their head, they take up algae and bacteria brought to them by the stream flow, and are in turn an important food source for fish and other aquatic organisms. Since they rely on flow to bring them food, these larvae require the fastest flow possible. If predators, crowding or slow flow are present, then these non-swimming larvae enter the water column to drift downstream in search of better conditions. Their ecological importance, large numbers, and passive transport all make this a very good system in which to investigate how behavior and hydrodynamics interact to determine population distributions, the focus of my research.

This summer, we have concentrated on two aspects of how organisms interact with their environment. The first project is a set of exploratory experiments aimed at determining what factors control the spatial distribution of larval settlement. Previous work has explored distributions at large scales, such as between riffles and pools, and very small scales, such as on a single rock, but little is known about intermediate scales. By varying the spacing between bed elements (plastic cubes used to mimic gravel and other streambed material) we hope to isolate factors such as grouping of elements and flow patterns in between elements. These experiments will be run in a laboratory flume that allows us to both recreate and control realistic flow conditions and determine the larvae’s distribution using video analysis.

The second project was an effort to develop a protocol for long-term sampling of the natural stream environment. Black flies have a yearly cycle of emergence, population growth, population decline, and over wintering where a few large larvae spend the winter months hiding under. What signals the spring emergence, what factors control the size of the mid-Summer population and what triggers the overwintering behavior are not known. This project, which will continue for several years, aims to collect data on the demography of the larval population as well as relevant environmental factors including flow, food availability, and water quality measures. It is hoped that after several seasons we will be able to better understand what some of the possible mechanisms are that define this cycle and what changes to those factors may mean for the flies.

Both of these projects will continue to elucidate the role of the physical environment in determining the population structure and distribution of these important members of the stream ecosystem. In addition the results of these studies will provide quantitative data that can be used in future efforts to model and predict the effects of environmental change in these commonly impacted systems.
Affect of arrangement of bed elements and flow on settlement of black fly larvae
Kristina Orbe,’14

Faculty Mentor: Jonathan Fingerut
Department of Biology

Supported by SJU Summer Scholars Program and the Biology Department

Black flies are seen by many as pests, and most research done on black flies is completed in hopes of eradicating the population from neighborhood streams and creeks. The goal of our research is to come up with a predictive model that would provide an estimate of the blackfly population in a stream judging by the speed of the flow or the number of bed elements, such as rocks or branches.

The first step in our research was to determine the affect of arrangement of bed elements in stream on settlement of black fly larvae. Two acrylic sheets were prepared with 30% coverage of acrylic cubes. One sheet had cubes arranged in a random manner; the other sheet had cubes arranged in an orderly fashion. These two sheets were placed in a flume able to simulate stream flow in the lab. Larvae eggs were collected weekly and were hatched in aerated tanks. The newly hatched larvae were introduced into the flume where they settled on either the random blocks or the ordered blocks. After two hours, the larvae that had settled on the cubes were counted in the flume using a CCD camera. Based on previous research we had expected to see an effect of arrangement, with more larvae settling in the random treatment due to its increased availability of unobstructed front edge (which facilitates settlement); however, no statistical differences was seen between treatments.

The negative result of this study points to a different factor determining the arrangement of settlement. Bed elements in a stream all effect the surrounding flow conditions, which led us to a second scenario in which we manipulated flow while keeping arrangement constant. New acrylic sheets were made by cementing rows of acrylic cubes at varying distances from each other. This new arrangement was believed to better show how individual bed elements interact with one another and affect flow. Fine scale flow patterns around each set of cubes were characterized using a Laser Doppler Velocimeter. We tested larvae settlement with this new arrangement hoping to see a distinct pattern. However, due to population drops in our field site, we were unable to complete this portion of the study.

Our work this summer yielded valuable results, as negative results can often be as useful as positive, paving the way for continued study of black fly settlement next summer.
Research Interests: strained organic molecules

The focus of my research program involves the synthesis and study of non-natural products that possess unique properties and enhanced reactivity as a result of forced deviations from their ideal geometries. In particular, my research group has been interested in studying the effects of bond angle distortion on the structures and properties of alkenes.

The carbon-carbon double bond of an alkene is made up of a sigma (σ) bond and a pi (π) bond as shown in Figures 1a-d. Maximum overlap between the p-orbitals of the π bond occurs when the axes of the p-orbitals are exactly parallel, as shown in Figures 1c and 1d. Any deviations from this ideal geometry are manifested in the form of enhanced reactivity and unique properties of the alkene. One type of distortion in alkenes is referred to as pyramidalization and results from a syn-folding of the R group substituents (Figure 1e). The degree of folding may be conveniently measured via the pyramidalization angle, which is defined as the angle between the plane containing one of the doubly bonded carbons and the 2 substituents (R) attached to it and the extension of the double bond. Representative alkenes possessing pyramidalization of their double bonds include cubene (1) and pentacyclo[4.3.0.0^{2,4}.0^{3,8}.0^{5,7}]non-4-ene (2) (Figure 1f).

During the summer of 2011, my research group continued the investigation of the synthesis and study of pentacyclo[4.3.0.0^{2,4}.0^{3,8}.0^{5,7}]non-4-ene (2). Our research has previously shown that alkylolithium induced dehalogenation of 4,5-diiodopentacyclo[4.3.0.0^{2,4}.0^{3,8}.0^{5,7}]nonane (3) leads to 2, which may be trapped as its Diels-Alder adduct. However, several alkylithium addition products always accompanied the trapped products. Because pentacyclo[4.3.0.0^{2,4}.0^{3,8}.0^{5,7}]non-4-ene (2) reacts with the alkylolithiums present in the reaction mixture, we investigated alternative synthetic procedures during 2011. This summer we investigated synthetic routes toward 4-iodo-5-(trimethylsilyl)-pentacyclo[4.3.0.0^{2,4}.0^{3,8}.0^{5,7}]nonane (4), a potential precursor (via fluoride treatment) to 2 that does not require the use of alkylithiums. We also investigated the synthesis of 2 via dehalogenation of 3 with sodium in refluxing dioxane and identified several of the products of this reaction.

![Figure 1](image1.png)

**Figure 1**

![Figure 2](image2.png)

**Figure 2**
The synthesis of Pentacyclo[4.3.0.0^2,4.0^3,8.0^5,7]non-4-ene
Dana Krajcsik,’13; Dave Manion,’13

Faculty Mentor: Mark Forman
Department of Chemistry

Supported by SJU Summer Scholars Program

This summer we worked with the Forman research group on the synthesis and study of non-natural products that possess unique properties and enhanced reactivity due to forced deviations from their ideal geometries. The goal was to synthesize pentacyclo[4.3.0.0^2,4.0^3,8.0^5,7]non-4-ene, which is a molecule of interest because it falls into a special category of alkenes—those which possess strain among the carbon-carbon double bond. In all alkenes there is a carbon-carbon double bond that should ideally have bond angles of 120°. However, some alkenes deviate from this ideal geometry causing higher energies and increased reactivity. These highly reactive alkenes possess bond angles either greater than or less than the ideal 120° due to strain among their carbon-carbon double bonds.

There are many sources of strain that alkenes can experience that can disturb the ideal geometry. Our compound pentacyclo[4.3.0.0^2,4.0^3,8.0^5,7]non-4-ene, experiences a type of syn-folding known as pyramidalization which causes the substituent groups to bend towards each other, creating a tetrahedral geometry rather than the ideal trigonal planar geometry. Since the bond angles of the carbon-carbon double bond are consequently altered, our compound is rendered highly reactive with a lifespan in the order of seconds. It is this high reactivity and short lifespan that creates difficulty in the synthesis of this compound and is the focus of our research.

One of the main focuses of our summer was to synthesize the precursors to pentacyclo[4.3.0.0^2,4.0^3,8.0^5,7]non-4-ene. Significant quantities of these compounds are needed for our research efforts. In our proposed methodology a primary precursor of our compound is closed diacid. The synthesis of closed diacid is a 3-step process, shown below. First, a Diels-Alder reaction was performed to synthesize a diester. Next, the diester was hydrolyzed in a hydrolysis reaction which yields an open diacid. The open diacid is then subject to ultraviolet light which includes photochemical cycloaddition to bring us to the closed diacid. This photo-chem reaction is very challenging since it produces very low yields and is very time consuming. All these reactions were repeated numerous times with careful attention to detail so that we synthesized as much closed diacid as possible.

Towards the end of the summer we were able to use our closed diacid to further our research in the synthesis of pentacyclo[4.3.0.0^2,4.0^3,8.0^5,7]non-4-ene. Using the closed diacid, we have been focusing on two different approaches to synthesize our target compound. Next summer we plan to use the closed diacid to synthesize diiodide or t-butyl ester, hoping one path, or both, will allow us to successfully synthesize and isolate our target compound.
The Synthesis of Pentacyclo [4.3.0.0^2,4.0^3,8.0^5,7] non-4-ene
Kyle Nolan,’12

Faculty Mentor: Mark Forman
Department of Chemistry

Supported by a Grant from the American Chemical Society-Petroleum Research Fund to Dr. Mark Forman

This past summer the Forman research group continued research on the synthesis and study of the effects of bond angle distortion on the structures and properties of alkenes, more specifically that of pentacyclo[4.3.0.0^2,4.0^3,8.0^5,7] non-4-ene.

Organic molecules that are known as alkenes contain a carbon-carbon double bond with ideal bond angles of 120°. When the structure of a molecule alters this ideal geometry, reactivity is increased and the properties of the alkene become unique. The carbon-carbon double bond of alkenes reacts to strain in two distinct ways, twisting and pyramidalization. Twisting occurs when the substituent groups cause the 90° rotation of the pi orbitals around the carbon atom. Pyramidalization, the strain our molecule experiences, is a type of syn-folding that occurs when the substituent groups of a molecule are attracted towards each other, reducing the bonding angles and altering the geometry. It is because of the increased energy and reactivity as a result of pyramidalization that our molecule, pentacyclo[4.3.0^2,4.0^3,8.0^5,7]non-4-ene, experiences such a short life span and the reason for our theoretical interest in synthesizing it.

The synthesis of a pyramidalized alkene is often accomplished via dehalogenation of vicinal dihalide, or diiodide, with an alkyllithium. However, previous students in the Forman group have learned that the alkyllithiums used to generate the pyramidalized alkene add to the strained double bond of the product. This addition reaction interferes with the group’s efforts at further studying the pyramidalized double bond. For example, the Forman group would like to study how pentacyclo[4.3.0^2,4.0^3,8.0^5,7]non-4-ene reacts with a variety of other reagents besides alkyllithiums. This can only be accomplished if new precursors and or synthetic methods are devised. Thus, this past summer I investigated the synthesis of 4-iodo-5- (trimethylsilyl) pentacyclo[4.3.0^2,4.0^3,8,0^5,7]nonane as a precursor to pentacyclo[4.3.0^2,4.0^3,8.0^5,7]non-4-ene that does not require the use of alkyllithiums. Although we were not able to synthesize this precursor, we did make progress toward this goal.
I am interested in the socio-political implications of collective memory and nationalism in Asia, particularly Japan, in which underlying cultural as well as social structures are pursued within the broader framework of the sociological turn in IR theories. Can the members of a generation feel responsibility and obligation to make restitution for wrongs perpetrated before they were born? In the case of Japan, this is to ask about the cognitive connection between Japanese people’s sense of nation and their perception about moral responsibility on Japan’s militaristic past.

More concretely, by referring to opinion surveys and interviews, I have been trying to assess the following questions:

• To what extent is responsibility a moral burden for the typical individual? To what extent is the expression of responsibility felt as a social obligation rather than the articulation of emotion?
• Is there a discernible vocabulary of regret on which respondents draw to answer questions about responsibility? What prohibits, suppresses, evokes, or shapes expression of regret and feeling associated with it?
• How do individuals articulate the link between identification with the state (and national pride) and sense of individual responsibility?
• How do respondents get their information about Japanese war atrocities? How much confidence do they have in the various sources (textbooks, mass media, internet, friends and family, etc.) at their disposal?

Methodologically, my research constitutes an attempt to restore individual subjectivity back into the study of collective memory and tries to detect what ordinary people believe, or how they feel about what they believe about the past. Without knowing what individuals believe about the past, we cannot expect to know how social context affects collective memory.
Have stereotypes in Cyprus between Greek and Turkish Cypriots changed since the opening of the Border in April 2003?
Margaret Myers,’12

Faculty Mentor: Kazuya Fukuoka
Department of International Relations

Supported by the SJU Summer Scholars Program

Cyprus is a small Mediterranean island south of Turkey, strategically located close to the Middle East and northern Africa. Cyprus is currently divided with the de facto Turkish Federation of Northern Cyprus in the North and the Greek Cypriots in the South. For 29 years no one was allowed to cross the Green Line and the only information each side had about the other was through political outlets and a biased media. Check points where people could cross the Green Line opened for the first time on April 23, 2003.

I hypothesized that being able to cross the Green Line would have an impact on the stereotypes each nationality held about the other. I thought that being able to meet the other community in person instead of through third parties would challenge the negative views that the Greek Cypriots have against the Turkish Cypriots and vice versa. While I did find some evidence to support this hypothesis, I also found the issues were not as simple as I had first believed.

In 1974 the Turkish army moved into northern Cyprus following an unsuccessful military coup by the Greek junta. Greek Cypriots view this as an invasion that led hundred of Greeks to flee their homes in the North and become refugees in the South. When the crossing points opened many Greek Cypriots visited their villages in the North where they found their family homes exactly as they were left. Some continue to travel back to the North weekly to take care of the churches that were abandoned. However, many Greek Cypriots will never cross the Green Line because they refuse to show their passports to enter their own country. Greek Children are often confused about distinguishing a Turk from a Turkish Cypriot, and many families still retain their refugee status.

On the other hand, Turkish Cypriots have been much more accepting of the crossings. They accepted the Annan Plan, a solution to unite Cyprus proposed in 2006 that was rejected by the Greek Cypriots. Unlike their Greek counterparts, they believe the Turkish troops completed a peace-keeping intervention which saved hundreds of Turkish Cypriot lives from genocide during the inter-communal violence of the 60’s. At that time, Turkish Cypriots felt insecure in their homes and villages and moved into enclaves for protection. Now many Turkish Cypriots have moved back to southern Cyprus or work in the south and cross the Green Line daily. However, there is still mistrust about the Greek Cypriots and their goal to unite with Athens. Many Turkish Cypriots want to keep part of the island Turkish for that reason.

Cypriots who were brought together in workshops and other peace-building activities have a better understanding of the fears and goals of each side. Unfortunately, for the majority of the population there is still a gap in understanding. The majority of information continues to come from biased media outlets and politicians. Although the Annan Plan was rejected, the opening of the crossing points has led to greater interaction between the people of each community. This has led to an understanding that, in order to come to a solution, both sides must understand the other’s perspective and be willing to compromise. Despite the difficulties, they must learn to move beyond stereotypes and prejudice if they ever wish to reunite their island.
Richard J. George
Department of Food Marketing
Saint Joseph’s University

Ph.D. Temple University

Research Interests: Food
Marketers Responses to Obesity

Being over-weight is no longer an individual and national concern, rather is a worldwide epidemic. Obesity is the 10th most preventable disease in industrialized, developed nations as well as developing nations. The Center for Disease Control and Prevention prefers the terms “at risk of overweight” and “overweight” for children based upon Body Mass Index (BMI). BMI is a measure of body fat based on height and weight that is associated with body fat and health risk. An estimated two-thirds of the U.S., adult population is overweight or obese. Similarly the number of overweight, America school-aged children is staggering. Sixteen percent of children and adolescents are overweight and 34% are at risk of becoming overweight.

Therefore, the work of two summer scholars, Corinna Noel and Bridget Babson, is both timely and critical. Legislation has been enacted in several states and cities requiring the posting of calories on menus. The question is does it make any difference in terms of consumer decision making? Corinna Noel posed and answered this question this summer. Her results are fascinating. Likewise, the work of Bridget Babson has relevance to the obesity epidemic. She developed Food Fun: A Nutrition Education Toolkit. The toolkit has two primary sections, with one for the parents and the other for young children. Both of these summer scholars have recognized the challenges posed by obesity and have conducted research that will make a difference.
Philadelphia may be the “City of Brotherly Love,” but it is also the city of food lovers. The entire nation is currently experiencing an obesity epidemic, but Philadelphia is statistically the most obese among the ten largest cities. This fact is no doubt a reflection of the high proportion of low-income families living in the city, since nutritious foods such as fruits, vegetables, and whole grains often cost more than fast food or snack items. Access to these foods is another obstacle to establishing healthy eating practices, as many sections of the city have been deemed “food deserts,” or areas where there is little to no access to the fruits, vegetables, whole grains, and low-fat dairy products necessary for a balanced diet.

My goal for this project, Food Fun: A Nutrition Education Toolkit, was to compile nutrition information and present it in a way that would be received and understood by the intended audience. Often times, health educators present the information through lectures, cooking demonstrations, books, or pamphlets. However, I did not think that this approach would be beneficial for my intended audience. I decided to present the information via tangible objects through a useable toolkit. The toolkit has two primary sections, with one for the parents and the other for young children. For example, the primary cooks in the family can read the Diabetic Exchange System printed on the cutting board, learn appropriate portion sizes using measuring cups and utensils, identify possible causes of emotional eating on a refrigerator poster, and eat on placemats with either an example of a balanced, plated meal, a supermarket “red zone” map, or a description of the hunger scale. The cooking portion of the toolkit is a unique way to encourage families to cook healthy meals at home while eating together at the table. A resource book is also included, which provides easy and fast recipes using low cost ingredients, calorie needs and calories in common foods, tips on how to find healthy food within food deserts, alternatives to fast food and corner store snacks, and fun ways for the family to get fit.

The “kid-friendly” section of the toolkit aims to be interactive, which will allow children to learn the basics of nutrition while also having fun. Ideally, the goal is that children could learn to make healthy choices when they are on their own, such as walking to and from school, in the cafeteria, or during snack times. In the kit they will find “hunger scale” playing cards, a portion sizes board game, an activity book filled with quizzes and puzzles on the food groups, coloring books teaching about food safety and portion sizes, and a matching game to come up with healthy snack ideas. These activities are geared toward elementary-aged children, since it is important to learn the basics of nutrition at a young age.

I am hoping to provide the education necessary for these people to make healthy choices. My goal for the summer was to create something that I could develop as an undergraduate student that could potentially make a greater impact on the city of Philadelphia. For further reading on this project, read the SJU Communications article entitled “Student Tackles Food Deserts With Nutritional Toolkit” at http://www.sju.edu/news/summerscholars/nutrition.html.
Calorie Posting on Menus: Does Gender, Age, and Education Level Impact Consumer Choices?
Corinna Noel,’13

Faculty Mentor: Richard George
Department of Food Marketing

Supported by the SJU Summer Scholars Program and the John P. McNulty Scholars Program

Recently there have been many laws passed calling for the mandatory posting of calories on menus in chain restaurants. The first of such was implemented in New York City in 2008. Many other states and cities, including Philadelphia, are following in these footsteps. As a result, consumers can see the nutritional information values of the food and/or beverages that they are purchasing. Such menus are evident at chains such as Starbucks, Cosi’s, McDonalds, Dunkin’ Donuts, Subway, Wendy’s, and Ruby Tuesdays.

This legislation was passed in the hope of ultimately fighting the obesity epidemic present in the United States today. Although the causes of obesity are unknown and often debated, the thought is that if consumers are more aware of the nutritional information of what they are eating and/or drinking, this might deter the purchasing of unhealthy products. The goal of calorie posting is to change consumers’ behaviors.

The question is whether or not the posting of calories on menus influence the purchasing decisions of consumers. Several studies have been done on this topic, focusing on individual and specific chain restaurants. For my project, I did not want to focus on any particular chain. I explored if and how consumer choices change in general when presented with calorie information on menus. I was interested in seeing if different variables, such as age, gender, and education level influence how the consumer acts.

To study this, I put together a mock menu that one would be likely to receive at a restaurant. There were two copies of this menu, identical except that one had calorie information on it for each choice and the other did not. I surveyed a convenient sample of 160 people, giving half of the participants the menu with calorie information and the other half the menu with no calorie information. I asked several questions including what influences their choice when purchasing a meal, what meal they would choose off the menu, and demographic questions including their gender, age, and highest level of education completed.

My study found that the difference in mean calories ordered with or without calorie posting is not statistically significant. Additionally, the characteristics of gender, age, and education level do not influence the mean number of calories ordered at a level that is statistically significant when presented with a menu that has calorie information available. These findings make us question whether or not calorie posting at restaurants is worth it. This study indicates that calorie posting does not influence consumers’ behavior overall and does not even influence the behavior of specific populations. If the goal of calorie posting is to change consumers’ behavior, this study suggests that calorie posting is not doing the job that legislators had hoped.
Petroleum and natural gas are the world’s primary source of fuel. Incidentally, the byproducts produced during refining this fuel are used as raw materials by the chemical industry to make everything from plastics to pharmaceuticals. While convenient, the exclusive reliance on these petrochemical starting materials is increasingly economically and environmentally expensive. Thus, just as this disproportionate reliance on fossil fuels has led to the development of energy alternatives, so too is there a similar demand for the development of alternative carbon-containing starting materials.

The most easily accessible carbon source is atmospheric carbon dioxide. My research involves the use of this carbon dioxide as a starting material for chemical reactions. Unlike petroleum or natural gas, does not have to be extracted from the ground, and does not require transportation across the globe in order to be used. It is also nonflammable and nontoxic. However, carbon dioxide’s innate stability presents a major challenge, and only a handful of known chemical processes can make use of carbon dioxide as a starting material. Therefore, in order to effectively use carbon dioxide in chemical reactions, its chemical stability must be overcome.

Specifically, in my laboratory we are investigating transition metal complexes which might catalyze the reaction of carbon dioxide with other simple organic molecules such as ethylene or an epoxide. To this end, my students and I are synthesizing a variety of compounds containing the transition metals tungsten and molybdenum that could promote such reactions. Gaining a better understanding of how such metal compounds interact with carbon dioxide is paramount to developing new catalysts than can enable carbon dioxide to become a more viable chemical starting material. Such reactions could then be used by chemists on both large and small scales to replace existing chemical processes that are expensive, environmentally damaging, wasteful, or inconvenient.
The Reactivity of Tungsten Cyclopentene Complexes with Carbon Dioxide
Robert Carden,’14

Faculty Mentor: Peter Graham
Department of Chemistry

Supported by SJU Summer Scholars Program

In today’s society there is a very heavy dependence on carbon-containing fuel. Many of the starting materials used in chemical industry rely on fossil fuels as a source of carbon. The main goal of my research has been to investigate tungsten complexes that might enable carbon dioxide to be incorporated into other small molecules. If such catalytic processes are discovered carbon dioxide can be better utilized by chemists as a carbon-containing building block to make useful chemical products.

My project has involved synthesizing tungsten compounds that contain an alkene, a carbon-carbon double bonds, coordinated to a metal complex. One example of an alkene complex is the cyclopentene complex depicted in Figure 1. The goal of the project is to determine conditions in which such metal complexes will react with carbon dioxide. The carbon dioxide could react in a number of ways with the metal complex, including by inserting into the cyclopentene ligand. One goal is to improve the synthesis of the tungsten cyclopentene complex so that we can then determine how it reacts with carbon dioxide. We hope to determine the best conditions for promoting such carbon dioxide reaction and determine the product or products produced.

In addition, I have begun to synthesize similar molybdenum containing compounds.

Figure 2. TpW(NO)(PMe\textsubscript{3})(\eta\textsuperscript{2}-cyclopentene). One of the tungsten cyclopentene complexes I have synthesized. The metal center is surrounded by four ligands including the alkene cyclopentene (right).
The Reactivity of Molybdenum Complexes with Carbon Dioxide
Jason Manjerovic,’12

Faculty Mentor: Peter Graham
Department of Chemistry

Supported by the SJU Summer Scholars Program and the Joseph B. Leach,’99 Memorial Research Fellowship

The vast majority of chemical processes involve petroleum or natural gas as a starting material. Just as scientists are pursuing alternatives to fossil fuels, alternative chemical starting materials are also an important area of current research. Our research is intended to develop improved chemical processes to synthesize chemical starting materials. Carbon dioxide is a target for use as a carbon feedstock; that is, any carbon-containing chemical that is possible to use as a starting material.

Developing carbon dioxide into a carbon feedstock would provide many advantages to the chemical world as it is readily available, safe, cheap, and accessible. However, carbon dioxide is not an easily-utilized chemical because it is both thermodynamically and kinetically stable. Although several CO$_2$-utilizing reactions are known, they require high temperatures and pressure. This shows the difficulty of working with CO$_2$ and indicates why our research focuses on developing new methods to utilize carbon dioxide.

