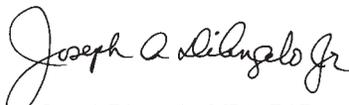


Welcome to the thirteenth annual Summer Scholars Dinner at Saint Joseph's University. We are very pleased to have the opportunity to bring together so many different people, friends of SJU and representatives of area businesses and corporations, SJU administrators, faculty, staff, and the Summer Scholars 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 eighth in which the Summer Scholars Program has been open to students and faculty in all areas of the university, and the third 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 26 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

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
Introduction	i
Table of Contents	ii-vi
Supporters of Student Research at SJU	vii
David Allan, Dept. of Marketing	1
- Kelsi Dana,'13	2
Paul Angiolillo, Dept. of Physics	3
- John Mike Devany,'14	4
- Cara Esposito,'15	5
- Daniel Flynn,'13	4
- Sebastian Parra Hurtado,'15	6
- Lisa Mariani,'14	7
- Leslie Morrow,'15	6
- Miles Radziwanowski,'15	6
- Nicholas Travaglini,'13	4
Catalina Arango, Dept. of Biology	8
- Andres Fernandez,'14	9
- Bryan Hennessy,'12,'13	10
- Lianette Pappaterra,'15	11
- Andrew Shaffer,'14	11
Tanya Berezovski, Dept. of Mathematics	12
- Joshua Bargiband,'12	13
- Sarah Bell,'13	13
- Lisa Chen,'14	14
Frank Bernt, Dept. of Teacher Education	15
- Lauren Mifsud,'14	16
- Scott Pyzik,'14	17

Jim Boettcher, Dept. of Philosophy	18
- Gia Montemuro,'13	19
John Braverman, SJ, Dept. of Biology	20
- Caitlin Callaghan,'13	21
Audre Brokes, Dept. of Philosophy	22
- Kelly Cox,'13	23
Tom Buckley, Dept. of Modern & Classical Languages	24
- Gillian Clark,'13	25
Janée Burkhalter, Dept. of Marketing	26
- Lauren Bogen,'13	27
- Grace Gunnels,'14	28
Jose Cerda, Dept. of Chemistry	29
- Victoria Angelucci,'14	30
- Danielle Houchins,'13	31
- Mary Malloy,'14	32
- Katherine McGovern,'14	30
- Margaret Roeder,'13	31
- Brady Werkheiser,'13	32
Susan Clampet-Lundquist, Dept. of Sociology	33
- Casey Callahan,'13	34
Peter Clark, SJ, Institute of Catholic Bioethics	35
- Alexander DeBernardo,'14	36
- Dominic Gatta,'14	37
Renee Dobson, Dept. of Music, Theatre & Film	38
- Patrick Bishop,'13	39
Jonathan Fingerut, Dept. of Biology	40
- Kristina Orbe,'14	41
Mark Forman, Dept. of Chemistry	42
- Eric Eisenhauer,'14	43

- Dana Krajcsik,'13	44
- David Manion,'13	44
- Elena Montoto,'14	43
Kaz Fukuoka, Dept. of Political Science	45
- Rachel Sellers,'14	46
Richard George, Dept. of Food Marketing	47
Elizabeth Sclafani,'13	48
Paola Giuli, Dept. of Modern & Classical Languages	49
- Joseph Logozzo,'13	50
Peter Graham, Dept. of Chemistry	51
- Robert Carden,'14	52
- James Ohane,'14	53
Heather Hennes, Latin American Studies Program	54
- Emily Smith,'13	55
Elizabeth Jaeger, Dept. of Psychology	56
- Lina Muktar Mohageb,'12	57
Virginia Johnson, Dept. of Teacher Education/ Faith Justice Institute	58
- Colleen Callahan,'13	59
Christina King Smith, Dept. of Biology	60
- Carol Collins,'14	61
Paul Klingsberg, Dept. of Mathematics	62
- Kaitlin Kelly,'13	63
- Deangela Valdez,'14	63
Doug Kurtze, Dept. of Physics	64
- Ryan Stull,'15	65
Sally Kuykendall, Dept. of Health Services	66
- Kevin Henry,'13	67

Julia Lee-Soety, Dept. of Biology	68
- Andrea Ito,'14	69
- Shannon Spencer,'14	70
Alison Lewin, Dept. of History	71
- Edward Foley,'13	72
Edwin Li, Dept. of Biology	73
- Bernadette Eichman,'14	74
- Gina Montone,'14	75
- Meghan Muretta,'15	76
Ben Liebman, Dept. of Economics	77
- John Rafferty,'13	78
Scott McRobert, Dept. of Biology	79
- Maria Galassi,'15	80
- Olivia Martino,'15	81
- Leigh AnneTiffany,'15	82
Randall Miller, Dept. of History	83
- James Kopaczewski,'13	84
Catherine Murray, Gender Studies Program, Dept. of Psychology	85
- Josephine Bahn,'13	86
- Elizabeth Keenan,'13	87
Steve Porth, Assoc. Dean HSB, Dept