Overall, our research is intended to find new methods to turn carbon dioxide into usable products. The creation of such products will likely require the use of transition metals to catalyze the chemical transformation of CO$_2$. To this point, we have synthesized a variety of transition-metal complexes that have been characterized by NMR and IR Spectroscopy. I generally work with molybdenum complexes containing an alkyne and methoxo group, a system developed by prior Summer Scholars students. My research focuses on continuing this research by using an acid to displace the methoxo group and allow coordination of CO$_2$. Hopefully, the results of this study will inform the creation of catalysts that combine CO$_2$ and alkynes. Such processes must be developed if carbon dioxide is to become a useful and versatile starting material for chemical reactions.
Tungsten Metal Complexes to Activate Carbon Dioxide
Ian McKendry, ’12

Faculty Mentor: Peter Graham
Department of Chemistry

Supported by the Philadelphia Society for Coatings Technology and the Chemistry Alumni Scholarship Fund

The goal of my summer scholars research project is to synthesize potential catalysts for the activation of carbon dioxide in order to use it as an alternative carbon feedstock. Carbon feedstocks are carbon containing compound that supply the basic building blocks of chemical reactions. The two largest sources of carbon feedstock currently are crude oil and natural gas, which account for roughly 99% of today’s carbon feedstocks. This dependence has many disadvantages including increased costs and environmental dangers. In fact, the costs of petroleum raw materials have become the largest single expense for the chemical industry. In addition, the dependence on crude oil is not only associated with long term environmental problems, such as global warming, but also short term risks like oil spills. If alternative methods of can be discovered to transform non-petroleum based carbon feedstocks into functionalized products, both industry and the environment would benefit greatly.

One underutilized carbon feedstock is carbon dioxide. Carbon dioxide is a byproduct in many chemical reactions such as respiration and combustion. It is a great potential feedstock due to its large abundance, low cost, and lack of toxicity. So why is carbon dioxide not currently used as a feedstock if it offers so many advantages? The primary reason carbon dioxide is not used is due to its high stability. This high stability is makes it very difficult to react it with other molecules. Thus catalysts must be used to activate carbon dioxide toward reactions that form useful products.

The work of my project is to investigate tungsten metal complexes as possible catalysts for reactions between an alkene, a compound containing a carbon-carbon double bond, and carbon dioxide to form acrylic acid. Acrylic acid is a functionalized product that is primarily used to manufacture paints and plastics. This summer, I have synthesized several tungsten metal complexes stabilized with different ligands, or molecules attached to the metal center. All of these complexes are designed to investigate the insertion of carbon dioxide into alkenes. In addition to the synthesis of alkene complexes, I have also synthesized a acetate complex which is an example of the product formed when carbon dioxide inserts into a C-H bond. The synthesis of such acetate or acrylate complexes will allow us to study the loss of carbon dioxide from a neutral complex. This is the reverse reaction of carbon dioxide insertion.
Dr. Ann Green  
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General Interests: Rhetoric and Composition, Service learning, Feminist theory, Race, class, and gender, Writing and writing pedagogy, Creative nonfiction writing, Diversity  

I write. My scholarly work is the study of writing and the teaching of writing. In order to do this work, I too must be an active writer. To this end, I write creative nonfiction as well as scholarly work in the field of Rhetoric and Composition. In particular, I have focused on race, class, and gender, and how these constructs intersect with the process of writing. I am interested in how the writer’s subject position affects both the genre of writing produced and the content of that writing. Often in my scholarly work, I look at how classrooms intersect with how writers produce their work. Of late, this work has included scholarship on service learning that seeks to explore how students in the service experience describe their own race, class, and gender in contrast to the learners they encounter at the service site.  

Most recently, I taught the first Saint Joseph’s service-learning class in China where SJU students worked with Chinese learners of English in order to promote the Chinese students’ oral English language skills as well as to learn about China. Over the course of four weeks and four major cities (Shanghai, Nanjing, Xi’an, and Beijing), we worked with college students, middle school students, children, and adults as we learned what Chinese people think of the Olympics, Tibet, U.S. culture, and variety of other topics. While I have not written about this experience for publication yet, I am certain that this experience will become the basis of a scholarly account of engaged, relationship-based service learning, as well as a potential travel narrative for publication in a journal of creative writing.
City Kids: A Study on Urban 
Education in Philadelphia 
Kate Southerton,’13

Faculty Mentor: Ann Green
Department of English

Supported by the SJU Summer Scholars Program

Since the founding of our nation, generation after generation has fought against persisting inequalities that by their very title, deny the truth that all men are created equal. Yet with each flaw mended, comes new problems. One, the inequality of education in America, still stands as our nation’s shame. Overwhelmingly, the only people who lay witness to insufficient urban schools are the students who attend them. And unlike the protestors during the Civil Rights Movement or the Women’s Suffrage Movement, these people are only children. We surpass most of the 1st world by over 5 million impoverished children. Teacher and writer Jonathan Kozol writes, “If you grow up in the South Bronx today or in south-central Los Angeles or Pittsburgh or Philadelphia, you quickly come to understand that you have been set apart and that there’s no will in this society to bring you back into the mainstream.” These are the realities that black, poor, kids in our city face. As Kozol warns, our education system does little to change this trend.

As a white, middle-class, college student, it can be easy to ignore the inequalities outside my window. After all, no one’s talking. But after taking a SJU course on the Civil Rights Movement and its lasting effects today, it’s hard to continue ignoring. I decided to spend my summer volunteering at an inner-city Catholic grade school. Even though I taught at a private Catholic school, the demographics mirrored that of a Philly public school. Over 50% of my students fell below the poverty. 98% of my students were black, 2% were Latino. Meanwhile, I researched the overwhelming problems with urban education, and the many successful teachers—Jonathan Kozol, Gloria Ladson-Billings, Hunt and Walch—who have created a positive environment conducive to learning. I tried to implement these strategies of honesty, attention to each student’s successes, and individual attention, as best I could in the classroom.

My students often sat in awe of me. Several of my younger students asked if my hair was a weave, or if my eyes were “real.” These questions show how separated the white and black cultures really are. Those who have successfully taught in urban schools all say the same thing. Only through honest acknowledgement of our society’s separation, can we begin to integrate again.
During summer of 2011 four students worked in my laboratory. Lisa Mariani’14 and John Mike Deavany’14 studied dynamics of ellipsoidal particles in dense suspensions with and without short-ranged attraction. Daniel Flynn’13 and Martin Iwanicki’14 studied dynamics of thermosensitive colloidal particles in dense suspensions.

Colloidal suspensions of spherical particles have been used successfully as a system that models the behavior of a regular glass. However, most molecules in regular glasses are not spherical. Thus, Lisa and John Mike made a suspension of ellipsoidal particles which portray better dynamics of molecules in regular glasses. Using confocal microscopy we collected preliminary data over several hours and then tracked the centers of the ellipsoids. We were able to study how ellipsoidal particles interact with each other and study their collaborative motion.

It is rather difficult to make dense suspensions of colloidal particles. Suspensions are very viscous and making any microscopy samples is challenging. Daniel and Martin explored a new way of making dense colloidal suspensions. Namely, they used a new kind of colloidal particles which change their size depending on the temperature. Increasing temperature causes these particles to shrink and decreasing temperature causes them to increase in size. Daniel and Martin were able to make a dilute sample and then by decreasing the temperature produced a dense sample. Therefore, we have obtained preliminary results of particle dynamics in dense colloidal suspensions.

Funding: Howard Hughes Medical Institute SJU Grant, Sigma Xi Research Society SJU Chapter, NSF MRI - 0821298, Summer Scholars Program.
Ellipsoidal Particle Dynamics in the Attractive Liquid Region
John Michael Devany, ’14

Faculty Mentor: Piotr Habdas
Department of Physics

Supported by the SJU Summer Scholars Program, HHMI grant, and the Department of Physics

This summer we have been studying the colloidal particle dynamics – the interactions between colloidal particles (2 μm polystyrene spheres stretched to an ellipsoidal shape) – which exhibit similar behavior to molecular glasses. Glass molecules are too small to visualize under a microscope. Thus, we used a model system of colloidal suspensions which undergoes a glass transition. Glass has long been a topic of interest amongst the material science community due to the fact that microscopically glass exhibits liquid-like or disordered structure, whereas macroscopically it behaves like a solid. In the past, spherical colloidal particles have been used to study the glass transition.

We chose to study a more unfamiliar system of ellipsoidal colloidal particles since typically glass molecules are asymmetric. A glass transition occurs when the number of colloidal particles in the sample increases to a certain packing fraction where the particles are densely packed but remain disordered.

Additionally, we made our ellipsoidal particles sticky by mixing smaller spherical particles with them. Thus, colloidal glass transition occurs not only from crowding but also due to sticking. In figure 1 we plot a mean square displacement vs. lag time to show how particles diffuse over time. The plot is almost linear indicating that our sample isn’t glassy yet.

Figure 2 shows a cartoon of the ellipsoidal colloidal particles and small spherical particles which induce attractive forces between the ellipsoids. Our goal is to study how they will stick and what kind of clusters will they form.

So far, we have only been able to examine the interactions between ellipsoids in a liquid phase. In the future we will make samples with higher packing of the ellipsoids in order to study their dynamics in a glassy phase.

Figure 1. Mean square displacement vs. lag time for a liquid-like sample.

Figure 2. A cartoon of ellipsoidal particles (the oblong red spheres) with an attraction (induced by the much smaller spherical particles)
Particle Dynamics in Multiple Glassy States
Daniel Flynn,’13

Faculty Mentor: Piotr Habdas
Department of Physics

Supported by the SJU Summer Scholars Program, HHMI grant and the Department of Physics

This research focused on investigating the colloidal particle dynamics in colloidal glasses. Unlike solids, which have a structured crystalline pattern, glass has no order to its molecular structure. In order to study the structure of molecular glasses using microscopy a model system of colloidal suspensions was used. A colloidal suspension is composed of micrometer sized particles dispersed throughout a liquid. A common example of a colloidal suspension is milk. By densely packing colloidal particles we form what is called a hard sphere repulsive glass. Hard sphere repulsive glass particles interact like pool balls and repel each other when they come into contact with each other.

Another way to make a colloidal glass is by adding a depletent, a second species of colloidal particles much smaller than the first (fig 1). The added depletent particles create an attraction between the larger colloidal particles forming another type of colloidal glass – an attractive colloidal glass.

Our samples consisted of water and NIPA (N-isopropylacrylamide). NIPA is a coiled polymer chain that changes its size with temperature; as you increase the temperature the particles shrink and as you decrease the temperature it expands. This property allows us to manipulate the packing of our samples.

We were able to make preliminary samples with high density of the colloidal particles obtaining repulsive hard sphere glasses. Next, we plan to make dense samples with depletant particles in order to obtain attractive colloidal glasses.

Figure 1. A cartoon of the source of attraction between colloidal particles. Large spheres represent colloidal particles and small spheres represent depletant particles which induce attraction.
Particle Dynamics in Multiple Glassy Systems
Martin Iwanicki,’14

Faculty Mentor: Piotr Habdas
Department of Physics

Supported by the SJU Summer Scholars Program, HHMI grant and the Department of Physics

Glass is a fundamental part of everyday life. While it is well known how to make glass, the science behind the process of making a glass is still fairly unknown. Glass appears to be a solid when one looks at it. However, structurally, it has a liquid-like structure. Colloidal particles are used in order to model the structure and dynamics of molecular glass. Colloidal suspensions are small solid particles suspended in liquid. To achieve a glass state, colloidal particles must be very concentrated in a suspension of a given liquid.

N-isopropylacrylamide (NIPA) particles (~0.0013 mm) were used in order to model a molecular glass. NIPA becomes a hydrogel, or a coiled polymer chain that absorbs water, after a synthesis of NIPA monomer particles, N,N’-methylene bisacrylamide cross-linkers, aminoethyl methacrylate, and ammonium persulfate. NIPA is fascinating due to its ability to absorb water as it cools and to shrink as it is heated. This quality of NIPA will be used in order to create dense, glassy samples by cooling the NIPA particles once on a slide.

NIPA colloidal particles act similarly to billiard balls, in that they bounce off each other when they interact. To introduce attraction between the NIPA particles, we added NIPA depletent particles (~100 nm). Due to their smaller size, these NIPA depletent particles create osmotic pressures that causes attraction between the NIPA colloidal particles.

The results so far have shown that we have been able to achieve a super-cooled liquid (Fig. 1), in which the particles still diffuse, but their motion is somewhat inhibited by their neighbors, but not as strongly as in a glass.

![Figure 1. Plot of the radial distribution function of the particles as a function of distance from a center of a particle. Each peak represents an increase in particle packing from a central particle.](image)

We are currently working on increasing the concentration of particles in order to make microscopy samples in a glassy system.
The dynamics of colloidal ellipsoidal particles in the attractive colloidal glasses
Lisa Mariani, ’14

Faculty Mentor: Piotr Habdas
Department of Physics

Supported by the SJU Summer Scholars Program and the John P. McNulty Scholars Program, HHMI grant and the Department of Physics

Glass is a common material found in objects such as ornaments and windows. Macroscopically, glass appears to be a solid; however, the structure of glass on the microscopic level is amorphous, as it is neither solid nor liquid. Rather, the molecules are in a dense, disordered state. Due to the small size of molecular glass molecules, glass cannot be directly studied under the microscope. Therefore, a colloidal suspension, where solid particles are dispersed in a liquid, is used to model the particle dynamics of a glass. Through this modeling, two types of glasses can be studied, the hard, repulsive glass and the attractive glass. In a hard, repulsive glass, the colloids repel each other upon contact. As the number of particles in the system is increased, jamming of the system occurs through caging of the colloids. In an attractive glass, the colloids are surrounded by a depletant, or smaller particles. These small particles randomly kick the colloids, creating depletion forces that make two colloids become stuck.

In the past, spherical particles have been used to study the particle dynamics during the glass transition. However, in our system we will use ellipsoidal particles due to the anisotropic, or non-uniform, nature of glass particles. Our model system is composed of 2µm spherical polystyrene particles that are stretched to aspect ratios of 2 and 3. The spheres are suspended in a gel of polyvinyl alcohol and water that is heated, stretched, cooled, and dissolved in water. Then, the ellipsoids are isolated through centrifugation. The depletant is 100nm polystyrene particles.

Differing from spherical particles, ellipsoids have a unique phase diagram for the glass transition due to their additional degrees of freedom. Currently, the ellipsoid phase diagram does not account for attractive glassy systems. We hope to study the different ways in which the anisotropic particles orient or translate themselves. Beginning with spheres, we have studied the motion of the particles in colloidal suspensions and we plan to continue these investigations in attractive ellipsoid systems in order to fully understand the glass transition for anisotropic particles.
Dr. J.P.E. Hodgson  
Department of Computer Science  
Saint Joseph’s University  

**Research Interests:** Natural Language and Logic Programming

I am interested in the use of computers to understand natural (that is human) language. This is a different problem from machine translation which yields to statistical techniques. The kinds of problems that interest me are question answering (which in some sense is what IBM's Watson does); summarization, meaning that one tries to determine the semantic content of text.

I have worked with summer scholars on both these topics and on a system that can be used to advise software engineers to improve software requirement documents. Logic programming is a paradigm in which rather than telling the machine what to do one tells it what the answer should look like. To be effective such systems often require that the problem be specified in a way that allows for more efficient search. One problem where this is particularly the case is scheduling. I am interested in trying to find ways to predict form the problem exactly what kind of extra information the system needs to come up with an efficient solution.
Feature Extraction from Product Reviews via Natural Language Processing
Dan Klein,’12

Faculty Mentor: Jonathan Hodgson
Department of Computer Science

Supported by the SJU Summer Scholars Program

With the emergence of user generated content through websites such as YouTube and social media sites like Twitter, the input of average consumers have become increasingly significant to industry and commerce. A notoriously bad product can become readily more visible thanks to the floods of user reviews that would accompany its release, which is where the basis for this research originates. Should one be in the market for a new appliance, such as a washing machine or, in the case of the research, a television, who would have the time to sort through the vast array of reviews to find out the product's strengths and weaknesses? To remedy this, I set out to create a program that would sift through these reviews and report back the most prevalent aspects to the user.

To narrow down the field of interest, I specified the product of choice to be LCD televisions, as they contain enough information to have multiple notable strengths and weaknesses, but specific enough so that common traits would appear more often in reviews. From here, I created a Java program that interfaced with a dictionary application, WordNet, allowing me to check for validity of the words and their part of speech (noun, verb, etc.). Once established, I gathered 51 reviews to be used as test data for a specific television, screening each for typos, excessive punctuation, and other such irregularities that would hinder the feature extraction process. Once cleaned and organized, I maintained a “black list” of nouns and adjectives that showed up as false positives during preliminary screenings. After compiling a large enough list, I compiled a list of features, both good and bad, from each review by hand to act as a control group to test the accuracy of the program's data collection.

In the end, the program produced two different kinds of error: False positives, and feature exclusion. False positives are features of the product that the program believed to be relevant, but turned out to be missing from the human feature extraction list. Feature exclusion is the opposite: features listed in the human's list that were missing from the program's. Between the two lists, the program produced 56 false positives, 81 cases of feature exclusion, and 76 matches with the human compiled list of features across the 51 reviews. While producing slightly more cases of feature exclusion than matches, the results were to be expected as no third party libraries were used to handle language processing and the extraction algorithm was programmed from the ground up.
My primary research focuses on the relationship of humans and animals in American history, and particularly, the development of American zoos. Drawing on primary sources in zoo archives, historical societies, and government depositories, as well as a wide range of periodical literature, I seek to recover the lived experience of zoogoing for Americans over the past 150 years, placing the institution of the zoo within its broader cultural, intellectual, and environmental context. Rather than assessing historical zoos by 21st-century standards, I try to reconstruct how zoo designers and zoo visitors understood these places in their own time, and how that understanding both shaped and reflected wider beliefs about the animal kingdom.

This insistence on examining historical actors in their original context and on their own terms has also led me to adopt the innovative teaching method, Reacting to the Past, in several of my courses. Using elaborate role-playing games, this pedagogy immerses students in moments of historical crisis, from Athens after the Peloponnesian Wars to the United States during the Constitutional Convention. Drawing on primary and secondary readings, students must try to achieve their characters’ “victory objectives” through persuasive oral and written arguments. In the process of playing a Reacting game, students come to realize that the course of history is driven not by destiny or determinism but by context and contingency, by the ideas and actions of historical agents. Understanding why historical actors made the decisions they did – and appreciating that those decisions could well have turned out differently – helps us to see more clearly both the similarities and the differences between past and present.
In February 2009, CNBC commentator Rick Santelli delivered what is now known as the “rant heard ‘round the world.” This tirade, which railed against the recent stimulus plans and invoked a conservative view of the Founders’ will, gave birth to the Tea Party. Since then, the Tea Party has taken center stage in the American political arena in their crusade for states’ rights and against federal government programs like health care reform, corporate bailouts, and increased taxes, among others. The 2010 midterm elections were an enormous victory for the Tea Party, with affiliated candidates winning a considerable number of seats in the House of Representatives and the Senate. Yet, despite this political success and media attention, the Tea Party is a widely misunderstood movement. This project seeks to define the Tea Party movement and its place on the American political spectrum by examining it in light of similar movements in American history. The hallmark of the Tea Party is their invocation of the Constitution and the original intent of the Founders and Framers. They contend that the Founding Fathers intended for a limited government that could act only on the powers enumerated to it through the Constitution. They believe all other powers are reserved for the states and the people, per the Tenth Amendment. Yet despite their almost Biblical reverence for the Constitution, the Tea Party’s mission to reduce the size and scope of government as ordained by the Founders actually misunderstands and misrepresents the primary reason for the Constitution’s creation. The Constitution was originally intended to expand the powers of the federal government, since the Articles of Confederation proved to be dysfunctional, granting too much power to the states and failing to allow the federal government to raise revenue.

The Constitutional provision that the Tea Party most often uses to validate their Constitutional claims is the Tenth Amendment, which states, “the powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people.” However, “Tenther” movements are about as old as the Bill of Rights itself. In 1798 Thomas Jefferson and James Madison tried to invoke this amendment in the Virginia and Kentucky Resolutions in response to the Alien and Sedition Acts. These resolutions, Jefferson and Madison attempted to make the argument that the States could nullify unconstitutional federal law by invoking the Tenth Amendment. Nullification arguments arose again in the early nineteenth century when John C. Calhoun argued that States could nullify federal law to protect their sovereignty. Finally, in his senatorial debates against Abraham Lincoln, Stephen A. Douglas argued that the Tenth Amendment prohibited the federal government from outlawing slavery in new territories because it was an issue reserved for the states.

Moreover, one very important similarity among these “Tenther” arguments is that they all failed. Federal government has, more often than not, been able to expand when needed; in fact, this expansion has sometimes been promoted by former proponents of states’ rights. For example, despite Jefferson’s earlier protest against the Alien and Sedition Acts, when he became President he acted on powers not enumerated to him by authorizing the Louisiana Purchase. The Tea Party is claiming that the Constitution has one, definite meaning. However, over two hundred years of Constitutional debate have shown us that the document has had many complex and even contradictory meanings.
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**Research Interests:** Development of thinking in teachers

The present educational policy of including students with special needs in regular classrooms with their non-disabled peers affords school communities both opportunities and challenges in providing the highest quality learning environments.

Since the mid 1990’s inclusion as an end goal of the federally mandated “least restrictive environment” has been increasingly implemented in most public school districts. Mirroring the evolving interpretation of inclusion in my teaching of the *Education of the Special Learner* course has allowed for a continued exploration of the various teaching strategies and classroom environments necessary to accommodate students with diverse learning needs. My research interests on inclusion have helped to identify best practices in this important and prominent educational practice.

This summer, Summer Scholar Tom DiNatale, an Elementary and Special Education major, has worked with me on a project to address the dimensions of inclusion that provide a daunting challenge for a specific group of students with learning differences. Students with characteristics that classify them with an Autism Spectrum Disorder (ASD) can exhibit many behavioral traits that lead them to unsuccessful classroom experiences. Our goal was to research and create a model for examining the affective and cognitive components programmatically useful in managing the behavioral traits of students with ASD. Specifically we have examined domains for output behavior and its regulation in order to provide teaching professionals with strategies that will assist with social interaction in the included classroom.

The conceptualized model will delineate the complex skills required for students with ASD to be more successful with peers and others in the regular classroom. It is our hope that such a model will contribute to the knowledge base on teaching and shaping behavior for students on the autism spectrum and provide them greater possibilities for friendship and acceptance in their classrooms.
Learning to Cope: Improving Emotional Regulation for Individuals with Autism to Increase Positive Expressive Behavior
Thomas Di Natale, ’12

Faculty Mentor: Virginia Johnson
Department of Teacher Education

Supported by the SJU Summer Scholars Program

In the book *A Mind at a Time* (2002) Mel Levine discusses how a student’s behavior can be monitored with certain output control strategies. He lists five output controls: Pace, Previewing, Quality, Options, and Reinforcement. He directs these control strategies mainly for the use for students with attention problems. His book generalizes strategies for students with special needs. In my research I have extended and adapted these output controls specifically for students with autism. Also I extended these output controls to include three more domains for output control: Theory of Mind, Joint Attention, and Environment. From these different domains a behavior was chosen to be the foundation of regulation in each domain. By defining each domain and the behavior they regulate teachers would then be able to pick from a multiple of strategies specifically designated for each domain to use depending their student’s needs. These tested strategies are used to help students with autism regulate their behavior and emotions. Due to the deficits of individuals with autism in reciprocal social interactions; communication; and restricted, repetitive behaviors, interests, or activities many individual need help communicating their wants and needs. Teaching emotional regulation is essential to improving social skills of individuals with autism.

Through the model I have created teachers will be able to identify a domain that their student needs help in and the behavior that needs to be regulated. Once the teacher picks the target behavior, my guide will lead the teacher to strategies that can be applied to the classroom to help the student. The goal of this model is to teach students specific skills that are needed to replace maladaptive behaviors in the classroom in order to increase positive behavior. In the past months I have been in contact with The Melmark School of Berwyn, PA where they focus on using ABA therapy for decreasing maladaptive behaviors and increase positive social interactions with peers. Also through contact with the Boston Hagashi School for Autism of Randolph, MA I have been able to learn about their teaching philosophy that is rooted in a Japanese philosophy of daily and active living. By pairing with these two schools they have been able to help extend my model to include strategies that can be used in more
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Research interests: The cytoskeleton and cell motility

Research in my laboratory centers on questions concerning cell motility. Our investigations focus on two areas: 1) understanding mechanisms of actin-dependent organelle motility, and 2) investigating the role of the actin motor protein, myosin 1e, in cell migration and lamellipodial dynamics. For organelle motility studies, we use retinal pigment epithelial (RPE) cells from fish. These cells are found at the back of vertebrate eyes, and contain numerous pigment granules that undergo mass migrations in response to light. RPE cells can be isolated from eyes of fish, dissociated, and cultured as single cells. Aggregation and dispersion of pigment granules within RPE is dependent on the actin cytoskeleton, and can be chemically triggered in isolated cells, allowing investigation of the mechanisms involved in motility. Questions we are addressing include:

- What is the orientation of actin filaments in apical projections of RPE cells?
- Do actin dynamics, including actin retrograde flow, play a role in motility?
- The signaling molecule, cAMP, stimulates pigment granule aggregation in vitro. Does cAMP activate protein kinase A in RPE, as it does in other systems? What are the targets of PKA?
- What type of myosin motors are in RPE and could effect pigment granule motility?

Our second area of research concerns the “unconventional” myosin, myosin 1e, and its role in cell migration. Myosin 1e has been implicated in membrane trafficking, specifically endocytosis and exocytosis. We use mouse melanoma cells growing in culture to investigate the following questions:

- Is adhesion, cell spreading, migration, or lamellipodial dynamics altered by knockdown or overexpression of myosin 1e in melanoma cells?
- Does myosin 1e play a role in trafficking of integrins, cell surface proteins that mediate adhesion of the cell membrane to the extracellular matrix?
- Does myosin 1e affect three-dimensional migration, that is, migration through a three-dimensional matrix, such as is found in tissue?

These questions concern fundamental processes that occur in all cells, and will contribute to our basic knowledge of cell function.
Examining the Role of Myosin1e in Cell Migration: The Effect of Myosin1e Knockdown on Adhesion and Cell Spreading in B16F1 Mouse Melanoma Cells
Kevin Cannon,'12

Faculty Mentor: Christina King Smith
Department of Biology

Supported by a gift from Nick Nicolaides,’87 and the Howard Hughes Medical Institute

Movement, a quintessential function for all cells, is a highly integrated process by which proteins synergize to orchestrate intricate cellular processes that allow whole cell motility. The dynamic actin cytoskeleton allows a cell to properly alter its morphology, and subsequently promote processes such protrusion, adhesion, and retraction. Actin colocalizes with myosin1e at the leading edge of migrating B16F1 mouse melanoma cells. The role of myosin1e in cell migration is still unclear; however, given its ability to act as a divalent cross linker by connecting and generating a force between actin filaments and the membrane, myosin1e has been implicated in functioning at sites of exocytosis and endocytosis.

The first goal of my research was to examine if myosin1e had an effect on a cell’s ability to adhere to a substrate. Adhesion is chiefly mediated by integrins--transmembrane proteins that function as a molecular clutch, tethering the actin cytoskeleton to an extracellular substrate. Using stable cell lines of B16F1 cells expressing less myosin1e (hereafter myo1e knockdown) and a control (hereafter non-targeting control) expressing normal levels of myosin1e, I was able to examine the functional effect of myosin1e knockdown on adhesion.

Cell lines were given thirty minutes to adhere to a substrate coated with the extracellular matrix protein laminin. Integrins are known to have specific binding affinities towards various extracellular matrix proteins; therefore, adhesion to laminin is integrin dependent. It was observed that significantly less myosin1e knockdown cells adhered to the laminin-coated substrate compared to the non-targeting control (figure 1). Next, both cell types were given 30 minutes to adhere to a substrate coated with poly-L-lysine, which places a positive charge along the substrate. Integrins have no binding affinities for the poly-L-lysine residues; therefore, adhesion to poly-L-lysine is integrin-independent. No significant difference in adhesion between the myo1e knockdown and the non-targeting control cells was observed.

Lastly, the ability of a cell to spread out along its extracellular substrate was examined in both myo1e knockdown and non-targeting control cells. Myo1e knockdown and non-targeting control cells were plated on laminin and poly-L-lysine coated coverslips and observed using DIC imaging. It was observed that on laminin coated coverslips, significantly more non-targeting control cells exhibited membrane protrusions such as lamellipodia and filopodia, while myo1e knockdown cells exhibited a rounded morphology (figure 2). However, when plated on poly-L-lysine coverslips, both the myosin1e knockdown and the non-targeting control cells exhibited rounded morphologies. Together, adhesion and cell spreading assays on both substrates imply that myosin1e has an effect on integrin-dependent adhesion / cell spreading and no effect on integrin-independent adhesion / cell spreading. Moreover, these results suggest a possible role for myosin1e in integrin presentation at the cell surface through either exocytosis or endocytosis.

Figure 1. Adhesion in B16F1 cells is reduced in myo1e deficient cells on a laminin coated substrate.

Figure 2. Spreading in B16F1 cells is reduced in myo1e deficient cells on laminin coated coverslips.
The Distribution of Unconventional Myosins
In Retinal Pigment Epithelial Cells
Carol M. Collins,’14

Faculty Mentor: Christina King Smith
Department of Biology

Supported by the SJU Summer Scholars Program and HHMI
Undergraduate Science Education Grant

Movement, a quintessential function for all cells, is a highly integrated process by which proteins synergize to orchestrate intricate cellular processes that allow whole cell motility. The dynamic actin cytoskeleton allows a cell to properly alter its morphology, and subsequently promote processes such as protrusion, adhesion, and retraction. Actin colocalizes with myosin1e at the leading edge of migrating B16F1 mouse melanoma cells. The role of myosin1e in cell migration is still unclear; however, given its ability to act as a divalent cross linker by connecting and generating a force between actin filaments and the membrane, myosin1e has been implicated in functioning at sites of exocytosis and endocytosis.

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Figure 2: Cell staining shows the localization of proteins within a cell. Top picture-localization of Myosin Xb.
Investigating a Role for Protein Kinase A in Melanosome Aggregation in Fish Retinal Pigment Epithelial Cells
Nicole Fischer, ’12

Faculty Mentor: Christina King Smith
Department of Biology

Supported by the SJU Summer Scholars Program and HHMI Undergraduate Science Education Grant

The retinomotor movement of melanosomes in retinal pigment epithelial (RPE) cells provides a valuable model system to study intracellular motility. Located behind the retina in the eyes of fish, the RPE cells contain melanosomes that aggregate into the RPE cell body in the dark and disperse into apical projections in the light. As fish lack dilatable pupils to control light flux into the retina, dispersal of melanosomes is a means of protecting the sensitive photoreceptor cells in the retina from bleaching in the light. RPE cells may be isolated from the eye and triggered to aggregate or disperse melanosomes in vitro. Addition of exogenous cAMP—a second messenger involved in signal transduction—stimulates RPE cells to aggregate their melanosomes.

The mechanism by which cAMP affects melanosome aggregation has never been demonstrated. Traditionally, cAMP activates protein kinase A (PKA), which in turn will activate a target protein via phosphorylation. An in vitro kinase assay was used to demonstrate that PKA is indeed active in RPE tissue. To determine whether PKA is specifically involved in aggregation, PKA inhibitors H89 and PKI were added to isolated RPE cells and aggregation was stimulated by addition of cAMP. RPE cells treated with H89, a non-specific PKA inhibitor, were unable to aggregate melanosomes upon addition of cAMP. Yet, H89 is known to cross-inhibit PKA and rho kinase, and inhibition of the latter has been shown to block aggregation. In need of a more specific inhibitor, the cell-permeable myristoylated PKI was used. However, PKI did not block cAMP-induced aggregation, either due to an inability to permeate the RPE cell membrane, the inhibitor’s general inefficacy in fish systems, or the possibility that PKA is not involved. As a positive control for PKI, rod inner and outer segments were treated with the inhibitor. In response to addition of cAMP (and subsequent activation of PKA) the myoids of rods will normally shorten. Myoid shortening was inhibited in rods treated with H89 and was not inhibited in those treated with PKI, suggesting that the observed inability of PKI to inhibit melanosome aggregation does not rule out PKA involvement; it is more likely that PKI is impermeable to or does not work in fish cells. Future plans include “syringe loading” of PKI, where mechanical disruption of cells by passing them through a syringe needle creates small tears that allow uptake of exogenous PKI. In addition, individual RPE cells will be microinjected with purified PKA catalytic subunit to determine whether melanosome aggregation is consequently stimulated.
Determining the Effect of Myosin1e Knockdown on the Lamellipodia Dynamics and Migration Distance Of B16F1 Mouse Melanoma Cells

Lauren Hamilton, ’12

Faculty Mentor: Christina King Smith
Department of Biology

Supported by the Anna K. and Bernard M. Hillman Summer Research Fellowship and the Biology Department

Cell migration is a process where various components of the cell work together for a similar purpose, that of directional motility. The general concept of cell migration is understood, but the role of specific players, such as the role of myosin 1e (myo1e), is still being examined. Protrusion at the leading edge of the lamellipodia, a flat, fanlike structure consisting of an intricate actin network is a primary determinant of cell migration, along with traction and contraction at the trailing edge. Actin-based motility is an essential part of cell migration and is facilitated by myosin. Myosin I proteins are so-called “unconventional myosins” with a single motor domain involved with the processes of cell attachment, vesicular transport, and signal transduction. Preliminary data has suggested that one Myosin I isoform, Myo1e, is in invadopodia of B16F1 mouse melanoma cells and immunofluorescence analysis verified the colocalization of myo1e with actin at the leading edge of B16 mouse melanoma cells, suggesting a role in cell migration.

The goal of my research was to better understand the role of myo1e in overall cell motility, including its involvement in lamellipodia, filapodia, and invadapodia, using time-lapse microscopy. Through the use of stable cell lines expressing reduced amounts of myo1e (knockdown), I was able to track the distance single cells migrated. Migration assays were performed twenty-four to forty-eight hours following the plating where images were taken for 2 hours at 1 frame per minute. Image J was used to track the distance migrated. The examination of single cell motility, as opposed to confluent monolayers, allowed me to more directly examine the lamellipodial dynamics and migratory patterns of the B16F1 cells. Preliminary data suggests that non-targeting control cells migrated, on average, approximately twice the distance compared to the knockdown cells. It was also observed that the knockdown cells lamellipodia was qualitatively distorted. The non-targeting control cells exhibited normal behavior with a uniform, fan-like lamellipodia, whereas the knockdown cells showed non-uniform lamellipodia and disoriented direction. Therefore, preliminary data suggests that reduced amount of Myosin 1e in cells may affect the total distance a cell can migrate and the lamellipodia formation.
Ailing Kong
Department of Teacher Education
Saint Joseph’s University
Ph. D. Michigan State University

Research Interests: literacy development

My research interests include first/second language development, literacy instruction, culturally and linguistically diverse learners, and children’s literature of diverse cultures. These interests were initially shaped by my own experience of learning English as a second language and teaching it as a foreign language in China. Now as a teacher educator and teaching courses of literacy methods and second language learning, I feel compelled to find out more about issues related to such questions as: How do children acquire their mother tongue? How can parents and caregivers help facilitate children in this process? How can teachers help their students learn to read and write? For children who are learning English as a second language, what role does their first language play in their learning of a new language? How to motivate students to learn a foreign/new language? Also as language constitutes part of the culture, how do second language learners accommodate or adapt to the new culture? In what ways can teachers use children’s books, a representation of the norms and values of different cultures, in teaching the language skills to students, especially students coming from diverse linguistic and cultural backgrounds?

A latest research project I participated in was with Dr. Aubrey Wang. We examined students’ motivation in learning Chinese as a foreign language in an American charter school. By analyzing data collected from student group interviews, survey questionnaires, and classroom observations, we found that students’ motivation to learn a new/foreign language is affected by multiple factors, including their perception of the usefulness of the language in their lives and their immediate learning environments concerning the content and delivery of the language instruction and the opportunities for their active participation. The motivators and demotivators spanned across the socioeducational, self-determination, and cognitive learning frameworks.
Lack of Quality Education for All; hindering the potential of Orphans and Vulnerable Children in urban Namibia
Christine Montgomery,’13

Faculty Mentor: Ailing Kong
Department of Teacher Education

Supported by the SJU Summer Scholars Program

After studying abroad this past spring in Namibia, I was captivated by the distressing state of Orphans and vulnerable children in Namibia. HIV and AIDS, motor vehicle accidents, TB, malaria, violent crime and many other factors are causing thousands of children to be orphaned at record rates. This small nation, though relatively safe and stable, struggles to rectify many of the appalling injustices carried over from the apartheid and colonization era, which ended in 1990. Namibia is heavily reliant on foreign aid and support from international charity organizations. Without the financial and structural help provided from these organizations, many would be left sick and helpless.

Throughout the semester, I began to volunteer at Hope Village Orphanage in the township of Katutura. Townships were created during apartheid and the miles of tin shacks, plagued with disease, overcrowding, and lack of sanitation, still bear testament to the era of colonization today. Katutura is Namibia’s largest township, and Hope Village provides care to over one hundred children, almost all of them inflicted with HIV since birth. What struck me during my visits to Hope Village was the number of kids not in school each day. In some cases, children without proper documentation, such as a birth certificate were ineligible to attend school and other children were chronically ill or just playing truant. Five and six year olds also occupied the orphanage all day, for pre-primary education is not free, so they resultantly could not attend school until the age of seven.

For my Summer Scholars project, I remained in Namibia an additional six weeks after my study program ended and worked with the five and six year olds at Hope Village, teaching basic English and engaging them in stimulating activities. There are nine main “mother tongue” languages spoken in Namibia, but English serves as a medium for instruction in the upper grades of school. The Hope Village children’s spoken English was above average to that of comparable Namibian children. This is most likely due to the exposure of English-speaking volunteers, and because English is the medium language to these children, who come from various different tribes. Understandably, orphans often have delays or troubles at school and rarely pass matriculation. I feel that their inability to attend school during those vital early years contributes largely to this problem. During my time at Hope Village I worked with the children on an alphabet book that they kept to practice with. Each day we focused on a new letter and the students engaged in an interactive read-aloud. I tried to inspire the children to dream about their future and mentally prepare for school, which I explained is vital in one day reaching their dreams. These children have all of the odds set against them, but their energy and excitement to learn was beyond anything I have ever witnessed.
The Atlantic thermohaline circulation is a pattern of flow in the oceans that has been running since shortly after the end of the last Ice Age, and which is one of the major factors determining the global climate. In the thermohaline circulation, water flows northward along the surface of the ocean from near Antarctica to the sub-Arctic, where it sinks and then returns to the Antarctic along the ocean floor. The surface water is warmed as it passes through the tropics, and it carries this heat into the northern temperate zone, where it warms the cooler northern air. This keeps the north Atlantic basin several degrees warmer than it would be without the circulation.

Arguably the most important effect driving the thermohaline circulation is the variation of the density of seawater with temperature and salinity. As surface water passes through the tropics, evaporation makes it saltier and thus denser. As it then passes through the northern temperate zone it cools off, which makes it denser still, until it ultimately sinks. Global warming will directly affect the sea surface temperature, and affect the evaporation indirectly, and thus it has the potential to alter the circulation. In fact, previous studies have indicated that sufficiently rapid warming could severely weaken the circulation, or even shut it down.

Our project aims to understand one feedback that should play a role in these scenarios, namely that between temperature and water vapor concentration. As global temperatures rise, more water evaporates from the oceans and resides in the atmosphere. Water vapor, however, is a greenhouse gas, so the presence of extra water vapor in the atmosphere amplifies the temperature rise. We are extending existing, simplified “box” models of the oceanic circulation by incorporating the temperature dependence of water vapor concentration above the ocean, the vertical structure of water vapor concentration in the atmosphere, the absorption and re-radiation of outgoing infrared light by variable amounts of water vapor and a prescribed amount of carbon dioxide (i.e., the greenhouse effect), and the intensity of incoming radiation from the sun. By varying the amount of carbon dioxide in the model, we will investigate the effect that different fuel consumption scenarios would have on the thermohaline circulation.
A box model is a very simplified model of the ocean, a planetary scale system, to focus on the circulation of the water. For our study, we were taking the ocean to be a single hemisphere and split into polar and tropical boxes and boxes underneath them (Fig. 1). Both the ocean and climate are more complicated than this on a larger scale, there is more than one ocean with one hemisphere, and on a smaller scale, there is circulation within each of the boxes, but the model gives a rough estimate of the behavior of the ocean and its effect on the climate.

The model was designed by writing out equations for the flow of water between boxes which is based on the temperature and salinity of each box and its neighbors. Lower temperature or higher salinity make the water in the box denser, so it sinks and flow out the bottom pipe into the neighboring box. The temperature and salinity change with time as water flows from one box to another.

We had started to build a model to incorporate green house gases the most important of which is water vapor. This was done by finding the concentration of greenhouse gas, in this case water, in the atmosphere and integrating to find the total concentration. The water in the atmosphere absorbs a certain range of wavelengths that are readmitted or reflected from the Earth to keep it cool. The water then emits this energy in a random direction, so half of it is returned to Earth. Our goal is to understand how water vapor concentration, temperature and circulation interact. Water vapor concentration affects temperature which affects circulation and water vapor concentration. Also, circulation affects temperature.

Figure 1. V1 is the tropical box, V2 is the polar box, V3 is the sub-polar box, V4 is the sub-tropical box, and the arrows indicate the direction of the flow of water.
When Courtney approached me earlier this year to discuss the possibility of serving as her mentor for a Summer Scholars Program project, I was immediately interested. I think this is a wonderful program and was anxious to offer my support. And, Courtney did not let me or the program down. As you can see from her description of the study, she took on a very technical and challenging topic. It may be difficult for the average reader to fully understand her work, but for those familiar with technical accounting and financial reporting topics, the work is admirable.

Courtney took on a very-current, challenging and controversial project. The issue is at the forefront of the accounting profession. Her work in this area should serve her well as she begins her career with KPMG next year upon graduation.

Throughout the project, she showed initiative and a very real sense of self-direction. She kept me apprised of her progress and findings. And, I think she learned how difficult a major research project can be.

Working with her over this past summer was a pleasure. It was refreshing to see her thirst for research and her motivation and self-discipline to execute her research agenda. It is a shame that she is graduation this academic year, as I truly enjoyed working with her. Of course, I realize it is time for her to move along. At the same time, I believe this experience has had a significant impact upon her education.

I am grateful for the university's support of the SSP and do hope that it continues in future years. Having worked with Courtney this summer, I look forward to collaborating with other talented, highly-motivated students in the future.

Courtney Mooney, ’12

Faculty Mentor: Joseph Larkin
Department of Accounting

Supported by the SJU Summer Scholars Program

During the spring of 2011, I interned with KPMG—a public accounting firm that provides audit, tax, and advisory services—and was able to assist with a year-end audit of a large bank in addition to small projects in the economic and valuation services practice. Due to the fact that I am an accounting and finance double major, these two experiences brought to life what I had learned in my accounting and finance classes. Furthermore, throughout my time at the business school, the global financial crisis has and continues to be a topic of many discussions, lectures and presentations. Ultimately, I found myself very interested in how assets and liabilities are valued, the potential impact valuation had on the financial crisis of 2008, and the relationship valuation has with fair value accounting and the evolving international financial reporting standards.

After an unstable economy and massive inflation in the 1970s, the historical cost accounting model came under great scrutiny and there was a push for mark-to-market or fair value accounting. Fair value accounting is based on current market prices or the price that one receives to sell an asset or transfer a liability in a normal transaction between market participants on a particular date. This concept greatly contrasts the idea of historical cost which is based on original cost at an acquisition date and is not linked to current market values. It is widely believed that fair value accounting increases financial reporting transparency and, therefore, increases stakeholder confidence in financial markets. However, fair value accounting became extremely controversial after many claimed that it exacerbated the financial crisis in 2008 after the market froze and prices were driven to all time lows. In order to better understand the controversy, I focused on two major concerns of fair value accounting—the difficulties of calculating value in an illiquid market and how valuation models should be used to determine fair value, specifically looking at the market approach, income approach, and cost approach.

In addition, I examined the convergence of US generally accepted accounting principles (GAAP) and International Financial Reporting Standards (IFRS) regarding fair value measurement. For example, as of May 2011, there was an amendment to US GAAP fair value standards because both US and international standard-setters are working towards worldwide financial statement comparability. This amendment focused on issues like a unified definition of fair value and fair value disclosure requirements for financial statements. Essentially, I studied the initiation and evolution of fair value accounting and how fair value accounting has progressively become a global collaboration.
Research in my lab focuses on cognitive development from birth to early childhood. We are particularly interested in understanding the mechanisms responsible for the development of everyday reasoning and decision-making. The core of this work addresses a basic question about generalization: How do children use evidence, newly learned facts, or prior expectations to make generalizations about new objects or situations?

Generalization is a central component of learning; a goal of any learning setting is to obtain (or provide) information that will generalize to new situations. To this end, we examine the consequences of learning on children’s future generalizations. For example, we have found that young children (e.g., 5-year-olds) generalize newly learned facts differently when provided only a few examples, then when given a large sample of examples. We also look at the other end of the equation, namely how people provide evidence that generalizes. For example, one set of studies explores how children decide who is a helpful teacher from whom to learn, and how these expectations about teacher efficacy influence future learning. The central goal of this work is to understand how children develop a system for making accurate generalizations.

A second line of work examines the developmental origins of irrational reasoning. For example, some of our work over the summer examined a particular reasoning error believed to be responsible for stereotyping. In other work we have explored the development of reasoning errors in economic decision-making. A striking conclusion from our work in this area is that young children appear more rational than adults. For example, adults find it natural to create stereotypes, while children do not. Thus, we aim to understand this apparent developmental paradox: What causes young rational thinkers to become older irrational thinkers?
The Illusory Correlation in 22- and 26- month old children
Tara Burpee,’12

Faculty Mentor: Chris Lawson
Department of Psychology

Supported by the SJU Summer Scholars Program

The illusory correlation describes a categorization error whereby people perceive a relationship between a set of variables even when no such relationship exists (Fiedler, Hemmeter, & Hofmann, 1984). Consider the common stereotype, tall people play basketball. We are drawn to make the connection between variables (e.g., tall and basketball player) even though a connection does not exist for most cases (e.g., most tall people are not basketball players). Decades of research have shown that adults form illusory correlations when categorizing objects (Fiedler, Hemmeter, & Hofmann, 1984; Sherman et al 2009). Only a small set of studies examined the formation of illusory correlations in young children (e.g., Primi & Agnoli, 2002), and no such studies have explored children younger than 6 years of age. However, many of the mechanisms proposed to account for illusory correlations are available early in development. To this end, my work over the summer explored this phenomenon in 22- and 26-months-old infants.

To examine illusory correlations, we devised a task in which we taught children some actions with some figurines and then asked children to model these actions. In one experiment, there were 9 figurines, made up of lions and planes. The materials were designed so that there was a “common” category (e.g., 6 lions) and a “rare” category (e.g., 3 planes). In a training phase infants were shown either a common or rare behavior for each individual, determined by the number of individuals who exhibited the behavior. Critically, the distribution of behaviors was the same for each category – 67% of the individuals from each group exhibited the common behavior and 33% exhibited the rare behavior. After the training phase infants were given each individual figurine one at a time and asked them to elicit one of the two behaviors with the individual. If participants respond on the basis of the evidence they were given they should demonstrate that 67% of both the “rare” and “common” categories display the common behavior and 33% of both categories show the rare behavior. However, if infants form an illusory correlation, they will demonstrate that the “common” category exhibits the common behavior and the rare category shows the rare behavior.

Preliminary evidence shows that 26-month-olds almost exclusively associated the common behavior to the common category (90%) and the rare category (87%). In contrast, 22-month-olds formed an illusory correlation such they associated the common behavior with the common category (83%) more reliably than they did for the rare category (55%). These results indicate that the disposition to form illusory correlations appears in the first years of life and is influenced by the composition of evidence.
Eukaryotic cells have linear chromosomes with ends that must be protected. Telomeres cap these ends with specific repeat DNA sequences that form unique secondary structures and recruit a variety of proteins. Because cells lack mechanisms to fully extend these ends during DNA replication, telomeres shorten with each round of cell division. This is thought to be a way for cells to limit their life spans so that aging cells may be replenished. Certain stem and progenitor cells express the telomerase enzyme complex and is able to avoid telomere losses, but cancer cells may inappropriate express telomerase to help them divide without limit. Understanding how telomeres are properly maintained may, therefore, further the knowledge in the natural processes of aging and cancer.

My lab is focused on how RNA-processing proteins may interact with telomeres and thereby help maintain them. Recent studies in mammalian cells have characterized how hnRNP A1, important for preparing RNA for protein synthesis and for the assembly of ribosomes, is able to interact with telomeric DNA sequences as well as telomerase. We are using baker’s yeast as a model system to study Npl3p, the yeast homolog of hnRNP A1. Yeast mutant cells with the full NPL3 gene deleted have been generated in telomerase-null cells to address how that affects the life span of the cell and the conditions of the telomeres. We have found that NPL3-deleted cells greatly accelerated the rate of senescence (cell cycle arrest) when telomerase activity is also compromised. One summer project addressed whether human hnRNP A1 is able to substitute for Npl3p in the yeast. When the hnRNP A1 gene was introduced in telomerase and npl3 double mutant cells, accelerated senescence was not ameliorated. The second project examined an RNA cap binding protein (Cbc2p) that interacts with Npl3p. Earlier experiments showed that Cbc2p, like Npl3p, has telomere maintenance roles. Furthermore, cbc2 mutant cells are unable to survive without NPL3. Both Npl3p and Cbc2 have two specific protein domains required for proper RNA processing: the RNA-recognition motifs (RRM) and an arginine- and glycine-rich region (RGG). We wanted to ask if these domains are also important for telomere maintenance functions. Plasmids with DNA sequences that would express mutant proteins were transformed into npl3 or cbc2 mutant cells that were also telomerase deficient. Thus, senescence rates of cells expressing specific mutant Npl3 or Cbc2p proteins were compared. While the RGG domain is important for the function of Npl3p, it did not appear to be important for Cbc2p. The RRM region was not necessary for either Npl3p or Cbc2p. We hope to gain insight into how proteins with other known functions have a role at telomeres, to somehow protect them in order to maintain chromosomal and cellular integrity.
Maintaining Telomeres by Cbc2p Does Not Require Specific Protein Regions
Hannah Radecki,’12

Faculty Mentor: Julia Lee-Soety
Department of Biology

Supported by the SJU Summer Scholars, the SJU Barbelin Scholars Program, NIH and HHMI

Investigating the lifespan of cells by tracking chromosomal telomeres has key relevance in medical knowledge of aging and cancer. Without the ability to maintain their telomeres, cells exhibit signs of aging, also called senescence. Telomerase, an enzyme that lengthens telomeres, is a major player in preventing senescence, but many other proteins also help telomerase. CBC2 is a gene in yeast that codes for the “Cbc2p” protein subunit of the nuclear cap binding complex, which helps export and process immature mRNA, a vital step in the production of most of our body’s components. Previously, we have shown that Cbc2p is involved in preventing accelerated senescence in cells without telomerase. Cells lacking Cbc2p are viable but grow more slowly than normal. Two important regions have been found in Cbc2p: an RNA Recognition Motif (RRM) and an “RGG box.” Other proteins have used similar regions to interact with RNA, though research has not been done concerning Cbc2. In this experiment we wanted to examine if single amino acid mutations disrupting these two important regions would prevent the protein from functioning at telomeres. Two mutations were introduced into the RRM and RGG boxes of the Cbc2 gene, notated as F91T and R152K mutants, respectively.

We generated four different mutant strains of yeast with either tlc1 (telomerase) or both tlc1 and cbc2 genes removed. Each strain also contained an extra-chromosomal plasmid that expressed an additional gene: wild type (WT) CBC2, cbc2-R152K, cbc2-F91T, or one control with an empty plasmid. In cells with a double mutation the plasmid gene is the only copy of cbc2 the cell has, allowing us to study how the mutant forms of Cbc2p may function. We compared the senescence rates of eight different strains, as shown in Figure 1.

For 12 days we determined if the mutant Cbc2 proteins are able to maintain telomeres and rescue accelerated senescence in tlc1 cbc2 double mutants. At 22 hours intervals the cell density was measured diluted to 2 x 10^6 cells/mL. The initial downward trend on the graph shows how all cells lacking TLC1 senesce rapidly until “survivors” form that are able to lengthen their telomeres by alternate means. The lowest “none tlc1 cbc2” line on this graph shows that, as expected, the double mutant cells with an empty plasmid senesced rapidly compared to the other seven strains until it formed “survivors.” The R152K and F89L tlc1 cbc2 strains show us how a cell senesces when its only copies of cbc2 are the ones with our chosen mutations. Interestingly, both of these strains were able to rescue accelerated senescence, similar to the way the wild type cells grew. This result suggests that neither of the mutated protein regions appear to be necessary for Cbc2p to maintain telomeres, though confirmation on whether functional proteins were actually expressed is required.

Figure 1. Mutant Cbc2p proteins with defective RRM or RGG regions are still able to rescue accelerated senescence. Strains are labeled by their plasmid gene and chromosomal mutations. Graph shows cell density as a function of population doublings, illustrating senescence and rescue rates for eight yeast strains. Bars indicate standard error of the mean. N=4.
Human hnRNP A1 cannot replace homologous yeast Npl3p in maintaining telomeres
Shannon Spencer,'14

Faculty Mentor: Julia Lee-Soety
Department of Biology

Supported by the SJU Summer Scholars Program and (NIH) National Institute on Aging

Telomeres are sequences of nucleotides located at the terminal ends of DNA strands that prevent degradation in eukaryotic chromosomes. Because DNA polymerase is unable to fully replicate the terminal ends, nucleotides are lost with each cellular division resulting in cellular aging known as senescence. Telomerase is an enzyme that helps compensate for DNA polymerase’s limitation, but inappropriate re-lengthening of telomeres by telomerase results in the formation of cancerous cells.

Saccharomyces cerevisiae (Baker’s yeast) is an ideal model for study because it resembles human somatic cells and contains the protein Npl3p, which is a structural homologue to hnRNP A1. hnRNP A1 is a mammalian RNA-processing protein that somehow contributes to preventing end degradation. Previous research has shown that telomerase-null cells unable to express the NPL3 gene cannot maintain their telomeres and senesce early.

The main focus of this project was to examine if hnRNP A1 could substitute for the lack of Npl3p in yeast cells. We introduced a control vector (none), or plasmids expressing either NPL3 (WT) or hnRNP A1 in tlc1 and tlc1 npl3 mutants. A senescence assay was completed by inoculating haploid cells in SC-URA medium and allowing them to incubate for 22 hours. The population doublings were determined by tracking growth rates. The procedure was repeated for twelve days. The graph shows that hnRNP A1 cannot substitute for Npl3p (Figure 1). The rate of senescence by the tlc1 npl3 double mutants expressing the hnRNP A1 plasmid is accelerated compared to the tlc1 single mutants with intact NPL3 expressing the same plasmid. The double mutants with the plasmid expressing NPL3 showed a rescue of accelerated senescence. This indicates that while Npl3p could rescue the npl3 phenotype, hnRNP A1 could not.

Figure 1: Human hnRNP A1 could not rescue faster senescence of the tlc1 npl3 mutants. Doublings were calculated by observing the growth rate of 2 x 10⁶ cells over 22 hours for 12 days. The error bars represent the standard error of the mean (n=5).
Edwin Li  
Department of Biology  
Saint Joseph’s University  

Ph.D. University of Rhode Island  

**Research Interests**: Membrane Biophysics

My research area focuses on understanding the physical and chemical principles governing the interaction of membrane proteins. Of particular interest is the interaction of mucin 1 (MUC1) with receptor tyrosine kinases (RTKs) such as fibroblast growth factor receptors (FGFRs) and epidermal growth factor receptors (EGFRs). RTKs are single-pass membrane proteins that regulate cell growth, differentiation and motility. Over-expression and mutations in RTKs have been associated with several forms of cancer. Likewise, MUC1 is a transmembrane protein and is over-expressed in cancer cells. Recent finding have shown that MUC1 and FGFR3 associate in cell membranes, and this interaction may be important in regulating intracellular signaling in cancer cells. However, very little is known regarding the mechanism of interaction between MUC1 and FGFR3.

Due to the difficulties in obtaining NMR structures of membrane proteins, interactions are studied in model membranes, bacterial membranes and eukaryotic membranes using molecular and biophysical techniques. Some techniques currently used in the lab include Forster resonance energy transfer (FRET), ToxR assay and Western blotting. Mutagenesis is often used with these techniques to determine which amino acid residues are critical for the interaction between two membrane proteins. Gaining structural knowledge regarding the complexes formed between MUC1 and other membrane proteins (e.g., FGFR3) may lead to the better design of therapeutics with high specificity to inhibit their interaction in cancer cells.
Measurement of MUC1/FGFR3 Interactions in Eukaryotic Cells Using Western Blot Analysis
Nick Iaccarino,’13

Faculty Mentor: Edwin Li
Department of Biology

Supported by a gift from Nick Nicolaides,’87 and the SJU Summer Scholars Program

Proteins in the cell membrane are able to interact with each other, and sometimes with other types of proteins, in order to activate signaling pathways. Mucin1 (MUC1) is a transmembrane protein that is involved in cell proliferation and has been shown to be overexpressed in certain types of cancers. Previous research has shown that MUC1 and fibroblast growth factor receptor 3 (FGFR3) interact in breast cancer cells. However, the mechanism behind their interaction is not known. Therefore, studying the specific amino acids involved in their heterodimerization is important. To do this, Chinese hamster ovary (CHO) cells were cotransfected with MUC1 and FGFR3. The proteins were then crossed-linked using bis(sulfosuccinimidyl) suberate (BS₃) and analyzed through Western Blots. The next step in our research will be to mutate specific amino acids in the proteins. The intensity of the bands from the mutants will be compared with those from the wild type using an image analysis software. This will determine the importance of those amino acids in the interaction between the proteins. The results from this research can be used to create therapeutics inhibiting the interaction between MUC1 and FGFR3.
Mucin 1 (MUC1) is a membrane protein that has a large, heavily glycosylated extracellular domain, a single alpha helix transmembrane domain, and a short cytoplasmic domain. MUC1 is overexpressed in cancer cells and interacts with receptor tyrosine kinases, such as fibroblast growth factor receptor 3 (FGFR3) and epidermal growth factor receptor (EGFR). However, it is unknown which part of the MUC1 protein is involved in these interactions. The purpose of this project is to determine if the transmembrane domains of MUC1 and FGFR3 are involved in this dimerization. In order to measure heterodimerization, it is necessary to know the strength of homodimerization of MUC1 and FGFR3 transmembrane domains. Dimerization of transmembrane helices can be measured using the ToxR assay. Before the ToxR assay can be used, a plasmid encoding a chimeric protein is required. The chimeric protein consists of a maltose binding domain, followed by a transmembrane domain and then a ToxR domain. This project consisted of designing ToxR plasmids with four different lengths of the MUC1 transmembrane domain. Two plasmids were cloned and verified by sequencing. The plasmid resulting in the higher ToxR signal will be used to measure the homodimerization of MUC1 transmembrane domain. Once the homodimerization of MUC1 and FGFR3 are measured, the heterodimerization can be determined. Afterwards, mutations in the transmembrane domains can be made in order to determine which amino acid residues are directly involved in their interaction.
My research interests and scholarly publications focus principally upon Greek and Roman poetry and society and, in particular, themes of poverty and hunger in classical literature. My article “Hesiod and Theognis on Poverty” (2002) was the first in-depth exploration of the significance of the concept of poverty in Hesiod’s poetry and the first that showed how poets could differ in their views of poverty when speaking from different levels of society: Hesiod as “peasant” farmer/poet and Theognis as “aristocrat.” My article “Poverty and Poetic Rivalry in Catullus” (2006) is the first to demonstrate a literal and metaphorical reading of poem 23, addressed to Furius, with whom Catullus engages in a sexual and literary rivalry for the affections of a lover, the aristocratic Juventius. Catullus exploits the contrast between Furius’ poverty, which reduces him to beggary, and Catullus’ own poverty, which still enables the poet to offer something valuable: poetry that is witty, refined, and amorous. My article “Mendicancy and Competition in Catullus 23 and Martial 12.32” (2008) builds upon this last piece in its study of the epigrams of the poet Martial (born c. 38-41 CE and died c. 101-104 CE). Martial, who himself claims to write in the tradition of Catullus, in several of his epigrams on poverty, has borrowed from Catullus’ poetry far more closely than has been acknowledged. While Martial lived in the 1st century AD and Catullus lived in the 1st century BC, composing poetry within differing societies, both poets make claims of personal poverty in the context of asserting their literary merits, and both criticize rivals for their extreme poverty that reduces them to beggary and prevents them from a mutually satisfying, reciprocal exchange of material and creative gifts. Still, Martial takes a more ambivalent, problematical stance on the relationship of poverty and wealth, and he exhibits a greater awe of the wealthy and interest in the tensions between wealthy and poor. I explore the structural, thematic, and verbal correspondences between several of Martial’s poems on poverty and Catullus’ poems on poverty and hunger, and I argue that the closeness of these correspondences creates doubt that Martial’s and Catullus’ poems reflect the precise realities of Roman life. Among my forthcoming publications are an article on beggars for Wiley-Blackwell’s new Encyclopedia of Ancient History and an article on love and literary criticism in Catullus 36 for Collection Latomus.
A Semantic and Syntactical Analysis of Ovid’s Baucis and Philemon
Nicole DeMarco,’13

Faculty Mentor: Maria Marsilio
Department of Classical Studies

Supported by the SJU Summer Scholars Program

The Metamorphoses, composed in Latin by Roman author Publius Ovidius Naso, comprise his most ambitious opus, which contains a total of fifteen books. Throughout the duration of these works are stories unified by myths laced with tales concerning the transformations, the metamorphosis, of humans into demigods and other various forms. In his myth *Baucis and Philemon*, Ovid depicts the story of a peasant couple whom, upon being visited by Mercury and Jupiter in specie mortali, that is, under the guise of mortal form, demonstrate traditional Roman hospitality to their guests despite their meager domicile and humble means while *mille domos clausere serae* to the other homes the gods approached in their sojourn for rest. Because of their actions and the way in which they epitomize the piety that had largely been replaced by opulence and an emphasis on wealth, husband Philemon and his wife Baucis do not endure the demise met by the rest of the town, being submerged in swampy marsh. Rather, they are transformed into two trees, which become entwined, so that they may continue to grow together harmoniously.

Because of where my personal academic interests lie, amid classical and linguistic studies, I chose to approach the Ovidian poem in such a way whereby I could examine its semantic and syntactical components, and subsequently summarize what one can surmise based on this evidence and its implications. The word *parva*, used five times, (as well as a variant *minimae*, which appears once), is not used disparagingly or derogatively by Ovid. I understand *parva*, an obviously integral aspect of the *parva casa* motif in Latin literature, to mean most accurately “small,” but in the sense of humble, meager, or modest, *not* in the sense of puny, unimportant, insignificant, cheap, or slight as it is sometimes defined. I would contend that *parva* is complimentary in a sense because it is indicative of the notion that both Baucis and Philemon are not consumed by the superficial and superfluous opulence that is both transient, but rather hold what is truly important in life in high esteem. It is abundantly apparent that the elderly couple values hospitality, as evidenced by the text itself, in which the couple makes offerings of food, *sordida terga suis* (l. 648), etc., drink *nec longae rursus referuntur vina senectae* (l. 672), a place to rest, *concutiuntque torum de molli fluminis ulva impositum lecto, sponda pedibusque salignis* (l. 655-6), to welcome the weary travellers as guests. The metrical variation between lines 674 and 675, *Hic nux,/ hic mix/ta est ru/gosis/ carica/ palmis Prunaque / et in pat/tulis re/dolentia/ mala ca/nistris*, where the former is heavily spondaic, the latter is primarily dactylic but both describe types of meager foods that Baucis and Philemon offer to their guests. The first three feet in *nitun/tur lo/ngeo ves/tigia/ ponere / clivo* (l. 694) are all spondaic, emphasizing the slowness of the elderly couples’ steps up the long slope as they make their ascent towards the summit, even while equipped with sticks on which to lean.
Ancient Symbolism Across Cultural Lines
Erin Forester, ’13

Faculty Mentor: Maria Marsilio
Ancient Studies Department

Supported by the SJU Summer Scholars Program and a gift from Dr. Maria Marsilio

Various cultures have developed and used symbols which appear to be similar in form and/or meaning. Two such symbols are the “meander,” or “meandros,” and the “swastika.” These symbols are found in such diverse (ancient) cultures as Greece, India, China, and the Americas. Sometimes, these symbols have similar meanings in different cultures, while at other times, they differ greatly from one culture to another.


Using both ancient and modern sources, I attempted to answer three questions about both the meander and the swastika. The three questions were:
1. When and where did the symbol evolve?
2. What was the significance of the symbol?
3. Is there a connection between the cultures that developed the symbol (i.e., did one or several cultures influence another culture’s use of the symbol)?

The goal of this research was to determine the significance of the use of similar symbols in different ancient cultures around the world.

The main focus of my project was on the third question that I posed, which dealt with whether the symbols were developed by various cultures independently or whether the cultures “borrowed” the symbols from each other. In order to answer this question, I looked to ancient architectural and decorative evidence of the symbols in order to determine in what time period the symbols were used in the cultures, as well as modern sources in order to analyze possible connections between the cultures, such as trade routes used and exploratory voyages undertaken.
Propaganda is tied to the cultural traditions and history of a society, and plays on human emotion to generate popular support for its desired object. Augustus, the first Roman emperor, effectively deployed a propaganda program that encompassed all aspects of society, using architecture, coinage, and literature to extend and consolidate his imperial authority. While successful, the veiled Augustan “restoration” of the republic, truly the creation of an authoritarian monarchy, was perceived and ultimately criticized in the literary works of Augustan authors; the veiled criticisms within these works, written by Horace, Virgil, Livy, and Ovid, use elements of propaganda to demonstrate problems with the new Augustan regime. That is to say, in passages that seemingly glorify the emperor, their true intention is to call attention to Augustan tyranny.

Research on this topic required close readings of primary texts in original Latin, as well as extensive reading of secondary scholarship on Augustan propaganda and the pathos of Roman authors. Each author presents a unique perspective on Augustan Rome, and their personal backgrounds in education and cultural development influence their works. Livy, a social conservative, wrote a history of the Republic that intended to instruct the society of Augustan Rome, in an attempt to recall former legends of national greatness to inform his contemporary world, which had become awash in greed, corruption, and perversion. Consequently, Livy’s critique of this corruption of the traditional Roman ethos is also a critique of Augustus, who represents the ultimate bastardization of Roman republicanism and self-sacrifice, while also perceiving Augustus and his supreme power as the only remedy to the destruction of civil war; Octavian as tyrant was the lesser of two evils.

Virgil and Ovid both present their criticism in poetic verse, which subsequently allows the author to use more symbolic, creative means to cover their dissenting opinions. Virgil uses the epic to present the founding story of Rome in the Aeneid, utilizing Aeneas as a counterpoint to Augustus. Aeneas may seem a strong epic figure, but he is plagued by indecision throughout the poem, and even demonstrates seemingly feminine characteristics, which correlates with the Virgilian critique of Augustus: Aeneas also exhibits virtuous piety, and contrasts Augustus’s proclivity for immoral behavior. Virgil’s Eclogues examine the traditional pathos of Ancient Rome, and further criticizes the new expansion of Rome’s military service and land confiscations.

Ovid provides examples of a stinging wit that cleverly conceals his insults of the emperor. Ovid’s relegation, the severest form of exile, to Tomi in 8 C.E. implies the success of his critique, especially against the Augustan moral program and the ostentatious upper-class in his poetic works, the Ars Amatoria and Metamorphoses. His story of Erysichthon harangues the excessive lifestyle of Augustan supporters, and the selfish desire of individuals to pursue complete authority.
Scott P. McRobert
Department of Biology
Saint Joseph’s University
Ph.D. Temple University

Research Interests: Animal Behavior, Evolution, Ecology

Research in my laboratory involves the examination of animal behavior through studies on rare, exotic and, in many cases, endangered species of fish, reptiles, amphibians, and insects.

Our work with fish involves analysis of shoaling, or grouping behavior. My students and I examine the factors that fish utilize when choosing shoalmates, including coloration, pattern, size, shape and shoal composition. In almost all cases, fish shoal with individuals that have features similar to their own. This may benefit them through the ‘Confusion Effect’ in which predators have difficulty identifying and attacking an individual within a group of phenotypically similar fish. We have examined shoaling in a number of different species and are now looking at the effect of experience and learning on shoaling behavior.

Our amphibian work focuses on environmental factors such as temperature, pH, density and pollution that influence metamorphosis. We are currently looking at metamorphosis across a wide variety of poison frogs and we run a yearly project in which elementary school children study metamorphosis in American toads.

Our reptile work involves the study of life history traits in rare turtle species. Working with the Turtle Survival Alliance we currently house a number of assurance colonies containing some of the world’s most endangered species.

Finally, our work with Drosophila involves analysis of the genetic and evolutionary bases of sexual behavior. Current projects include an examination of interspecific interactions in local Drosophila communities and a project to understand the effects of sleep deprivation on sexual behavior in Drosophila.
Mixed Shoaling Behavior of Zebrafish (Danio rerio) with (Danio albolineatus)
Molly Southwell,’13

Faculty Mentor: Scott McRobert
Department of Biology

Supported by the SJU Summer Scholars Program and the Howard Hughes Medical Institute

The research in Saint Joseph’s University’s Biodiversity Lab focuses mainly on shoaling behavior in fish. The word shoal simply refers to any social grouping of fish. Shoaling offers numerous benefits, including protection from predators. In a phenomenon known as the Confusion Effect, shoals of similar-looking fish appear to confuse predators, thus enabling them to escape. Since fish change shoals on a regular basis, individuals are often faced with the decision of which shoal to join. Joining the ‘correct’ shoal is critical, especially with respect to the confusion effect, which depends on an individual’s ability to ‘blend in’ with its shoalmates while joining the wrong shoal could have disastrous consequences. Most shoaling studies, however, indicate that fish are very good at choosing shoalmates with similar characteristics to themselves. My research this summer focused on the shoaling preference of Danio rerio, or zebrafish, to mixed species shoals with Danio albolineatus, or pearl danios.

The study of shoaling behavior in the lab uses 20 gallon aquariums divided into thirds by the addition of two panes of glass. “Target” shoals are placed into the end chambers and an individual test fish is added to the central chamber. During an experiment, the time the test fish spends near each end chamber is recorded. Increased time near one end indicates a preference for the shoal in that chamber.

For the first shoaling assay, 20 test zebrafish were given the choice between a 10 zebrafish shoal and an empty target chamber. The data showed a significant preference for the 10 zebrafish shoal with a p value of <0.001 (independent samples t-test) thus showing zebrafish prefer to shoal rather than swim independently. Next, 20 test zebrafish were given the choice between 10 zebrafish and 10 pearl danios. Again, the zebrafish showed a significant preference for the conspecific 10 zebrafish shoal with a p value of 0.001. This assay demonstrated the zebrafish could distinguish two different species and still preferred to swim with the shoal of the same species. To test the zebrafish’s preference for mixed shoals, a dilution series with the total number of fish remaining at 10 and the number of one species decreasing by increments of 2 were compared. First, a shoal of 8 zebrafish and 2 pearl danios were tested against a shoal of 8 pearl danios and 2 zebrafish. From the data collected by 20 test fish, zebrafish showed a significant preference (p = 0.003) for the 8 pearl danios and 2 zebrafish shoal, which was not expected. Next, a shoal of 6 zebrafish and 4 pearl danios was tested against a shoal of 6 pearl danios and 4 zebrafish. Again, the test fish showed a significant preference (p=0.003) for the shoal with the higher dilution of pearl danios.

In the second part of this study (to be conducted during the fall and spring semesters), zebrafish will be given the choice between a conspecific shoal of 10 zebrafish and a mixed shoal following the same dilution series. These four assays will determine whether zebrafish prefer to swim with a conspecific shoal or a heterospecific shoal.
I am most interested in the area of hunger, both domestic and global. I traveled to Ghana in West Africa in 2007 to work with farmers. My reason for being there was to help them to distribute their products more effectively. I also traveled to Ghana later that year to help small businesses develop business plans with microloan funding. While neither of these trips directly dealt with hunger, they allowed me to work with poor farmers and others to develop a source of resources which would make them more able to buy the foods that they needed.

I am the faculty advisor for the Hawks against Hunger and I am pictured (I am the grey beard) above with officers and members at last year’s Walk against Hunger. This is an annual walk which takes place the second Saturday in April. The Hawks have consistently been in the top five among organizations raising money through the event.

I also teach a class “Food and the Poor” in which the students, besides learning about the causes and possible solutions to hunger, have to volunteer at a site which feeds those in need for three hours per week.

I am a member of the Board of Directors of Philabundance, which runs the Philadelphia Food Bank, and have been an integral part of developing creative on the ground solutions to hunger. Two of these, Fresh for All and the Community Food Cupboard have gotten a great deal of publicity in the local media.

Currently we are working on another project which we hope will be a partial solution to food deserts, urban areas without access to full line supermarkets and too much access to fast food restaurants.

I worked with Danielle Critelli this summer studying hunger in Guatemala.
The Severe Hunger in Guatemala and Proposed Solutions
Danielle Critelli,'13

Faculty Mentor: Martin Meloche
Department of Food Marketing

Supported by the SJU Summer Scholars Program

This May, I participated in the summer immersion program for Guatemala. Two groups of about fourteen students each went to San Martin Jilotopeque, a small town in the region of Chimaltenango, to work with an organization called SHARE Guatemala. Most of the people in his region are of Mayan ancestry and still incorporate these traditions into their everyday lives.

Our work consisted of physical labor at a school, but we also had the opportunity to sit with women and learn about their pasts and struggles. My group worked at a school called Los Pinos, translating to The Pine Trees, which is an appropriate name as the school sits on the side of a hill looking over a beautiful valley filled with pine trees and open land for grazing. We worked with members of the community on mixing and laying cement by hand for a lower court yard for the kids to play on.

Guatemala has very serious statistics facing hunger; it is not an issue of not being able to provide enough food for all Guatemalans, but families are unable to obtain the necessary resources. With a population of about 14 million, over half are considered to be living in poverty. Most families live on their own farms and grow crops for personal consumption, but are not receiving the nutrients necessary for healthy lifestyles. Guatemala’s children malnourishment rate is the highest in Latin America with 50% of children under five being malnourished.

I wanted to focus on the hunger issues of the Mayan people who live in these rural areas because I felt they were most in need and the furthest from receiving any aid. Walking through their community, we were invited into their homes and saw their living conditions. Their farms are on sloped hills, which are the least ideal farming conditions, especially after the drought in 2009 that dried out the land resulting in the death of at least 54 children and two back to back tropical storms in May 2010 that flooded the fields, leaving them unable to grow crops for the rest of the year. Governmental programs try to distribute fertilizer and more sustainable farming techniques to farmers in need, but it is rare that this aid reaches the rural communities. These people were also the target of Guatemala’s 36 year long civil war, that left their communities destroyed, their families broken, and their lives in fear.

Through my research and experience, I developed a few ideas on what I think will be the best aid for families in need. There are programs that provide baskets of food and services that include nutritious food, education, health care, farming techniques, and housing security, but these baskets are expensive and I hope to work to make them more easily obtainable. I wish to install programs to keep children in school and assist families who lose help by keeping their children in school. I also believe that by providing families with tools and teaching them how to farm more sustainably and filter water will give them the ability to do this all on their own. The only way for changes to be made is to provide resources for families to provide for themselves.
Randall M. Miller
Department of History
Saint Joseph’s University
Ph.D. Ohio State University

Research Interests: American social, political, and regional history, with special interests in the eighteenth and nineteenth centuries.

My work has largely concerned issues of forging identity and community, the ways people organize and respond to social change (e.g., civil rights), people at war, and media images and interests. Such work has led to books on such varied subjects as slavery and freedom in the Old South, the northern homefront(s) during the American Civil War, Reconstruction after the American Civil War, religion and society, ethnic and racial images in American film and television, immigration and forming ethnic communities, interactions among different religious, racial, and ethnic groups, urban development (especially in the South and the Sunbelt), and American politics, among others. Of special interest is discovering how people express their own selves in word and material culture. Probably my best-known work in that regard is the book, “Dear Master”: Letters of a Slave Family (Cornell University Press, 1978, rev. and enlarged pbk. ed., University of Georgia Press, 1990), which related the story of an African-American family, as revealed in their letters, that spanned over two generations in bondage (in Virginia and Alabama) and, for some, in freedom (in Liberia). In my teaching, I have emphasized similar interest in finding and interpreting new materials, most particularly in crafting writing assignments that ask students to discover and engage primary sources such as diaries, letters, and autobiographies of “ordinary” people (e.g., people heading west on the overland trails, soldiers and civilians in wartime, workers in factories and fields), as well as using the built environment and material culture to “find” people’s values, interests, and identities by what they made and used. Most recently, I have been exploring several topics related to homefronts in wartime, politics and religion, and political leadership. Charles Withers’s work on English-Indian relations during the early colonizing period in North America, especially the ways English ideas about “savagery” informed their perceptions of and interactions with native peoples at the Roanoke colony in the late sixteenth century, reflects, and profits, my own interests in the processes whereby peoples identify themselves. It also speaks to the recent scholarly interest in understanding the dynamics and directions of “encounters” in the Atlantic world—a subject central to teaching history today.
Savages and the Cittie of Ralegh’:
A Study of how English Perceptions Effected Relations with the Roanoke Indians during Early European Colonization
Charlie Withers,’13

Faculty Mentor: Randall Miller
Department of History

Supported by the SJU Summer Scholars Program

The year was 1584, and a growing curiosity was spreading throughout the British aristocracy. Newspapers and pamphlets spoke to the anticipated English exploration in the Americas. The possibility of gold, fertile soil, and the spreading of Christianity to the savage, native population, had become an enticing prospect. After Sir Walter Raleigh persuaded Queen Elizabeth I to grant him a patent for exploration, a colony was established at Roanoke Island but survived only briefly. Later accounts describe the English settlement in the New World ending in disaster. When Governor John White returned to the island after obtaining needed supplies in England, he found that the colony had vanished. All that was left were the letters ‘CRO’, perhaps a reference to the nearby island Croatoan, carved into a tree. Under the ‘CRO’ was a Maltese cross, a signal that “trouble had forced the colonists’ departure”.

The enigma that is now known as the Lost Colony has sparked the curiosity of historians around the world. After visiting Fort Raleigh’s National Historic Site in Roanoke Island, North Carolina while on vacation last year, I became fascinated with this great American mystery and the leading research behind it. Dendrochronological as well as archeological findings have led many historical scholars to conclude that a severe drought along with a lack of food and supplies led to disease and starvation. Others look to the journal entries of Ralph Lane and other Roanoke colonists to decipher whether hostile relations between the colonists and the native Indian tribes contributed to the settler’s disappearance. Out of the various research studies associated with the Roanoke colony, I found myself returning to historical investigations surrounding the relationships between the English colonists and the native Carolina Indians. I began moving from larger questions regarding the Lost Colony mystery to the specific inquiry about English-Indian relationships, for example, why did the English refer to the natives as “savages”?

During the summer of 2011, under the mentorship of Dr. Randall Miller, I examined the English relations with the native Indians of Roanoke Island and how European beliefs and perceptions of the “savage culture” effected those relations as well as the rise and eventual fall of Fort Raleigh. By submitting a weekly, working bibliography with a diverse range of primary and secondary literary sources, along with the guidance and supervision of Dr. Miller, I explored current lines of inquiry regarding these ethnological studies. This research, along with a site visit at Fort Raleigh, resulted in a paper describing and analyzing these anthropolic and ideological issues while establishing a basis for further research on the subject.
Throughout my career, I have focused my research efforts on trying to understand the role gender plays in people’s behavior, focusing both on similarities as well as differences between women and men as well as differences within each group. Over the years, the specific focus of my research has shifted, although body attitudes and weight concerns and sexuality have been topics of continuing interest. Being a feminist, I have often employed the perspective of satiric empiricism in my research, a method for exposing biases and unwarranted assumptions often implicit in traditional research approaches. The goal of this perspective is to transcend artificially constructed barriers between people reified in the concept of difference.

Current research interests include understanding the behavior of men and women related to the hook-up (sex without affection) phenomenon. On the face of it, this phenomenon seems to symbolize women’s increased sexual freedom (an important goal of the feminist movement). Looked at more closely, however, one sees evidence of the enactment of traditional gender roles and differential evaluation of this behavior indicative of the traditional sexual double standard. Given the mixed evidence for the continued existence of the traditional sexual double standard, I have focused on identifying conditions under which evidence for it usage can be found. I am currently continuing a study developed in collaboration with a summer scholar who has worked with me for the past two years looking at this question in heterosexual men and women and homosexual men and women, the latter being a group understudied in the field.

Another important goal of the feminist movement has been to free women from obsessive preoccupation with physical appearance. Not only does such preoccupation distract women from more valuable pursuits but it also sometimes leads to the development of life-threatening psychological disorders. Why despite great strides made by women in education and employment, do women continue to focus on and struggle with body dissatisfaction and weight concerns? And what factors, if any, mitigate such concerns? The latter question was the focus of research I am currently conducting with a second summer scholar. The purpose of this research is to determine whether feminist identity impacts body dissatisfaction and disordered eating through its reduction of self-objectification.
The Sexual Double Standard and Homosexuality
Karly Cahill,’12

Faculty Mentor: Catherine Murray
Gender Studies Program

Supported by the SJU Summer Scholars Program

Over the course of the summer, I completed a literature review of psychological research focusing on how the sexual double standard applies to homosexuality. The traditional sexual double standard is defined as men being praised for engaging in sexual activity for which women are derogated. However, no research has been done examining whether or not this same pattern holds true for gay men and lesbian women. Research on attitudes and perceptions of homosexuals indicates that a different pattern may emerge.

In attitudinal studies of homosexuality, gay men are typically derogated more than lesbian women. In a national telephone survey, Herek and Glunt (1993) reported a majority of participants expressing negative attitudes toward gay men. More than half of the respondents considered male homosexuality, to be “just plain wrong,” or “a perversion.” LaMar and Kite (2001) examined differences in men’s and women’s attitudes toward lesbians and gay men. On a condemnation-toleration subscale, men evaluated gay men more negatively than lesbians, while women evaluated gay men and lesbians similarly.

Additionally, when examining the traditional sexual double standard, females are often the harshest raters of targets. The majority of current research on homosexuality focuses on male attitudes, but in studies of male and female attitudes, men have shown the most negative attitudes toward homosexuality. Research that has compared people’s attitudes toward lesbian women and gay men finds that women show equivalent attitudes toward each, but that men have significantly stronger antipathy toward gay men than toward lesbian women (Herek, 2002; Kite & Whitley, 1996, 1998).

One of the theories proposed to explain disdain for homosexuality, and specifically male heterosexual’s disdain for gay men, is gender role violation. Davies (2004) found moderate but significant correlations between affective reactions and hostile sexism, male toughness, and male sexuality, supporting that negative attitudes toward gay men are part of a larger construct concerning traditional gender roles. Men who are more prejudiced are also more likely to be close-minded, sexist, conservative, have higher degrees of religiosity, and hold hypermasculine beliefs about gender (Barron, Struckman-Johnson, and Banka, 2008). Males who view homosexual men as lacking masculinity, or even possessing femininity may perceive a threat to the masculine order. In contrast, lesbian women can be objectified by males and therefore restrained within the patriarchal order. Based on attitudinal research, I would predict that there would be a reverse sexual double standard between gay men and lesbian women. I would also predict that male participants would be the harshest raters of targets.

Jonason and Marks (2009) found support for the traditional sexual double standard by examining judgments of targets engaging in an uncommon sexual act. Threesomes were used as the uncommon sexual act because sexual norms have evolved over time, and those actions which once elicited a double standard may no longer do so. In the fall I will be conducting a similar study, using the same materials as Jonason and Marks, but altering the scenario to include lesbian and gay targets in order to test for a sexual double standard.
Dieting and desire for the thin ideal have become somewhat normative. While this can be attributed to the media’s preoccupation with an unrealistic standard of beauty, there has been an evident increase in both body dissatisfaction and disordered eating habits among women. This social problem mainly concerns females, and studies have shown that women are the most affected by feelings of body dissatisfaction, which can lead to more serious psychological behaviors such as depression, anxiety, and disordered eating. Many studies have made an effort to pinpoint a factor that would protect women against body dissatisfaction and disordered eating. Feminism seems to be an effective set of theories that would serve as a safeguard against body dissatisfaction, since feminism extols that women embrace their appearance without regard to the popular thin ideal. However, the results of studies testing feminism as a protective factor proved surprising; feminism has not been proven to have any relationship with body satisfaction.

So what therefore could account for this seeming enigma? Feminism itself proved to be an elusive variable to measure and account for. As a movement, Feminism has undergone significant changes, with the first wave dating back to the 19th century. Since then, cultural understandings and reactions to feminism have significantly changed, and therefore feminism proves to be a difficult variable to measure. Many women endorse feminist beliefs, yet do not self-identify as a feminist. Furthermore, feminist beliefs themselves are quite complex and span a variety of different social problems and issues that women face today. Therefore, many women would easily endorse the idea of women’s economic and political equality, while other “radical” beliefs are not as widely embraced and steer women away from identifying themselves as feminists.

While feminism itself may be hard to measure and prove as a protective factor, another variable called Body objectification bridged the gap between the two seemingly unrelated variables. Body Objectification is a theory which explains that women are often treated in society as sexualized objects, and by being treated as such, they internalize these perceptions and see themselves as others see them. Body objectification is shown to be related to body satisfaction. Therefore, body objectification may be the link between feminism, body satisfaction, and disordered eating. If feminism serves as a protective factor against body objectification, it could also indirectly protect against body dissatisfaction and disordered eating. The proposed correlational study will use a survey of college women to test this hypothesis in order to evaluate the appropriateness of using feminism as a protective factor against body dissatisfaction and disordered eating.
Since 2006, I have served as Associate General Editor of Melville’s Marginalia Online (http://www.boisestate.edu/melville/), an electronic archive of Herman Melville’s reading that includes critical editions of surviving books from Melville’s personal library. The marginalia Melville left in his personal library is an essential part of the manuscript archive for his fiction and poetry because many of these volumes served as primary source material for his published works. The working manuscripts for most of Melville’s major works are either unlocated or destroyed, but one can find valuable clues to his compositional processes in the margins and on the endpapers of the books he had before him while he wrote. As our project has already demonstrated, he relied heavily on other books in the composition of his own prose and poetry. When Melville’s Marginalia Online launched in January 2006, it disclosed for the first time significant portions of erased annotations in Melville’s copy of Thomas Beale’s The Natural History of the Sperm Whale (London: Van Voorst, 1839), revealing unique evidence of his creative processes and remarkable new information about the genesis and evolution of Moby-Dick (1851) in manuscript. Similarly, our surrogate edition of Matthew Arnold’s New Poems (Boston: Ticknor and Fields, 1867) illuminates thematic and rhetorical aspects of Melville’s epic poem Clarel (1876). (These editions are viewable with Adobe Reader 8.0 on the “Catalog” page of the site. In addition to the Beale and Arnold volumes, the site currently includes editions of Melville’s marginalia in his copies of the Bible, and Nathaniel Hawthorne’s Mosses from an Old Manse. In January 2009, an additional seven volumes will be added works that will greatly facilitate scholarship on Melville’s reading and writing, his use of sources, and the extant manuscripts of his completed writings.

Over the past several years, with the support of a Digital Humanities Fellowship from the National Endowment for the Humanities, I have been able to partner with the Special Collections and Digital Library at Villanova University to create digital surrogates of original volumes Melville owned and marked. Most recently, in the spring of 2010, we digitized the Melville holdings of the Berkshire Athenaeum in Pittsfield Massachusetts, a collection that includes Melville’s copies of The poetical works of Edmund Spenser (Boston: Little, Brown and Co. 1855), Matthew Arnold’s Poems (Boston: Ticknor & Fields, 1856), and Oliver Goldsmith’s The Vicar of Wakefield (New York: Wiley and Putnam, 1845). The digital versions of these volumes will serve as the basis for the Web 2.0 version of Melville’s Marginalia Online we are currently developing.

Summer Scholars who contribute to this project engage in all aspects of the creation of a digital surrogate, including examination of originals, digital scanning at Villanova University, OCR conversion and copy-editing here at Saint Joseph’s, and bibliographical and historical research online. They are also given a unique opportunity to study the history of the book and the culture of reading in the nineteenth century.
Toner: Collected Short Stories  
Leo Costigan,’12  

Faculty Mentor: Peter Norberg  
Department of English  

Supported by the SJU Summer Scholars Program

The short story is the preferred medium for writers wishing to provide a passing glance of the life of an individual character. They frequently serve as stepping stones to larger story ideas, and offer opportunities for younger writers to experiment with wide varieties of tones, subject materials, and settings. They are also the chief vehicles of instruction in fiction writing classes at the university level. This summer was spent completing a total of five interconnected short stories to be submitted for publication in online/print literary magazines. The stories will also serve as my portfolio as I apply for a Masters of Fine Arts (M.F.A) in creative writing at schools such as New York University, Sarah Lawrence College, and Syracuse University.

The stories in this collection are written in the realist tradition, but are set in the not-so-distant future. The lives of five separate employees of a large department store are detailed to help shed light on issues such as loneliness, fulfillment, child birth, delusion, and empathy as they exist in the modern workplace. The stories are told in the third-person limited, almost as though the characters spend a great deal of time mentally “narrating” their own lives as they go about their daily tasks.

For example, the story “Gabby” follows a middle-aged woman working the jewelry booth of the department store. Her desire for children is amplified by the loneliness she experiences in her solitary work position, as well as the empty relationship she shares with her husband at home. This desire eventually warps her grasp of reality, forcing her to fantasize about the possibility of swallowing one of the diamond rings in the display case of the jewelry booth—an act that she eventually feels will bring about a pregnancy.

It is not typical for collections of short stories to interconnect. However, collections such as Sherwood Anderson’s Winesburg, Ohio, Justin Cronin’s Mary and O’Neil, and Sherman Alexie’s The Lone Ranger and Tonto Fistfight in Heaven prove that this format can help demonstrate the effects of issues that initially seem unique, suppressed, and unapproachable. The format in these particular stories allows the reader to view the characters through the eyes of other store employees—a technique that helps balance the introverted way in which each character understands his or her progress in life. The interconnectedness of the characters ironically highlights the fragmented relationships that inevitably form in a work environment that undervalues communication and personality. Although the characters work together directly, they find it difficult to breach the individual lives of their peers. The store favors policies that encourage privacy and personal space to a degree that ultimately leaves the characters feeling directionless and interchangeable.
Cristian Pardo  
Department of Economics  
Saint Joseph’s University  

Ph.D. University of Maryland  
at College Park  

Research Interests:  
Macroeconomics, International  
Finance, Dynamic  
Microeconomic Modeling  

My main area of research focuses on the causes of business cycles under financial frictions. In particular, I have investigated the link between entrepreneurial risk aversion, financial imperfections and business cycles. I started with the question of why emerging economies tend to have stronger economic responses to shocks than more developed countries. Private entrepreneurs, who are more common in emerging markets, tend to invest large fractions of their wealth in a single, small company, thus highly vulnerable to risk. Therefore, due to risk aversion, private entrepreneurs must cope with the greater cost resulting from higher risk, a cost that becomes more important the lower their level of wealth is. Consequently, risk aversion among private entrepreneurs can impose significant costs to society as unfavorable shocks that reduce entrepreneurs’ wealth, such as a jump in oil prices, increase this cost and thus reduce private entrepreneurs’ willingness to invest. Therefore, the said behavior towards risk by private entrepreneurs may result in a mechanism that magnifies the effects of shocks on the economy, thus producing stronger output fluctuations. In more developed economies this situation is not as common.

In a related area, given that most emerging economies tend to borrow mainly in foreign currency, changes in the value of their currency affect the value of foreign debt and thus entrepreneur’s wealth. In my research I show that domestic depreciations, an economy’s natural response to adverse shocks, are stronger under fixed than under flexible exchange rate regimes. Consequently, fixed exchange rates may further magnify the effects of shocks due to the resulting stronger depreciation. I show that flexible exchange rate regimes could be preferable under conditions less restrictive than those found in previous literature.

In addition, I am currently doing research on Dynamic Microeconomic Modeling, both in the area of health economics and labor economics. In general, this type of research deals with the question of what factors people base their choices of major decisions, such as to whether or not have family, have kids, work, study, type of work, health insurance, etc. In particular, one of my latest research papers examines the determinants of the choice of health insurance type in a stochastic, dynamic environment. Developing an structural model and using panel data from Chile, I estimate the importance of certain variables that individuals take into account in choosing health insurance types (private or public), such as premiums, expected out-of-pocket costs, and individual preferences in choosing.

Another paper in this field relates to the choice of the type of job individuals choose: to be a wage-employee and receive a paycheck every period, or to be self-employed and potentially earn more, but face more risks. I here again develop a dynamic stochastic structural model, which together with the use of data, allows me to estimate the parameters that best reflect the actual choice made by people.

While structural models face trade-offs between complexity and computational tractability, structural analysis allow researchers to model the actual processes that lead to changes in individual behavior. With them, we can also predict into the future what the evolution of such choices will look like, given some demographic assumptions, such as on population aging and growth. In the health insurance paper, I examine the impact of eliminating restrictions due to pre-existing conditions. In the labor economics paper, I analyze the effect of mandating self-employed workers to pay for unemployment insurance.
Investigating the Implications of Transparency in the Derivatives Market
Matthew Emery,’12

Faculty Mentor: Cristian Pardo
Department of Economics

Supported by the SJU Summer Scholars Program

Many have blamed the current economic climate on a failure in the derivatives market. A financial derivative is an agreement between two parties which establishes an amount of money to be exchanged based on the performance of an asset over time. One of the most common assets which investors base these contracts on is stocks. In general, derivatives facilitate risk sharing. Due to a lack of transparency this market ended up massively transferring risks to agents that were unaware of them. Once those risks were realized many agents were so deeply invested in affected assets that they suffered massive financial stress and often bankruptcy. This stress became so widespread that it affected virtually the whole economy. To limit the extent of the crises as well as ensure that such a catastrophe would not happen again, Treasury Secretary Timothy Geithner proposed greater transparency within the derivatives market in May of 2009. Economists believe this newly introduced legislation will reduce the systemic risk derivative contracts pose to financial markets and to the economy as a whole.

My summer scholar’s project investigated what steps were taken to make the derivatives market function more smoothly and transparently and how they would reduce the risk they impose to society. Specifically, I focused on how the new legislation will affect derivative’s pricing. In order to do so, I used the Black Sholes model, which takes inputs such as stock price, strike price, stock volatility, interest rate, and term of the derivative to predict the price of call and put options for a stock.

The Federal Reserve Bank of Philadelphia releases a quarterly report that describes new banking legislation’s impact on Asset-Backed Securities (ABS). Essentially, the amount of risk for ABS buyers would assume will now be lower as ABS sponsors must take on more of the higher risk, ensuring a more fair risk sharing. In order to estimate this effect I have assumed that less risky means a downward shift in volatility.

In order to monitor the change that this legislation will have on derivative pricing I have chosen ten stocks and calculated the percentage change in put/call option pricing for each stock by adjusting their volatility coefficients in decrements of 5 percent. That is, I compare one-year prices by taking the percentage difference between the put/call prices at the current volatility rate and the put/call prices at 95%, 90%, etc. of the current volatility rate. I then compute the difference of the percent changes between each interval of volatility in order to observe the nature of the relationship that exists between changes in volatility and different stock option prices. This method measures how changes in volatility affect future stock prices.

My initial findings for the ten stocks indicate that there is a positive linear relationship between different magnitudes of volatility and the corresponding put/call prices. In other words, for the same stock, put/call prices drop by the same percentage change every time volatility falls by an additional 5 percent. The percent change across different stocks, however, varies due to differences in their original volatility. The key underpinning of my findings is that reduced stock volatility creates a downward shift in both the call and put price of an option. That is, this legislation would not only reduce the risk that derivative buyers would take on, but it would also reduce their prices. On the other hand, it would not only increase the risk that sellers would have to assume, but also reduce the selling price of these instruments, thus making the issuing of derivatives less attractive to sellers. My results indicate that this legislation will be successful because it will more fairly distribute risk and profits among participants in this market.
My position in the English Department at Saint Joseph’s is a unique one because not only do I teach general education writing and literature course, but also the courses in our drama track, while serving as co-Artistic Director of our university theatre company, Cap and Bells. I direct one play each year in our theatre season, and I also continue to be involved in new play development as a director and actor in various workshops and festivals.

My research interests span the fields of drama and Southern literature, with a particular interest in religion, folklore and popular culture. My dissertation was entitled Appalachia on Stage: The Southern Mountaineer in American Drama, and I continue to explore that topic today, as well as other areas of dramatic literature.
A Rip Roaring Middle Ages Musical Comedy!
Michael Sokolowski,’12

Faculty Mentor: Laura Pattillo
Department of English

Supported by the SJU Summer Scholars Program
and the Department of English

I have spent my entire time at Saint Joseph’s dedicated to two things: theater, and creative writing. I have been in nine shows, and taken several creative writing courses, constantly seeking to improve each time in each endeavor. But for my summer scholars project, I wanted to combine both of these crafts that I love so much, and write a musical comedy. In a nutshell, it goes as follows:

At the peak of the First Crusade, a swindling drifter named Moocholo, who owes a large sum of gold to some mysterious Arab traders, comes into a small town in Italy ravaged by economic woe. All of the nobles, the men who have most of the gold, have gone away to fight in Jerusalem, leaving only the poor behind with no gold. But before Moocholo can move on to a new town, he encounters a timid goldsmith named Graziano with a secret- all of the nobles left their gold in his vaults when they went away. Recognizing the opportunity to pay back the traders and swindle out some gold for himself, Moocholo quickly poses as a business partner in a potential gold lending business. Convincing Graziano that this is the best way to save the town from poverty, he quickly gains Graziano’s trust, gets access to the gold, and sets off, leaving the town behind, scammed. Of course, things don’t go as planned. Moocholo runs back to the town in a panic- having just destroyed the traders’ ship and lost all of the gold in a bizarre accident. As if on cue, trouble arrives. The traders come demanding their gold. To make matters worse, the knights who left Graziano their gold, all return from the Crusades, demanding their gold as well.

Hilarity ensues, surely, as you will see in the final presentation. Despite the lighthearted nature of this project, it is in no way any less challenging or less important than any other project. I have spent not only hours every day writing, but hours doing extensive research, reading books, journals, and web articles all about the Middle Ages around the time of the First Crusade. I’ve read books on Italian “commedia” to understand the style of the era, and I’ve watched DVD’s documenting the creation of some of today’s most popular musicals.

Comedy is an important tool. We use satire to make real statements about our world. And that is one of the goals of this show. This musical uses a fictional financial crisis in the Middle Ages to poke fun at our current day issues. Also, taking place in a time of extreme religious prejudice between Christians, Jews, and Muslims, this musical allows us to explore how even today this same prejudice exists due to our lack of understanding of one another, and it uses laughter to combat this. Laughter is, after all, the best medicine.

As for the writing, I have come a long way. To complete an entire musical in a three month period is hardly practical. But what I have done is written the first real draft of the books and lyrics, doing all work by hand in a very large notebook. But a very important part to the entire process, though, was seeing it. On a few occasions, I gathered friends together to read completed scenes. It was by far the best way to decide what was perfect, what needed work, and really opened my eyes to things I hadn’t ever considered.

But the Summer Scholars Program is just the first step (albeit, a very large one). This is a real show, intended to be seen by the masses. Once everything I have written has been perfected several times over, I am going to make contact with people familiar with music composition, and when I find one interested in my project, collaborate. And then, as they say, showtime.
STEPHEN J. PORTH, Ph.D.
Associate Dean and Executive
Director of Graduate Business
Education, Professor of Management
Haub School of Business
Saint Joseph's University

Dr. Stephen Porth is Associate Dean and Professor of Management of the Haub School of Business at Saint Joseph's University, Philadelphia, PA, USA. He is the Executive Director of graduate business programs in the Haub School, which includes nine degree programs and over 1200 students. Dr. Porth is Senior Editor of the Journal of Jesuit Business Education. His research and teaching interests are in the areas of strategic management, leadership, management consulting, and business ethics. Dr. Porth is also a management consultant, specializing in leadership development and strategic management programs. He has written two books, one which is now in its third edition and has been translated into Chinese, and he has published extensively in management journals, including the Journal of Operations Management, Journal of Management Education, Management Decision, Journal of Organizational Change Management, International Journal of Production Research, and International Journal of Operations and Production Management.

Dr. Porth serves on the Board of Directors of Nutritional Development Services and the Board of Trustees of Country Day School of the Sacred Heart. He is past president and a current board member of the Colleagues in Jesuit Business Education.

GEORGE P. SILLUP, Ph.D., M.S.
Chairman, Pharmaceutical & Healthcare Marketing Department; Fellow, Pedro Arrupe Center for Business Ethics
Ph.D., Human Development/Psychology
The Fielding Institute – 1990

Prior to joining the full-time faculty at Saint Joseph’s University in 2004, Dr. Sillup worked in the diagnostic, pharmaceutical and medical device industry for 28 years and held positions from salesman to COO. He worked in major corporations, such as Johnson & Johnson, as well as in start-up businesses, where he sold products, conducted research and launched several new medical/pharmaceutical businesses into global markets. Dr. Sillup has attained favorable reimbursement coverage and coding for pharmaceuticals, medical devices and drug-device combination products with international regulatory authorities and with the U.S. FDA and CMS (Medicare). He has been a member of several boards of directors, e.g., American Heart Association, and is establishing a presence in the literature. In 2011, he published in the International Journal of Electronic Healthcare with his colleague, Dr. Ronald K. Klimberg, “Health Plan Auditing: 100-Percent-of-Claims vs. Random-Sample Audits” and in the pharmaceutical industry’s trade publication, Pharmaceutical Executive, with his colleague, Stephen J. Porth, “Pharma in the News; The Seventh Annual Press Audit – Flu Vaccines Take Front and Center”.

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Pharmaceutical Industry Ethics
Leo Porth,’13

Faculty Mentors: Stephen J. Porth
& George P. Sillup
Departments of Management and Pharmaceutical
& Healthcare Marketing

Supported by the SJU Summer Scholars Program

This summer we analyzed five major US newspapers for articles on ethics in the pharmaceutical industry. We read front-page articles and editorials from the *New York Times*, *Wall Street Journal*, *Los Angeles Times*, *Washington Post* and *USA Today*. Our team reviewed and rated each article following specific guidelines to categorize them objectively. Each article and headline was classified as a negative, positive or neutral representation of the industry. We also noted whether each article represented both sides of the ethical issue, to include perspectives of the newspaper and the pharmaceutical industry, or just one side.

Following each review, we supplied information about any pharmaceutical company identified, their products and whether they were mentioned negatively, positively, or neutral for input into the EthicsTrak™ database. A valuable tool we updated and used while reviewing these articles is the ethical issues legend, which guided us to the core subject in each article, such as drug safety or high drug prices. It also helped us to interpret trends within the industry during specific time periods and within each newspaper. Each quarter, we assessed trends and prevalent issues determining the one or two major industry topics most covered in the papers. For example, in 2010 healthcare reform was a huge trending topic, but it isn’t nearly as prevalent in 2011. This summer there hasn’t been any one major story but there have been numerous articles about KV Pharmaceutical and their high pricing of a drug to prevent premature births. Also, due to the lack scandals and law suits there have been many articles about new developing drugs in the industry. Results of our research will contribute to the annual article Drs. Porth and Sillup write for *Pharmaceutical Executive*, the industry’s publication, as well as for future publications in the peer-reviewed literature.

By working in the Summer Scholars’ Program this summer, we learned how current events reported in newspapers can influence the pharmaceutical industry. The program not only allowed us the freedom to surface key questions but also helped us to develop a scientific perspective of the world around us. Additionally, we gained fundamental research skills that we are applying while studying abroad and during an internship with a major pharmaceutical company.
Pharmaceutical Marketing: An Industry Ethics Review
Kelliann Rooney,’12

Faculty Mentors: Stephen Porth & George Sillup
Departments of Management & Pharmaceutical & Healthcare Marketing

Supported by the SJU Summer Scholars Program and the SJU Dean’s Office, HS&B

The Pharmaceutical Industry, while continuously researching and developing new treatments and answers to the ailments and diseases of the world, has also grown to be viewed in a controversial light. Despite the industry’s advancements, it has been criticized for ethical issues including but not limited to high drug prices, drug safety, and data disclosure issues. This summer we continued our extensive research on how the pharmaceutical industry has been portrayed by the media—focusing specifically on newspaper coverage.

We investigated newspaper coverage about ethical issues and the pharmaceutical industry from the five largest newspapers. Articles from The LA Times, The New York Times, The Washington Post, The Wall Street Journal, and The USA Today are then filtered through our methodology. Determining factors we use to categorize these articles include whether they are front page or editorial news, whether the headlines and actual article content is negative or positive, and which companies and products are being mentioned. We monitor this information using excel spreadsheets and an access database we call EthicsTrak™. By examining this information, we are able to review our findings and come to conclusions on the industry’s ethical stance in the media. We met regularly throughout the summer to discuss our reviews, as sometimes dissecting an article can prove to be difficult. On occasion, we had online meetings using Wimba, which allowed us to present to each other from across the globe.

Dr. Sillup and Dr. Porth use our carefully gathered research to write their annual article which is published in Pharmaceutical Executive. The article combines the research and their insight on it to make conclusions about the ethical situation of the pharmaceutical industry. Working on this project this summer we have not only improved our excel and access databasing skills but also learned to use advance programs like Wimba, but we have also learned the process of doing careful and thorough research that is necessary to back up a published work. Most importantly, we have investigated numerous areas of our field and have learned about current issues in the industry in which we may someday be a part. The knowledge, insight, and experience gained throughout this summer research project are invaluable.
Joseph M. Ragan, MBA, CPA, is associate professor and chair, department of accounting at Saint Joseph’s University in Philadelphia. He is also founder of the STAR Scholar Society and serves as SAP Academic Coordinator. His research is at the intersection of financial accounting and information systems, and his interests include examining the business value of information technology. An emergent feature of this research is in the development of software application packages that enhance management of the business value chain. He has served as a systems consultant to a number of Fortune 500 companies and has authored many articles on the development and design of SAP Application Scenarios. He currently serves on the Board of Educational Advisors for SAP America.

A value chain is the connected set of activities that span acquiring raw materials, producing products and services, providing customers after-sales support, and ultimately, recycling products or parts. Distinct legal or organizational entities typically carry out the many steps in a value chain. The purpose of value chain analysis is to understand how the linkages and interrelationships between the various entities that form a value chain affect the entities’ costs and profits. This type of analysis is extremely useful for setting or evaluation business strategy and for strategic cost management.

Professor Ragan’s work in application modules of SAP R/3 software has gotten international attention. Student research projects tend to involve large company databases working with companies such as IBM, Siemens, BMW, and General Electric. Students test modular applications of SAP software and develop scenarios to better enable business analysis.
The Sarbanes-Oxley Act of 2002 brought about great change for public companies and their auditors. Sarbanes-Oxley or SOX as it is commonly called, introduced a set of standards to help decrease the risk of corporate fraud and increase shareholder visibility. For auditors of public companies the Act meant that in addition to a financial audit, the auditing firm must also make a statement on the viability of the internal control system of the company, and how well it works in monitoring fraud and providing reasonable assurance that the system is working.

In the accounting classroom it is important to prepare future auditors with the skills to perform a system audit. The big four accounting firms have all made markets in system audits. The accounting firms are looking for technologically savvy students who have been exposed to large scale ERP systems such as SAP. Students who are exposed to the basics of system audits have a significant advantage in public accounting over those who have no exposure to ERP systems and internal controls.

This project culminated in the development of a practice set to teach internal controls and auditing using real life scenarios. The practice set puts students in the shoes of an EDP auditor. The practice set uses SAP ERP ECC 6.0 to simulate as closely as possible the systems environment of a large enterprise. As companies continue to adopt new accounting systems the audit must become more focused on the performance of the system. Modern systems are able to monitor themselves. The role of the auditor is to investigate the exceptions that the system finds. For example: In one SAP scenario auditors/students use a transaction code named ‘SUIM’. This transaction code allows auditors to investigate user exceptions that the SAP system has flagged. Some exceptions may include users with too much access to the system or access to the system after a “Valid To” date.

The project provided great insight to the future of the accounting system. As accounting technology evolves it becomes our responsibility to provide students with the necessary skills to effectively use the technology. This research only addresses a small area of the internal controls environment. In the future the research could be expanded to address new technology offerings that not only monitor the internal controls environment but, look to correct the internal controls environment if exceptions are found.
My research in environmental chemistry is focused on the study of pollutants such as metals, inorganic substances and radionuclides in the water, sediments, and rocks of Pennsylvania.

During this past Summer, we analyzed the levels of metals in a large network of rivers draining Pennsylvania, in particular, the Susquehanna-Lackawanna drainage basin which comprises most of the drainage for the Eastern portion of the state. In addition, this watershed accounts for 50% of the inflow of, and is the largest source of industrial pollution to, the Chesapeake Bay. Anthracite coal mining in Northeastern PA has long been a source of acidity, turbidity increases, and metals influx to the Susquehanna drainage basin. For the past two years, we have been studying physical parameters such as pH, temperature, conductivity, and temperature in the water, and the concentrations of various metals in the water and sediment in 11 river sites in the region. This project is expected to be a multi-year project, focusing on the concentrations of various metals in aqueous, sedimentary and aquatic vegetation phases.

In another ongoing study, we have been evaluating precipitation- and acid-rain induced weathering of limestone exposed at a historic cemetery in Philadelphia. We are conducting a large-scale, quantitative analysis of the weathering changes produced in headstones dating from the 1700’s, 1800’s, and 1900’s, up to the present time, and are interested in correlating the weathering patterns and depths with known records of precipitation for the region, in an attempt to study the impact of acid-rain on the weathering of local monuments.

In a new study begun this past Summer, we have been measuring the presence of the long-lived halogen radionuclide $^{129}$I in Philadelphia stream water. We are correlating these concentrations to the spikes of the short-lived iodine isotope $^{131}$I that have been reported in the drinking water supply in recent years, in order to elucidate the source of $^{131}$I to the water supply.
The Presence of Metals in the Water and Sediments of the Susquehanna-Lackawanna Watershed of Pennsylvania
Cathy Blithe, ’11; Timothy Lex,’12

Faculty Mentor: Usha Rao
Department of Chemistry

Supported by the SJU Summer Scholars Program

Intensive coal mining of four high-grade Anthracite coal zones in Northeastern Pennsylvania over the past one hundred and fifty years has resulted in the mobilization and wide distribution of various metals associated with coal deposits. In an ongoing project begun in the Summer of 2009, we have analyzed the levels of metals in the Susquehanna-Lackawanna drainage basin, an EPA-designated “American Heritage River” system that forms 50% of the inflow of, and the largest source of industrial pollution to, the Chesapeake Bay. Anthracite coal mining in Northeastern PA has long been a source of acidity, turbidity increases, and metals influx to the Susquehanna drainage basin. We have undertaken a study of the state of the watershed, analyzing physical parameters such as pH, temperature, conductivity, and temperature in the water, and the concentrations of Ni, Zn, Fe, Ca and Cu in the water and sediment in 11 river sites in the region. This project is expected to be a multi-year project, focusing on the concentrations of various metals in aqueous, sedimentary and aquatic vegetation phases in the Susquehanna watershed. Ni, Zn and Cu were present in low concentrations in water and sediment, while Ca was highly elevated in the aqueous phase and Fe in the sedimentary phase. Future analyses of metals in aquatic vegetation, watershed soil and different aqueous and sedimentary fractions are planned on a seasonal basis.
Studying the environmental pollution of water, air, and rocks in Philadelphia
Chris Millet, ’13; Mike Montemarano, ’13

Faculty Mentor: Usha Rao
Department of Chemistry

Supported by the SJU Summer Scholars Program and the Chemistry Alumni Scholarship Fund

We have been studying the weathering of limestone at a historic cemetery on the Main Line of Philadelphia. St. Paul’s Cemetery associated with St. Paul’s Lutheran church in Ardmore opened in 1765, with the earliest tombstone emplaced in 1766. Many of the headstones at the cemetery are made of sedimentary limestone, a common building material used throughout Philadelphia at the time. Limestone, like its metamorphic counterpart marble, is susceptible to dissolution in natural rainwater, and experiences enhanced rates of weathering when exposed to acid rain. We have been conducting a large-scale, quantitative analysis of the headstones to study the weathering changes (depth of weathering, scaling, crusting) produced in rocks dating from the 1700’s up to the present time. We are interested in correlating the weathering patterns and depths with known records of precipitation for the Philadelphia region, in an attempt to study the impact of acid-rain on the weathering of local buildings and monuments. A future aspect to the study will be to dissolve limestone blocks in carbonic and sulfuric acids of different concentrations in the lab to measure the dissolution of calcium at different acid strengths.

In a new study begun this past Summer, we have been measuring the presence of the long-lived halogen radionuclide $^{129}$I in Philadelphia. The city of Philadelphia has drawn much attention in recent times for reporting unexplained spikes of the short-lived iodine isotope $^{131}$I in its drinking water supply, on occasion in excess of permissible radionuclide levels for drinking water. The source of this $^{131}$I is as yet undetermined primarily due to its intermittent nature; these spikes have been variously speculated to be from medical waste, either discharged directly from hospitals or indirectly through patients after radiological treatment, or to result from unreported leaks from regional nuclear power plants. We have begun measuring $^{129}$I levels in the drinking water since the long-lived isotope persists in water bodies and is more amenable to measurement after a release event, and the two isotopes share some, but not all, sources of release, thus providing a potential means of assessing the sources of $^{131}$I to the drinking water supply.
Research in mathematics education is very difficult. The focus of the research is human knowledge, understanding and attitudes. There are complex issues related to teaching and learning in general, and more specifically to teaching and learning mathematics. Creating controls on the factors that impact a learning outcome is difficult. We often see references to “math anxiety” and how effects a student’s ability to concentrate and keep an open mind. One question we have asked is: Does mathematics anxiety have a negative effect on learning mathematics? On the other hand, does poor performance in mathematics produce math anxiety? In a project that has spanned two summers, Moira Devlin and I have considered several issues: Can we determine which view is correct? Is it possible that there is a third variable that controls both anxiety and performance?

Can we change a student’s attitude towards mathematics? Can we reduce his/her anxiety? If change is possible, what strategies can we employ to reduce the stress and improve the learning outcome? Moira has completed an exhaustive search of the literature on this issue and we have developed strategies that can be used to enhance learning mathematics at the college level as well as reduce mathematics anxiety and improve learning.
Math Education, Math Anxiety, and Math Achievement
Moira K. Devlin,’12

Faculty Mentor: Agnes Rash
Department of Mathematics

Supported by the Summer Scholars Program

The concentration of my research has been an issue relating to the mathematics education of humanities majors and elementary education majors called mathematics anxiety. Math anxiety is mainly defined as the feelings of tension that interfere with manipulating numbers and solving math problems in a wide variety of ways both inside and outside the classroom.

A new curriculum for undergraduates took effect in 2010. In this curriculum, all students take a mathematics “beauty” course, which is designed to teach math theory and proofs. One of these courses, The Whole Truth about Whole Numbers, was designed to introduce students to topics in number theory and proofs pertaining to elementary concepts.

We wanted to determine how effective The Whole Truth about Whole Numbers course was at changing anxiety and knowledge of the students. We implemented a pretest-posttest design in the Fall 2010 course on math anxiety and knowledge to determine if there is an increase in knowledge and an attitudinal change as a result of taking this course. We recorded the scores of both the pretests and the posttests of both the math anxiety test and the math content knowledge tests. We measured the overall change between the pretest and posttest of each through a matched paired t-test. It was determined that from 20 students, the average math anxiety posttest was 0.05 higher than the average math anxiety pretest. This shows that math anxiety did not significantly change. On the other hand the math content knowledge test showed that of 22 students, the average posttest score is 7.9091 and the average pretest score is 4.5000. This shows that knowledge increased on average 2 to 4 problems.

From literature research, we explored the different relationships between math anxiety and math achievement among middle school and high school students. Many different researchers discussed two main theories which dealt with high anxiety leading to poor achievement or poor achievement leading to high anxiety. We want to further this research to focus on that relationship in college level math courses for non-math and non-science majors.

The other main issue we found was the idea of intervention programs to help decrease math anxiety and increase achievement. This idea of intervention programs is encouraged but has not yet been done or researched. Our goal is to practice intervention through variations of Sudoku puzzles created by myself and a game created by Dr. Agnes Rash into the The Whole Truth about Whole Numbers curriculum. From this, we plan to implement the pretest-posttest design for math anxiety and math achievement to investigate the effects of the intervention programs and the relationship between math anxiety and math achievement among college students.
Research Interests: studying the O2 sensing mechanism of FixL, a heme-based sensing protein from S. meliloti; designing inhibitors of the human IDO enzyme for cancer therapeutics

My research is in the areas of biochemistry and inorganic chemistry because I study the role of metals ions in biological systems. My particular area of research interest is the heme-based gas sensor proteins that sense either carbon monoxide (CO), nitric oxide (NO), or oxygen (O2). These gas sensor proteins have a sensing area that receives the signal and communicates the information to a transmitter domain that sends out the amplified biological signal. These proteins are involved in many important biological signaling processes such as blood pressure regulation, neurotransmission, gene transcription and chemo taxis in a wide variety of mammals and bacteria. However, the detailed mechanisms by which many of these proteins function are not yet well understood.

In my research laboratory we study FixL, which is an oxygen sensing heme protein from the bacterium Sinorhizobium meliloti that regulates nitrogen fixation in the symbiotic root nodules of legumes and is part of the heme-PAS and histidine kinase family of sensors. The kinase activity of FixL is “off” when oxygen is bound to the heme sensor but “on” under hypoxic conditions in the root nodules when oxygen is not bound to the heme sensor. FixL is an excellent model for both the heme-PAS family and the two-component histidine kinase family of response regulators because there is a wealth of biochemical data available to us.

This summer our research group (EuTchen Ang, Nickolas Julian, Kim Nguyen and Christine Ott) looked at the role of conserved proximal residues in the oxygen sensing domain of FixL by studying site-directed variant proteins where individual amino acids were replaced to probe their function. In particular we looked at the role of a conserved amino acid in the heme sensor region of the protein that binds oxygen. Past groups had made a variety of site-directed mutants and found that several gave stable variant proteins with interesting properties.

This summer my students grew up the E. coli cells of seven different variant FixL proteins, purified the variant proteins and characterized them with a wide variety of techniques including SDS-PAGE, gas binding studies with UV-vis and CD spectroscopy at Haverford College. My students discovered that all of these variants were purified to homogeneity (purified so that they are the only protein in the sample). In addition they discovered that all seven variant proteins bound cyanide to form the same kinase “off” state as the wild-type (native) enzyme.

However, the Y197A variant where the nearby tyrosine is replaced with a small methyl group (alanine) did not bind the reporter molecule NO like the other variants and wild-type. This indicates that this tyrosine 197 may play an important role in the signaling mechanism since removing it caused the NO not to bind to the heme iron. This agrees with past studies where we noticed that the Y197A variant autoxidized much more rapidly and with on-going CD spectroscopy studies that suggest that the structure of Y197A is dramatically perturbed in the kinase-off state. My students also helped test out a new kinase assay and we plan to put these results together for a paper.

My students also began to study the human heme protein IDO (indoleamine-2,3-dioxygenase) and its interaction with specific inhibitors for designing novel cancer therapeutics. This is a new collaborative research project in my lab with the Lankenau Research Institute (Dr. Alex Muller) and Bryn Mawr College (Dr. Bill Malachowski).
The Importance of Conserved Fα-helix Residues in the Oxygen-sensing and Nitrogen Fixation Regulation Mechanisms of the FixL protein from Sinorhizobium meliloti
EuTchen Ang,'13

Faculty Mentor: Mark Reynolds
Department of Chemistry

Supported by the Anna K. and Bernard M. Hillman Summer Research Fellowship and the Chemistry Alumni Scholarship Fund

The protein FixL is a heme-based oxygen-sensing protein from Sinorhizobium meliloti. Alongside ApPDEA1 and NPAS2, SmFixL is a member of the Heme-PAS family of gas sensors that regulate nitrogen fixation and micro aerobic respiration in S. meliloti. The PAS (Per-Arnt-Sim) domain is a protein domain contained in a wide variety of signaling proteins where they are used as a signal sensor. We used FixL to study the connection between the heme-containing PAS domain and the kinase domain.

To make the purification process easier, we used a truncated form of SmFixL contained in Escherichia coli cells with its hydrophobic amino acids removed, making it soluble. The truncated SmFixL* plasmid pGG820 was purified from the cells to make site-directed mutants, and upon sequencing, were transformed into E. coli BL21 DE3 cells and plated out on Luria-Broth (LB) with ampicillin. We have the variants (R200A, R200E, R200H, R200I and R200Q) from the site-directed mutation of R200 as well as the variants Y197A, I209M, R214A, and D195A. The conserved, proximal Fα-arginine residue was altered to alanine, glutamate, histidine, isoleucine and glutamine. The protein was then purified with DEAE (diethylaminoethyl) anion exchange, S-200 gel filtration and hydroxylapatite columns. The cells were characterized with SDS-PAGE and visualized by staining with Coomassie brilliant blue. The protein concentrations and heme concentrations of each protein were determined using the Bradford Assay and pyridine hemochrome assay respectively. Using UV-visible spectroscopy, we scanned the variants to determine whether they were in oxy, deoxy, or oxidized states. We also introduced the protein samples with various gases such as NO and CO, which are good oxygen analogs.

This summer, we were able to run Circular Dichroism spectra at Haverford College to examine the secondary structure of our proteins. We obtained some data, but the results were not conclusive enough so we plan on repeating our CD experiments to obtain more information.

We concluded that the R200 variants are stable and purify in the met, oxidized state without BME and glycerol, and that all seven SmFixL* variants bind cyanide like wild-type protein to form a yellow complex, which is a good model of oxygen binding. Our goals for the future is to purify more of our eight stable proteins without BME and glycerol for characterization and activity studies, to look at models for the “kinase-off” state and determine the kinase activity of each of these variants in the kinase “on” and “off” states to determine which amino acids are important for signal transduction.
The Biochemical Mechanism of the Heme-based Oxygen Sensor smFixL* from S. meliloti
Nickolas Julian,’13

Faculty Mentor: Mark Reynolds
Department of Chemistry

Supported by the SJU Summer Scholars Program

This summer, our research was concerned with the biochemical mechanism of oxygen sensing in the bacterial heme protein smFixL*. smFixL is expressed in the bacterium Sinorhizobium meliloti; however, it is responsible for regulating nitrogen fixation in the root nodules of alfalfa plants. smFixL is a member of the Heme-PAS family, meaning that it has the same conserved amino acids surrounding a heme cofactor as other members within the family. Furthermore, smFixL is part of a two component histidine kinase family, consisting of an oxygen sensing heme-domain and a kinase domain that is regulated by gas binding. When oxygen is bound to the heme cofactor (the oxy state), the kinase activity is “shut off,” and when there is no oxygen bound (the deoxy state), the kinase domain is active or “on.” In the active state, signals are able to be transferred and relayed, resulting in the activation of transcription factors responsible for nitrogen fixation. Naturally, smFixL is comprised of three domains: a cell membrane bound domain, and oxygen sensing heme-domain, and a kinase domain; however, our lab works with a truncated version (smsFixL*) in which the membrane bound domain is removed.

In order to study the mechanism of oxygen sensing, nine variants were made using site directed mutagenesis on conserved amino acids within the heme-domain that are believed to be important in oxygen sensing and binding: R200A, R200E, R200H, R200Q, Y197A, R214A, and D195A. The first letter of each variant represents the original amino acid in the wild type polypeptide, while the last letter of each variant represents the amino acid it was changed to. Each variant was grown and expressed in E. coli, collected using centrifugation, and then separated and purified using three different columns. After we collected the purified protein, we were able to characterize it by examining its binding properties when introduced to various gases such as nitrogen monoxide and cyanide. This was done using UV-vis spectroscopy, which measures absorption in the ultraviolet-visible spectral range. A different absorption reading indicates that the protein is in a different state. From this, we hope to obtain a better understanding of the oxygen sensing and binding mechanism as well as determine which conserved amino acids are important for relaying signals to the kinase domain. Future work will include running kinase assays to determine the kinase activity of each variant as well as conducting a new means of purification that involves attaching a His-tag to the protein and collecting it using one nickel column.
The Biochemical Mechanism of the Heme-based Oxygen Sensor FixL from S. meliloti
Kim Nguyen,’13

Faculty Mentor: Mark Reynolds
Department of Chemistry

Supported by SJU Summer Scholars Program and a gift from Anne Marie and Jay Borneman,’80

SmFixL is an oxygen sensing heme protein from Sinorhizobium meliloti, a nitrogen-fixing bacterium in the root nodules of alfalfa plants. FixL plays an important role in signal transduction in many different organisms. A part of the heme-PAS and histidine kinase family, FixL is believed to autophosphorylate and phosphorylate the protein FixJ. It has been shown that FixJ controls the expression of other regulatory genes that regulate the transcription of genes required for symbiotic nitrogen fixation. In other words, FixL is the sensor and kinase, while FixJ is the regulator. When oxygen is not bound to the heme, FixL is active in the met/oxidized state or deoxy/reduced state. When oxygen is bound to the heme, the kinase activity of the FixL is “off” and FixL is in the oxy state.

This summer, the main variants that were studied were R200 (A, E, H, I, and Q) and Y197A. All the variants were produced through mutagenesis. The first letter of the variant signifies the original amino acid, the number specifies the location of the residue, and the letter at the end represents the new amino acid. For example, the original amino acid of R200H was arginine (R), which was then changed to histidine (H).

The variants were expressed through E. coli cells. After treating the cells with lysozyme and using sonication to lyse the cells, the protein was collected by centrifugation. The process of purifying the protein consisted of DEAE anion exchange, gel filtration, and hydroxyl-apatite affinity chromatography columns. After purification, the protein was concentrated and then characterized by SDS-PAGE. UV-Vis spectroscopy was used to observe the state of the protein before and after the protein was exposed to either nitric oxide (NO), sodium cyanide (NaCN), or carbon monoxide (CO), which are analogs for oxygen.

A new aspect of this summer’s research was using circular dichroism spectroscopy to observe any change in secondary protein structure when the protein was in the kinase “on” state and when the protein was in the kinase “off” state when cyanide was bound. The results demonstrated that in the kinase “off” state, Y197A behaved differently from wild-type and R200Q. The CD spectroscopy indicated that Y197A undergoes an important secondary structure change when oxygen or an analog binds to the heme site. Further research to explore the significance of this residue in oxygen sensing and kinase activity will consist of continuing binding studies and running more CD spectroscopy scans.
Conserved $\alpha$-helix Residues Play an Important Role in the Oxygen Sensing Mechanism of the heme-PAS SmFixL protein from Sinorhizobium meliloti
Christine Ott,’12

Faculty Mentor: Mark Reynolds
Department of Chemistry

Supported by the SJU Summer Scholars Program

This summer, I worked with Dr. Mark Reynolds, Kim Nguyen, EuTchen Ang and Nick Julian in the Biochemistry Lab. Together we investigated the oxygen sensing mechanism of the protein FixL*. The protein FixL* is a truncated version of the protein SmFixL. SmFixL* is found in the root nodules of alfalfa plants and is responsible for the regulation of nitrogen. FixL* is member of two families; the heme-PAS family and two-component histidine kinase family. In order to be a member of the heme-PAS family, a protein must have heme and has the same conserved amino acids as the PAS domain. Being a part of the two-component histidine kinase family means that the protein has two domains. The two domains are the heme domain and the protein kinase domain. The heme domain binds and senses oxygen. When FixL* has oxygen bound to it, it is in the “off” or oxy state. When FixL* is without oxygen it is in the “on” state. Meanwhile, the protein kinase domain is a structurally conserved protein domain which contains the function of the protein kinases. Protein kinases are a group of enzymes that have a subunit which is responsible for transferring a phosphate to one or more amino acid residues in the protein. This causes a change, which will affect the protein’s function. To further study the oxygen sensing mechanism we examined the role of conserved $\alpha$-helix residues in the heme domain of FixL*. We did this by doing site-directed mutagenesis, UV-visible, EPR and resonance Raman spectroscopy. Using site-directed mutagenesis, we came up with eight $\alpha$-helix variant proteins: R200A, R200E, R200Q, R200H, R200I, Y197A, Y201A and D195A. However, Y201A and R200I did not express observable quantities. This means that after the variant protein went through the purification it did not show an orange or a red color, which indicates the presence of heme. By doing site directed mutagenesis we found that Y201 is important for the fold of the protein. Meanwhile, Y197A and the R200 series are important for that stabilization of the oxy state. Further work will be with kinase activity assays to see to electronic difference between the variant proteins and wild type FixL*
The major goal of Special Education is to prepare students to become adults with the best quality of life possible. The Individuals with Education Act (IDEA) mandates transition planning to begin at age fourteen, and at sixteen the process must be formalized with a written transition plan. Included is the transition plan should be linkages to connect outside support agencies and the student along his or her parents to help ensure a positive outcome after leaving high school.

Recent research has shown that schools are not always in compliance with this part of IDEA, and that many teachers do not know which agencies are available to help students with disabilities with the transition from high school to work or independent living. This has been an area that I have been concerned about for quite some time.

Students with disabilities may remain in high school through the year they turn twenty-one years of age. Students with moderate or severe disabilities usually spend a portion of their high school years in employment training. Some may practice taking public transportation, conduct job shadowing sessions, and/or work part-time in various supervised positions to learn and practice the employment and social skills necessary for gainful employment.

Most students leave school with an employment position with the assistance of their high school transition coordinators. If students and their parents are provided with information linking them with outside support agencies during their annual transition meetings, they will be prepared to find further employment when needed in the future. Without that information, many individuals with disabilities will remain unemployed for the remainder of their lives.

My research is designed to improve the transition process for both teachers and their students. To that end, I am interviewing personnel from various agencies, both local and national, who have potential to support individuals with disabilities toward positive employment situations. This will lead to better prepared Special Education teachers for transitioning students toward continued employment and, ultimately, a better quality of life.
Analysis of Post-Transitional Job Placement for Individuals with Special Needs
Dianne Zeigler,’12

Faculty Mentor: Eileen Sabbatino
Department of Special Education

Supported by the SJU Summer Scholars Program

Throughout the duration of summer 2011, I conducted a research project entitled the Analysis of Post-Transitional Job Placement for Individuals with Special Needs.

The Individuals with Disabilities Education Act (IDEA) is the leading legislation mandating Special Education Services. IDEA mandates a standard of quality of life and a standard of quality of opportunity that must be provided to an individual diagnosed with a disability from birth through the age of 21.

Beginning as early as age fourteen, planning must begin to transition students with disabilities from the school setting to post school life. This planning process is defined as transitional services. Transitional services are defined as a set of activities that allow for a successful progression from school to post school life (Rosenberg, Westling, & McLeskey, 2008). The central goal of these services is to prepare the individual for the best possible quality of post school life. Although there are strict mandates, which create uniformity in educating students with disabilities, the types of services they must receive, and how their progress is assessed, the homogeneity ends with transitional services at age 21. Students who choose to enter the workforce following high school are supported through a variety of methods with differing levels of support. In addition, many individuals who wish to enter into the workforce are assisted with job placement support through third party organizations.

My project began with online research of ten organizations within the Philadelphia Area which provide employment services to students with disabilities. Through public access websites and phone calls to offices, I researched the mission statement, employment services provided, demographics, history, and modes of contact for each organization. I then used this information to compile an informational pamphlet outlining the post-transitional services available for students with disabilities in the Philadelphia area. This pamphlet is written for non-professionals with the intent of providing a resource for parents and other caregivers concerning the definition of transitional services, the services a student is legally entitled to, and the organizations in Philadelphia that may provide services along with the organization’s contact information.

Along with researching the organizations in the Philadelphia Area that provide services, I also tracked the federal funding of Special Education, specifically funding for transitional services. I began by studying the federal education budget as it funneled down through the PA state budget, and finally to the budgets of the various schools in Montgomery County. This research allowed me to better understand the fluid nature of funding, and also the financial situation of those individuals planning transition work.

The final portion of my summer research was the compilation of a literature review of current studies of transitional services. The goal of my literature review was to gain a full understanding of the past and current research-based transition methods, implementation of transitional practices, and recommendations for future transitional services. This has provided a basis for my anticipated further study of the procedures that post-transitional job placement agencies utilize with individuals with disabilities.

After participating in the summer scholars program I intend on continuing my research with my mentor during the 2011-2012 school year.

Jean M. Smolen  
Department of Chemistry  
Saint Joseph’s University  
Ph.D. Johns Hopkins University  

Research Interest: The fate of environmental pollutants in aqueous and soil environments

My research focuses on the fate of complex organic molecules in model systems that mimic the natural environment. Many organic pollutants are degraded via chemical processes influenced by chemical (organic and inorganic) species. Ongoing projects in our lab seek to contribute to the vast effort underway to identify the constituents of natural sediments and aqueous environments that contribute to or can accelerate the degradation of organic pollutants. The goal of this work is to construct a chemical model of the natural environment that evaluates whether the presence of naturally-occurring chemical constituents, such as natural organic matter and organic acids, contribute to the abiotic reduction of organic pollutants through the generation of ferrous iron from ferric hydroxides or through the generation of other effective reductants.

Experiments that examine the degradation of organic compounds susceptible to reductive transformation are currently being conducted in batch systems in which reducible organic compounds (such as 4-cyanonitronbenzene) are added to aqueous suspensions of clean metal oxides (FeOOH) and organic reductants (ascorbic acid). Metal oxides are used as models for natural sediments. Dissolved metal ions such as Fe(II) are generated due to the reaction of the organic acids with the oxide surface. The effect of the organic acids on oxide dissolution is evaluated along with the effect of metal ion concentration on rates of chemical transformation.

Ultimately, the results of these experiments will be compared to results from experiments conducted with groundwater, lake or marine sediments. After identifying some of the important chemical constituents of these sediments, the rates of degradation will be compared with those in clean systems with a similar composition. With this information, it will be possible to predict degradation rates based on the chemical composition of natural systems.

These research projects have already had a significant impact on student learning and experience. With some guidance, my research students are able to design specific experiments that will generate the data that is necessary to better quantify our experimental systems. The students are exposed to analytical equipment and techniques that they will encounter in industry and academic labs including liquid chromatography, gas chromatography, atomic absorption spectroscopy and ultraviolet/visible spectrophotometry.
The role of Ascorbic Acid and Cysteine in the Transformation of Nitroaromatics in Goethite Suspensions
Andrew Kusterbeck,'14; Alex DeBernardo,’14

Faculty Mentor: Jean M. Smolen
Department of Chemistry

Supported by the SJU Summer Scholars Program and the Environmental Science Program

Industrial pollutants are introduced into the environment daily, and many of them are harmful nitroaromatic compounds. Iron oxides are prevalent in the environment, and they can often facilitate the transformation of said pollutants into less harmful compounds. Our study concerns how different iron oxides and naturally occurring reductants react with nitroaromatics. 4-cyanonitrobenzene (4-CNB) is the nitroaromatic used for our study, due to its solubility in water, good mass balance, and rapid reaction with other chemical compounds. Since there are numerous iron oxides in the environment, we used goethite (FeOOH) as the constant oxide in all of our experiments. We often used varying sized particles of goethite to examine how this affected the overall reaction.

Ferric oxides predominately contain Fe(III) in their natural state. Previous research in the field of environmental chemistry states that ferric oxides generate Fe(II) through a reaction with naturally occurring reductants. Ascorbic acid and cysteine are the two reductants used in our experiments. When Fe(II) is produced and adsorbed onto the surface of the ferric oxide, it is effective in the transformation of nitroaromatics (Klausen et al., 1995). Previous research by the Smolen group demonstrated that neutral pH ferric oxide solutions produce larger amounts of Fe(II), as well as re-adsorb more Fe(II) onto the oxide surface.

Our research tested the hypothesis that smaller goethite particle sizes with greater surface areas would react with 4-cyanonitrobenzene more rapidly (Cwiertny et al., 2008). We tested Bayer goethite, micro-rod, nano-rod, and intermediate sized particles, and our data was consistent with the previous hypothesis. The goethite used in our research was synthesized by the 2009 Smolen group.

A significant portion of our research focused on how the concentrations of ascorbic acid and cysteine affected the transformation rate of 4-cyanonitrobenzene. When we held the goethite particle size constant, we observed that higher concentrations of both ascorbic acid and cysteine produced more Fe(II) in solution. This ultimately led to faster transformations of 4-cyano-nitrobenzene.
Determination of Ionic and Inorganic Concentrations in the Belmont Water Supply and Saint Joseph’s University Campus
Anna Feairheller,’11; Jessica Kesler,’12

Faculty Mentor: Jean M. Smolen
Department of Chemistry

Supported by the SJU Summer Scholars Program and the Chemistry Alumni Scholarship Fund

The Belmont water supply is the water provider for the entire West Philadelphia area, including parts of the St. Joseph’s University Campus. The Belmont water supply consists of Schuylkill River and Delaware River waters.

Our summer research began with taking water samples from St. Joseph’s Campus: the Science Center, Mandeville, Post Hall and Campion on the Philadelphia side of campus, which is fed by the Belmont water supply, as well as Merion Hall, O’Pake Gym (Lower Complex) and Connelly Hall on the Lower Merion side of campus. Samples from these sites were also treated through Brita and Zerowater filtering systems while a reverse osmosis filtering system located in the Science Center was resourced for samples. A comparison was done between the tap water samples to see which filtering system best reduced our substances of interest. Using Standard Methods, we tested our samples for phosphorous, iron, lead, copper, and calcium carbonate. We selected these substances based on the Philadelphia Water Department’s Annual Water Quality Report.

For analysis of the tap water samples, we compiled a comparative analysis of our results. We found that phosphorous concentrations in the tap water increased after being treated through the Brita filter while the amount of phosphorus in the unfiltered samples were decrease to below the detectable range of 0.1500 mg/L by the Zerowater filter. We also found that the phosphorous levels at St. Joseph’s were above the EPA maximum contamination level of 0.1 mg/L. Copper and iron were almost completely eliminated by the use of the Zerowater filters with the exception of one site; Merion Hall. The Brita water filter decreased the amounts of copper and iron, but not as drastically as the Zerowater filter. The unfiltered samples showed a wide range between the sampling sites for these metals. In general, Merion Hall showed greater concentrations in copper and iron than other sampling sites. For the testing of lead, all samples gave readings below detection range. The Brita and Zerowater filters both removed all amounts of calcium carbonate. The unfiltered samples were in the range of hard water, between 120-180 mg CaCO₃/L. All results from the reverse osmosis system read at or below detection level for all analyses. For sites such as Merion Hall that showed much higher concentrations compared to other sampling sites, a more in-depth analysis was performed during the course of the summer as well as an analysis of local creeks.

We hope to continue and expand on this research in the future by further investigating the usefulness of water filters on tap water and performing a comparative analysis of local creeks, relative to the Belmont water supply, and SJU Campus tap water. We hope to explore the water supply of Lower Merion as it relates to the SJU Campus. We also hope to investigate organic substances using GC/Mass Spectroscopy.
I am interested in plants and fungi, and especially in the interactions between these two groups of organisms. For many years the major focus of my lab has been a system involving corn (maize) and the plant pathogenic fungus *Ustilago maydis*. The disease caused by this fungus is known as corn smut, and it’s generally known to people who grow corn all over the world. It has been fairly easy to breed smut-resistant corn plants, so our reasons for working on this fungus aren’t so much about trying to stop this particular disease. Rather, we study corn smut because it is a very useful model system. Corn plants that are just a week old can be reliably inoculated with fungal cells that are easily grown in culture. We can study the progress of disease in many ways, using a variety of different kinds of microscopy. In addition, because the entire genome of *Ustilago maydis* has been sequenced, we have access to well-characterized mutants and other tools that can help us link form with function.

Recently one area of research has involved experiments to determine what the fungus senses on plant cells that provide the signal for infection to begin. Students have used living leaves and leaf replicas to try to answer this question. A second focus in the lab has been to study how the fungus overwinters in the soil, between times when the host plant is available. Students have carried out experiments to look at the survival of fungal cells in different types of soils, also varying temperature and moisture conditions.

As a broadly-trained botanist, I also have some more general interests in the distribution of plants and fungi. Lately this has taken the form of some preliminary studies of plant distribution in highly disturbed urban landscapes.
Corn Hybrids and the Effects of
Ustilago maydis
John Eastman,’13

Faculty Mentor: Karen Snetselaar
Department of Biology

Supported by the Beach Foundation and the Howard Hughes Medical Institute

_Ustilago maydis_ is a fungal pathogen that infects corn plants. It infects by using an appressorium. There have numerous attempts at trying to reduce the effects of the fungus. There are a few different ways at reducing the damage of the fungus. The most effective way is to use hybrid corn seeds.

This summer I worked with corn hybrids and tried to determine what made some hybrids resistant and some susceptible to the corn plant fungal pathogen, _Ustilago maydis_. My group and I inoculated our standard corn plant, Golden Bantam, as well as different hybrids. The hybrids that I specifically looked at were Silver King, which is the resistant hybrid, and Silver Queen, which is the more susceptible hybrid. After inoculating many plants, the figure illustrated that there was no difference between the two hybrids (Figure 1). The infection was scored on a scale from 0-4 with 4 being the worst infection and 0 being the least amount of infection. There should have been less signs of infections for Silver King and more signs of infection for Silver Queen. However, this was not the case when analyzing my results. My hypothesis for what made the plants resistant was how tight the leaves grew. The diameters of the stems were measured and there was a significant difference between Silver King and Silver Queen (Figure 2).

From doing this research this summer, future plans for more research in this area have been determined. Hopefully in the future the hybrids can be looked at a cellular level. Also, if more hybrids were involved, then the differences between the hybrids can be better understood. Since inoculating with a syringe bypasses the resistance, if a better way of inoculating without a syringe could be discovered then the hybrids and their different ways of handling the fungus could be better understood.

![Whole Plant Infection Rate](Figure 1)

![Stem Diameters](Figure 2)
The Effect of Turgor Pressure on Filament formation in *Ustilago maydis*
Paul Ryan,’13

Faculty Mentor: Karen Snetselaar
Department of Biology

Supported by the SJU Summer Scholars Program and the Biology Department

This summer I worked with the fungal pathogen *Ustilago maydis*. *U. maydis* infects corn plants through the use of an infection structure known as an appressorium. Appressoria are structures used by various types of fungus that allow for penetration of the plant’s cuticle. Appressorium either use pressure, or enzymes to get passed the plant’s epidermal cells. My work examined if different osmotic conditions hindered, or promoted the ability of this structure to infect. When infecting corn plants one has to make inoculum consisting of Fb1 and Fb2 gene loci. In order to alter the solute concentration, I added a sorbitol, a sugar alcohol. There isn’t much difference when looking at the average infection; however, fewer plants got infected when 0.7 M sorbitol was used (Figure 1). I will work in the fall to examine this trend.

Previous work done by Smitha Yerrum, a graduate student of Dr. Snetselaar, showed that low solute concentration allowed for optimal growth of infection filaments. Based on this data I decided to look at the effect of turgor pressure on mating filaments. *U. Maydis* is a dimorphic fungus, meaning it has the ability to fluctuate between a budding stage and a filamentous stage depending upon certain conditions. When two gene loci, Fb1 and Fb2, are compatible the two structures become filamentous and form a mating filament. The mating filaments under concentration of 0.2-0.6 M sorbitol grew significantly in comparison with water (Figure 2). This could possibly suggest maybe the ability to form filaments more quickly is important in the infection process.

![Figure 1. Darker the color, more intense infection.](image1)

![Figure 2. Mating filament length](image2)
Infection Capabilities of the Pathogenic Fungus *Ustilago maydis* in the Bundle Sheath Cells of *Zea mays*

Frankie Thelmo,’14

Faculty Mentor: Karen Snetselaar
Department of Biology

Supported by the Howard Hughes Medical Institute and the SJU Summer Scholars Program

This summer, under the guidance of Dr. Karen Snetselaar, I studied the infection capabilities of the pathogenic fungus *U.maydis* in the bundle sheath cells and vascular tissues of the *Z.mays* or corn plant. *U.maydis* is a biotrophic pathogenic fungus, meaning that in order for the fungus to survive it must infect a host that is living. The need for *U.maydis* to remain inside a viable host makes it somewhat difficult to study in a microscopic scale as anything smaller than macroscopic observations of the entire plant often end up destroying the host cell and therefore the fungus inside of it.

My task this summer consisted of trying to develop a technique which would allow for easier microscopic analysis of fungal infections. To do this I used a method designed by the Sheen Genetics Lab at Harvard Medical School (Methods for Mesophyll and Bundle Sheath Cell Separation, 1995) but, only used part of their method as I was interested in individual cells rather than genetic analysis. Using this technique I was able to obtain individual bundle sheath *Z.mays* cells and infected them using the *U.maydis* cells.

To further investigate my research I used confocal microscopy which allowed me to take images of fungal infection of bundle sheaths on a cellular level, previously infection had been obtained but with only as large as whole *Z.mays* leaves. Images were stained with Calcoflour (a blue dye which stained the plant cell walls) and wheat-germ-agglutinin (WGA, a red dye which stained fungal cell walls) .Using confocal microscopy’s utilization of laser light I was able to observe different focal planes without interference from the rest of the light spectrum, which allowed enhanced imagery.

My research allowed me to view images that were highly suggestive of infection; one interesting thing though was the absence of a tell-tale sign of infection, appressoria. Appressoria are small bulbous-like protrusions which signal that plant infection is occurring. This leads to the question of whether or not true infection took place or the fact that appressoria may not have been necessary due to the breakdown of the whole plant leaf and thus the removal for the fungi to form appressoria and simply just overtake the cell.
The Effect of Auxin on the Formation of Appressoria in *Ustilago maydis*
West Weiss,’13

Faculty Mentor: Karen Snetselaar
Department of Biology

Supported by the SJU Summer Scholars Program
and the Howard Hughes Medical Institute

This summer I worked with *Ustilago maydis*, a pathogenic fungus that infects corn (*Zea mays*). *U. maydis* has an asexual budding phase within its life style, but under certain conditions complementary strains of the fungus begin making mating filaments. Mating filaments from two cells connect and create an infection filament. While on the plant host, infection filaments differentiate into a structure called an appressorium, which is used to infiltrate the plant’s epidermal cells. It is unknown whether the differentiation into appressoria is caused by mechanical or chemical stimuli. This summer I worked with auxin, a plant hormone found largely in tissue infected by *U. maydis*. With the use of an auxin transport inhibitor I investigated if the stimulus causing the differentiation of infection filaments to appressoria was chemical rather than mechanical.

The above data represents results from a corn inoculation with fungal cells suspended in the auxin inhibitor (NPA) and water. Infected plants are scored ten days after inoculation on a 1 to 4 scale. A score of 0 indicates no infection, 1 indicates the presence of anthocyanins, 2 indicates tumors <1mm, 3 indicates tumors >1mm, and 4 indicates the most severe infection. The above graph represents inoculation results based on severity, the darker the graph the more severe the infection. According to these results there isn’t a substantial difference in infection rates or severity for plants treated with the auxin inhibitor as compared to the water control. Further research is directed into increasing the concentration of auxin inhibitor as well as watering plants with the inhibitor in the days prior to inoculation.
As a plant physiological ecologist I am most interested in understanding how future changes in climate will impact ecosystem functioning through changes in plant physiological and evolutionary processes. Therefore, my research examines the physiological and developmental responses of annual and perennial plant species to elevated atmospheric carbon dioxide and other global change phenomenon in both an ecologically and evolutionarily relevant context. It is paramount to understand the consequences of increasing atmospheric CO2 and related climate change for plants from the gene to the ecosystem level in order to make predictions about future ecosystem functioning. Currently, projects in my lab are examining the consequences of altered precipitation patterns on the important biofuel grass species *Panicum virgatum*. We are also examining the effects of climate change phenomenon on the parasite-host relationship of soybeans and soybean cyst nematodes. A third project is working to elucidate the mechanisms behind altered flowering time of elevated CO2-grown plants using the model plant *Arabidopsis thaliana*. 
Investigating the role of Precipitation in Genetically Diverse Panicum virgatum
Michael Greco,’12; Nicole Slezak,’12

Faculty Mentor: Clint Springer

Supported by the United States Department of Energy Biomass Program

Panicum virgatum (switchgrass) is a C_4 perennial grass that is widely distributed throughout the grasslands of North America and exhibits a broad adaptation to a range of environmental conditions. Many agronomic cultivars exist, as *P. virgatum* has been extensively bred for use as a forage crop and perennial biofuel. Climate variability within the central Great Plains is expected to increase in the future, impacting the interannual changes in temperature and precipitation variability. In order to accurately predict ecological responses to future climate change, it is imperative to assess the responses of dominant plant species and the mechanisms underlying these responses.

Our research assessed the ecological significance of physiological and morphological plasticity in ecotypes of a regionally important and locally dominant species, *P. virgatum*, in light of predicted changes in climate and precipitation amounts. Using a novel outdoor mesocosm facility at the Konza Prairie LTER site in eastern Kansas, we manipulated precipitation amounts and genetic diversity to produce above- and below-average rainfall treatments imposed on natural *P. virgatum* ecotypes collected from 4 native grasslands in the Flint Hills, KS as well as the biofuel cultivar 'Alamo'. Sixty mesocosms of varying switchgrass genotypes were planted (Kansas, Oklahoma, and Texas species). Half of the plants received watering every 6 days while the other half were watered every 12 days. The amount of water the 6-day water treatment plants received 8 gallons of water twice in a 12 day period while the 12-day water treatment plants received 16 gallons of water once every 12 day period. The two watering treatments are designed to mimic possible changes in precipitation due to climate change. The experiments that were performed were photosynthesis measurements, light- and dark-adapted fluorescence, and water potentials on each plant to determine the amount of stress on the switchgrass varying genotypes.
Finding the Genetic Diversity of 90 native Panicum virgatum L. (switch grass) populations from lowland and upland Konza prairies
Jessica Jean,’13 Lincoln University

Faculty Mentor: Clint Springer
Department of Biology

Supported by the Howard Hughes Medical Institute

*Panicum virgatum* L., also known as switchgrass, is a native C₄ perennial grass that is found on many diverse environments throughout the United States. Switchgrass has many functions such as hay production, forage (food for horse or cattle), habitat restoration, and erosion control. The Department of Energy selected switchgrass, to be a biofuel crop because it demonstrates high productivity, long life cycle, the ability to acclimate to many climates and environments including poor soils and marginal cropland, low water and nutrient requirements as well as positive environmental benefits.

My research focuses on the genetic diversity of switchgrass from various watersheds on Konza Prairie near Manhattan, Kansas. There are various management techniques that consist of lowland and upland; switchgrass that has been grazed by native herbivores, and cattle. These colonies also have different burn regimes that are between 1, 2, 4 and 20 year burn cycles. Finding the genetic diversity amongst these native plants from the upland and lowland prairies will allow us to better understand how switchgrass has the ability to adapt to different climates and environments across the prairie. This knowledge could also aid in planning future projects knowing what approach can be taken with each different genotype.

DNA was extracted from 90 plants collected from 5 different areas and 28 watersheds on the prairie. To ensure there was DNA in all of the samples I performed an assay to test the quality and quantity of the product. My main focus with this project was to perform polymerase chain reaction (PCR) and prepare samples for microsatellite sequencing. PCR is an important molecular biology technique that enzymatically amplifies a specific region of a DNA strand. This prepares the samples for DNA sequencing. Future work will be sending the samples for microsatellite sequencing that will be used to measure genetic diversity.
Firstly, I am interested in the Quality of Life (QOL) of patients diagnosed with Alzheimer’s Disease (ALZ). If a person is diagnosed with ALZ, I would like to research different coping mechanisms which can be utilized to help maintain QOL not only for the patient, but also for caregivers and family members who are impacted by this debilitating disease. I am interested in researching ALZ QOL as a whole to include the patient, the caregiver, and the family. My interest is to identify what daily tasks a patient with ALZ can re-learn to increase their QOL and to determine how caregivers and family members can maintain their own QOL while caring for a loved one once diagnosed. My interests also include supportive in-home care for patients with ALZ, lower stress levels for caregivers, and identification of coping skills to keep family units intact and their relation to overall QOL.

Second, I am interested in researching the co-morbidities which affect caregivers of patients with ALZ. Caregiver stress is a large area related to ALZ. In the clinical setting, we are now seeing that when an ALZ diagnosis is made; heart disease, blood pressure, diabetes, and depression are just several of the ALZ co-morbidities which affect the caregiver. Prevention of caregiver illness is of utmost importance. I am interested in researching the use of disease prevention education, coping mechanisms, and ALZ education in relation to co-morbidity prevention in ALZ caregivers.

ALZ trickles down. Coping skills (to include the patient, caregiver, family unit) and caregiver co-morbidity prevention are my main interests of focus.
Analysis of Home Health Care Programs for Alzheimer’s Patients
Carly Kindbom,’12

Faculty Mentor: Eileen Sullivan
Department of Health Services (IHS)

Supported by the SJU Summer Scholars Program

Alzheimer’s disease is an irreversible, progressive brain disease that slowly destroys cells involved in memory, thought, and reasoning. It is the most common cause of dementia among older people and affects not only the lives of the victims, but of their family members and caregivers. Understandably, most research done on Alzheimer’s is directed towards prevention and treatment. Dr. Sullivan and I therefore decided to focus our efforts on improving quality of life for not only the patient, but the family members as well. We believe that the way to do this is by getting more therapy programs covered by Home Health Care. Providing these will allow victims to stay in their homes longer, which in turn will improve independence, quality of life, and comfort for the victims while lessening the burden that falls on caregivers.

It is our experience that many home health agencies will cover Occupational Therapy, Physical Therapy, and Cognitive Therapy for neurological injuries classified as a Motor Vehicle Accident, Head Trauma, Seizure, or Stroke asserting that the patient can "regain" tasks that were lost. These services are NOT covered for patients with Alzheimer’s disease, under the claim that once a task is lost to Alzheimer’s, it is “non-re-gainable”. Though ALZ victims may not be able to permanently “regain” a task, we see no reason that they should not receive the therapy to help them “relearn” tasks such as eating, personal hygiene, and muscle conditioning. If these treatments are provided for other neurological impairments, they should be for Alzheimer’s as well. Caring for a person with Alzheimer’s disease can have high physical, emotional, and financial costs. The demands of day-to-day care and changing family roles are hard to handle. Having these therapies at home would improve ability to maintain the disease as well as quality of life for both the victim and the family members/caregiver’s.

Our goal for this summer was to develop a solid foundation of research, the findings of which were just summarized above. We think it is unacceptable that these services are not covered, and will move forward over the next year to determine a full list of the home health benefits provided to Alzheimer’s patients in the tri-state area by surveying different home health agencies. We selected 60 home health care agencies from the tri-state area (20 from each state) and are in the process of creating a survey from our findings. Though a project like this takes time, Dr. Sullivan and I feel like we have established an excellent base this summer on which we can build and use to draw attention to these issues, ultimately improving overall quality of life for these patients.
Paul Tefft
Department of Biology
Saint Joseph’s University
Ph.D. Southern Illinois University

Research interests: Comparative physiology; host-parasite relationships

My primary research interest is in the interactions of parasites with their hosts. Since the parasite my students and I work on is a plant-parasite nematode we have to consider the physiology of both plants and animals. The nematode called the soybean cyst nematode (SCN) causes several billion dollars loss to the soybean crop worldwide and is considered the number one pest of this crop. Over the last 30 years our work has focused on helping to understand the factors that govern the development and reproduction of this organism. We have examined the mating behavior, the pheromone production, the role of host plant physiology on fecundity and egg hatching of this species. By far the majority of work has been on the physiology of egg hatching. This nematode is not only interesting because of its economic significance but because it has a relatively complex life cycle with complex developmental control. Working with students in the lab and watching them develop an interest in doing science is the best part for me about doing research.
The Establishment of a Monoxenic Culture of a Soybean Cyst Nematode Population from Lancaster County, Pennsylvania
Adelaide Bertram,’12

Faculty Mentor: Paul Tefft
Department of Biology

Supported by the SJU Summer Scholars Program, the Beach Foundation and the Howard Hughes Medical Institute

The destructive infestation of the soybeans by the soybean cyst nematode (SCN), *Heterodera glycines*, is the cause of nearly 1.5 billion dollars in yearly crop loss in the United States. *H. glycines* is a host specific parasite that has a high reproduction potential. The female develops a protective cyst around her eggs after copulation that protects them from environmental stresses until the eggs are stimulated to hatch. Because of the cysts’ ability to survive, the soybean cyst nematode eggs are able to remain dormant for decades in the soil. This has been an impediment to prevent or control the damage caused by *H. glycines*.

One objective of our study this summer was to establish monoxenic cultures of SCN so the physiology and development the nematodes can be studied and better understood. Soybean seeds sterilized with bleach and ethanol were plated in nutrient agar. The plated seeds were incubated until their roots were approximately 2 to 3 cm in length, at which point the root tips were cut and transferred to Gamborgs B-5 media. This has been done successfully without the presence of contaminants when performed using sterile techniques. The roots are allowed to grow and are then inoculated with disinfected eggs and larvae of SCN. An inoculum containing SCN is treated with various disinfectants singularly or in combination. Disinfectants we have tried include bleach, chlorhexidine diacetate, 8-quinolinol sulfate and mercuric chloride. We have tested these disinfectants in conjunction with egg hatching studies to determine the right combination of disinfectant that is sub-lethal to the nematodes.

Once the cultures are established we will conduct experiments on the development and physiology of the nematode. Developmental stages of SCN are usually not accessible because they develop within the plant tissue. This summer we began modifying a technique used with root-knot nematode to enzymatically digest roots of soybeans in order to recover different developmental stages of SCN. Finally we adapted a technique to collect and extract large numbers of cysts and eggs using a sucrose gradient and centrifugation.
Dr. John Tudor  
Department of Biology  
Saint Joseph's University  
Ph.D. University of Kentucky  

Research Interests: Genetic analysis of the predatory life cycle of *Bdellovibrio bacteriovorus*.

My laboratory has been examining the life style of a small bacterium with the long-term goal of understanding the underlying mechanisms in its developmental cycle. *Bdellovibrio bacteriovorus* is an obligate predator, attacking and devouring other bacteria. The developmental cycle of this unique bacterium is bi-phasic (see figure below). As free-living attack phase predators they exhibit extremely rapid motility (up to 160 cell lengths per second) as they search for susceptible prey. Following an attack and irreversible attachment, the bdellovibrio penetrates the outer envelope of the prey cell and nestsles in the periplasmic space, where it initiates the intraperiplasmic growth phase. During this phase, the bdellovibrio initiates DNA synthesis and elongates into a long spiral utilizing the cytoplasm of the prey for nutrition. After about three hours, the filament fragments into four to five progeny, each with its own flagellum, and lyses the prey envelop releasing new attack phase cells. With the work of a number of undergraduate research students, two of these questions have been answered: the enzymes involved in penetration, and the translocation of a porin (channel) protein into the cytoplasmic membrane of the prey protoplast for gaining access to nutrients.

The current thrust of research in my laboratory is to create transposon insertion mutants of *Bdellovibrio* that lack the ability to prey on susceptible bacteria. We have isolated a truly facultative strain (can grow either predaceously or axenically), and have been able to develop new methods for delivering transposons into the bdellovibrios and screening for predation. Transposons, with flanking DNA, from these mutants have been recovered and cloned into *Escherichia coli*. Several of these clones have been sequenced and compared through BLAST analysis with the *Bdellovibrio* genome currently deposited with the National Center for Bioinformatics. We are continuing to isolate new mutants, isolate their DNA and sequence the genes that are essential for predation. We are also examining gene expression through the use of Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) quantitative real-time PCR (qRT-PCR). As we continue these studies, it is hoped that we will gain new insights into the control of this unique predatory life style, and perhaps one day to utilize this bacterial predator as a biological control for harmful bacterial species.
Isolation and Characterization of Predatory Genes from *Bdellovibrio bacteriovorus*
Catherine Elorette,’14

Faculty Mentor: John Tudor
Department of Biology

Supported by the SJU Summer Scholars Program, HHMI and the John P. McNulty Scholars Program

*Bdellovibrio bacteriovorus* is a Gram-negative bacterium that attacks and preys on other Gram-negative bacteria. The life cycle of *B. bacteriovorus* consists of two stages, an attack phase and an intraperiplasmic growth phase. During the attack phase, *B. bacteriovorus* seeks out its prey and attaches to the host. It penetrates the outer membrane of the prey and enters into the periplasmic space, where it enters the intraperiplasmic growth phase. During this phase a structure called a bdelloplast is formed where the bdellovibrio grows, using the host as a source of nutrients. The bdellovibrio reproduces and lyses the prey cell, then moves on to infect a new bacterium. Although the genome of bdellovibrio has already been sequenced, there is still more to be learned about the individual functions of its genes.

My research this summer focused on isolating non-predatory mutants of host independent *B. bacteriovorus*. Host independent variants of *B. bacteriovorus* were developed using strain 109J. Random transposon mutagenesis was used to insert a plasmid into the host cell. The plasmid randomly replaced a segment of the *bdellovibrio*’s genome, and then the mutants were screened for predation using cultures of *E. coli*. Mutants that were determined to be predatory-deficient had their DNA isolated, then amplified using arbitrary prime PCR. The sequences that were amplified were sent off for sequencing, then compared against BLAST using the NCBI database.

So far ten genes have been sequenced and analyzed. The predicted gene products for these ten genes included several instances of conserved sensor histidine kinase, as well as serine protease, both of which would be predicted to affect the predatory behavior of *bdellovibrio*.
Analysis of Predatory Gene Expression in 
Bdellovibrio bacteriovorus using RT-PCR 
and qRT-PCR
Lena Lupey,'12

Faculty Mentor: John Tudor
Department of Biology

Supported by the SJU Summer Scholars Program, the American Society of Microbiology and the Anna K. and Bernard M. Hillman Summer Research Fellowship

*Bdellovibrio bacteriovorus* are Gram-negative obligate predators of other Gram-negative bacteria, such as *Escherichia coli*. The bdellovibrio life cycle consists of two phases--the highly motile attack phase, in which bacteria seek out prey, and intraperiplasmic growth phase, in which bacteria predate, grow, septate, and eventually lyse the prey cell. A number of genes are known to be involved in early stages of predation. *Bd0427* codes for the major outer membrane protein, a unique alpha-helical porin found to be inserted into the cytoplasmic membrane of the bdelloplast by the bdellovibrio within minutes of attack.1,4 *Bd2428* codes for an extracellular serine protease. Many proteases are secreted by the bdellovibrio within the first 30 minutes of attack for the acquisition of prey nutrients.2 *Bd3279* codes for a polysaccharide deacetylase. Thomashow and Rittenberg showed that a deacetylase removes acetyl groups from the peptidoglycan during the first 30 minutes in order to terminate glycanase activity, preventing premature bdelloplast lysis.3 The use of reverse-transcription PCR (RT-PCR) and real-time quantitative RT-PCR (qRT-PCR) will help to correlate the putative functions of these genes to transcriptional expression patterns drawn from quantitative analyses. For each of these genes, expression data is given as fold-expression relative to our reference gene, *Bd2400*.

Current qRT-PCR data are consistent with respective putative gene functions. *Bd0427*’s peak in expression at 150 minutes corresponds with the growth of bdellovibrio progeny inside the bdelloplast. *Bd2428* and *Bd3279* both peak at 30 minutes. *Bd2428*’s peak in expression occurs when it is vital for attack-phase bdellovibrio to break down nutrients for metabolism, while *Bd3279*’s peak corresponds with bdelloplast formation and stabilization of the outer membrane.

In the future, qRT-PCR will be repeated for *Bd0427*, *Bd2428*, and *Bd3279* to confirm results. Further, a number of additional genes of interest thought to be involved in predation will be analyzed. Expression patterns of genes of interest will be compared to those of host-independent bdellovibrio strains.

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Isolation and Characterization of Predatory Genes from *Bdellovibrio bacteriovorus*

Victoria Martino,’13

Faculty Mentor: John Tudor
Department of Biology

Supported by a gift from Nick Nicolaides,’87 and the SJU Summer Scholars Program

*Bdellovibrio bacteriovorus* is a Gram-negative bacterium that preys on other Gram-negative bacteria. *B. bacteriovorus* has a life cycle which consists of two phases: the attack phase and the intraperiplasmic growth phase. During the attack phase, *B. bacteriovorus* penetrates the outer membrane of the prey entering into the periplasmic space. Then it enters the intraperiplasmic growth phase of its life cycle. During this phase a bdelloplast is formed where the bdellovibrio lives and feeds. The bdellovibrio reproduces and lyses the prey cell then moving on to infect a new prey. The genome of *B. bacteriovorus* has been sequenced; however, there are still questions remaining as to what portions of the genome control predatory behavior.

The goal of my research was to determine genes, which possibly control predatory behavior. In order to determine what genes possibly control predatory behavior, host independent (HI) variants of *B. bacteriovorus* 109J were developed. Predatory-deficient mutants were created through random transposon mutagenesis using the host independent variants. In transposon mutagenesis, a plasmid, which carries a transposon that can interrupt any gene within the *B. bacteriovorus* genome, is electroportated into an electrocompetent bdellovibrio. Mutants created using transposon mutagenesis are then screened for the ability to prey in co-cultures with *E.coli* in order to determine predatory-deficient mutants. Predatory-deficient mutants have lost their ability to prey. After confirming predatory mutants, the chromosomal DNA of the predatory mutants was isolated and the predatory genes were amplified using arbitrary-primed PCR. The PCR products were then sequenced and analyzed using BLAST against the NCBI database. This summer, 10 genes have been amplified and analyzed. From the sequences that were analyzed, putative gene functions were determined. Two possibly important putative gene functions include conserved sensor histidine kinases and serin protease.

It is expected that both of the gene functions would play a role in the ability to attack a prey cell.
James Watrous  
Department of Biology  
Saint Joseph’s University  
Ph.D. Georgetown University  

Research interests: non-linear characteristics of physiological time series, with special emphasis on neural and cardiovascular dynamics

My research focus is the analysis of the time series generated by the electrical activity of neural and heart cells and the use of this information to characterize the dynamical state of the systems they describe. The study of neural networks is accomplished by using a number of computer simulation tools to build and analyze these networks. The output of a simple three-neuron system is shown in Fig. 1. Each neuron behaves differently based on their unique properties and the type of connection between each neuron. In addition to the oscillations seen in this figure, I am also interested in the phenomenon of neural bursting. This event is characterized by a series of nerve impulses occurring within a short period of time, followed by a period of quiescence. A variety of networks and their behavior are currently being studied including those involving more than simple voltage gated sodium and potassium channels. Other projects deal with neuronal models of circadian (~24 hr) rhythms and networks that lead to epilepsy in the hippocampus.

For many years it was believed heart rate regularity characterized the healthy or normal state. The diseased or unhealthy condition was always associated with some sort of irregularity, regardless of type. Today, however, our view of what constitutes a normal sinus rhythm has changed considerably. Using the techniques of nonlinear analysis and applying concepts of chaos theory, there is a new way of looking at heart function. Fig. 2 shows what a typical ECG looks like under the new paradigm. Instead of plotting the data as a function of time, the figure shows electrocardiogram (ECG) data plotted in phase space. We look at specific changes in these diagrams to provide clues about cardiac function. There are two questions my laboratory is currently studying: 1) How do the dynamical properties of the cardiovascular system change with age? 2) What role does the autonomic nervous system play in regulating the dynamical properties of the heart? Computer models of heart cell behavior are used to examine the role ion channels play in the overall physiology of the heart.

Fig 1. Neural Network Oscillations  
Fig 2. Phase Space ECG Diagram
Small-World Network Modeling of Epileptiform Behavior Within the CA3 and CA1 Regions of the Hippocampus

Stephen Capuzzi, ’12

Faculty Mentor: James Watrous
Department of Biology

Supported by the SJU Barbelin Scholars Program

Epilepsy is a common neurological disorder, characterized by seizures generated through an overload of synchronous positive feedback in neural networks. Epileptiform activity is classified through the observation of both ictal bursts (50-100 ms) and prolonged seizures (100+ ms). Previous research by Netoff et al. (2004) on epilepsy in the CA3 and CA1 regions of the hippocampus, has found that the presence of long-distance synaptic connections in small-world networks and stochastic ion channel behavior affects the severity of the epileptiform activity.

Using the Java-based software Simulator for Neural Networks and Action Potentials (SNNAP) and small-world network architecture, representational models of the CA3 and CA1 neural networks consisting of 32 neurons were constructed and subsequently differentiated based on their synaptic properties, such as the number of recurrent synaptic connections and synaptic strengths. The CA3 and CA1 models, which utilize the high computational power and synchronous behavior of small-world networks, successfully simulated the respective epileptiform activities predicted by Netoff: voltage versus time output screens for neurons in the 3, 6, 9, and 12 clock positions of the ring-shaped network displayed high-intensity ictal bursts followed by complete network shutdown in CA3 and sustained, prolonged seizures in CA1.

In nature, neural networks in the CA3 and CA1 regions can randomly rewire, thereby affecting signal propagation and thus epileptiform activity. This study simulates the effect of random rewiring of long distance synaptic connections on the epileptiform activity of the CA3 and CA1 networks. As the number of long distance connections was increased, a distinct transition in epileptiform behavior from prolonged seizing (Figure 1A) to ictal bursting (Fig. 1B) in CA1 and from ictal bursting (Fig. 1C) to network shutdown (Fig. 1D) in CA3 was observed, which concurred with previous research.

Biological ion channels have a probabilistic element of random opening, closing, and inactivation due to thermodynamic fluctuations called stochastic ion channel behavior. Simulations of the CA3 network with stochastic sodium and potassium ion channel behavior were conducted in order to study their effect on epileptiform activity. Summations of the bursting durations in the four clock position neurons over the course of one second was measured for networks containing 0, 1, 2, 4, 6, 8, 9 long distance connections at 10%, 25%, 50% stochastic behavior. Computations showed an initial increase of epileptiform activity from 0 to 1 long distance connections; however, the subsequent networks showed significant suppression of activity despite increases in stochastic behavior and long distance connections.

Fig 1. A) CA1 Network with 0 long distance connections; prolonged seizing B) CA1 Network with 22 long distance connections; ictal bursting C) CA3 Network with 0 long distance connections; ictal bursting D) CA3 Network with 13 long distance connections; network shutdown
Analyzing and Modeling Frequency Changes in the Suprachiasmatic Nucleus
John O’Donnell,’12

Faculty Mentor: James Watrous
Department of Biology

Supported by the SJU Summer Scholars Program and the Anna K. and Bernard M. Hillman Summer Research Fellowship

Fig. 1

The suprachiasmatic nucleus (SCN) is a small structure inside the brain located in the anterior hypothalamus directly behind the optic chiasma. The SCN controls circadian rhythms, (~24 hrs), which effects activity level, digestion, hormone levels, and sleep patterns. The most interesting aspect about the neurons in this structure is that they fire rhythmically, and autonomously, meaning these neurons fire without any outside stimulus. This autonomous firing differs between day and night periods. During the night SCN neurons fire with a frequency of roughly 3Hz (Fig.1), while at day they fire at a frequency of about 9Hz (Fig.2). Previous research has shown that the SCN has light sensitive channels, and it receives signals from the optic nerves. The question I asked was “how do these light sensitive channels produce different firing frequencies in day and night cycles?”

Using the computer program SNNAP, a neuron simulator, I constructed a neuron containing the three basic channels, Na, K, and Leak. A Ca channel that created an ion pool in the cytoplasm of the neuron was added followed by a calcium regulated potassium channel, which has been shown to be in SCN neurons, the Ca ion pool would cause this channel to open once it reached threshold. After minimally manipulating the channel kinetics of the neurons I was able to get the neurons to fire autonomously, and could increase or decrease their firing frequency. After a single, autonomous neuron was successfully constructed, a network was constructed. In this network each neuron was connected to the four closest neurons, and, using a random number generator, added six long distance connections (Fig.3). The majority of the neurons in the 28 neuron network do not display pace-making ability, and are just below the threshold to fire autonomously. My results showed that changing the Ca ion concentration is one of the reasons if not the reason for the fluctuation in firing frequencies in SCN neurons.
Research Interests: Digital Imaging and Image Combination

While an English major at Saint Joseph’s and simultaneously a photography student at The Tyler School of Art, I became excited by the possibilities of combining images. What intrigued me was the potential for narrative synergy, creating stories by combining photographs I had taken in different locales into a series of images that implied much more than did any of the individual shots. That excitement has never left me.

In Effigies, an eight year portfolio shot in Ireland and in the studio in Philadelphia, shots of the wild Irish landscape were digitally combined with images of people shot in the studio to consider how a land can shape a people even after generations of separation.

More recent work has brought me back to shooting exclusively on location, combining multiple shots into realistic narrative images.
Portraiture has long been a way to capture the likeness and personality of a sitter. Because the main focus of the image is of the subject’s face, emotionality is derived from facial cues. These subtle cues of the sitter have long been characterized as the subject’s “gaze” – the connection from the sitter’s eyes upon a certain fixation.

I began researching various street photographers whose goal aimed to capture one succinct moment in time. Because these images are taken on the street, the subject not only responds actively to his or her environment, but there is little to no directorial influence from the photographer. These images lead me to shoot in Center City at the Philadelphia Museum of Art, and in New York City at Central Park. Though the two locations were quite different, the people I photographed assumed similar roles. I chose to shoot each subject from behind in an attempt to remove the face, leaving only body language and spatial proximity to “define” the subject. Often times the likelihood of the person could be defined by the gestures they made to those people around them, as well as the things carried in their hands.

The next progression in my research diverged completely from street photography and focused on directorial studio photography. As the photographer, I am able to control every aspect of the photograph within the studio, and I sought the use of artificial lighting and models to construct a more political image. Using a scarf draped over the model’s head, I began to explore the literal action of “masking” the subject. Because the subject’s face is hidden, the viewer is deprived of any cues or gaze. Whether or not the images are viewed as the photographer masking his models—or something that is self-deprecating by the subject—is completely up to you as the viewer. The idea remains: the scarf acts as a physical representation of something the subject hides behind. Sometimes the mask is only a partial obstruction, while other times it engulfs the body completely. I allowed each model to choose what they wanted to wear (or not wear), making the scarf the single unifying object between the pictures.
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**Research Interests:** Data Mining and Predictive Analytics

I am interested in using data mining and predictive analytics theories and applications to solve real world problems. I have worked on numerous research projects across industry dealing with mining patterns and signals within a large data sets to interpret what it means, quantify its value and feasibility of implementation; identifying bottleneck areas that can slow down the manufacturing processes and increase defects; improving forecasting accuracy for both inline and new products; and recognizing customers responsive to sales calls and optimally positioning firm’s resources to minimize wasted efforts.

With overwhelming amount of data firms are able to collect and access today, data mining and predictive analytics are becoming more and more important to drive more accurate decisions faster. In doing so, firms are able to add values to their business and increase their chances of successfully compete in today’s global environment.

The process of data mining and predictive analytics starts with understanding the data thoroughly. This step is followed by understanding the challenges one wants to tackle using the data as a source of information. To convert the data into actionable knowledge to add value to the firm, the correct preparation of data becomes very important. Once data is prepared, the analytical process begins by exploring data and applying advanced tools, such as decision trees, regressions, and neural networks, to understand the relationship between the inputs (independent variables) and outputs (target variables). The last steps are the correct interpretation of the findings and presenting it to the key stake holders.
Evaluating the Threat of Cord-Cutting to the Video Distribution Industry
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The Economic Recession of 2008 forced millions of Americans into cost effective spending and although the economic crisis may be over, many have retained their spending habits – especially in regards to technological entertainment. We began to see it with digital music and “ala carte” services such as iTunes. An interested consumer is no longer forced to purchase an entire album but is now able to buy individual songs for less than a quarter of the price; later came a strong demand for e-readers to access novels and newspapers; than a tablet computer that challenged the conventional use of a desktop or laptop personal computer. Is the traditional television next?

Various consumers are beginning to substitute their traditional video distribution such as cable and satellite service for online video platforms such as Netflix, Hulu, Apple or Google TV. These platforms no longer solely offer movies, but television series as well and have an average monthly expense of $18 versus $56 for basic packaged cable or satellite. This wide difference of cost has some consumers “cutting the cord” connecting their television to a cable box or satellite. Therefore, online video is causing the current video distribution industry to reevaluate its Pay TV model. In reality, many industries are affected by cord-cutting including media but traditional video distribution stands to be the foremost business at risk. Innovations and advancements within technology has allowed online video to be accessible through multiple platforms including TV, PC, and mobile phones whereas cable and satellite are restricted only to the TV platform.

The concept of my research is much broader than the topic itself. It is an evaluation of a viable threat to an entire long-standing industry, and even further, how companies within this industry will use innovation to try and surpass it. Cable and satellite providers are beginning to respond with new online platforms, more competitive offerings, and usage based pricing. As data continues to be assembled, I will apply data mining techniques and multivariate statistical analysis that factor in demographics, viewing habits, and economic trends with the intention to expose hidden patterns and discover appropriate knowledge that can add value to a firm’s decision making process.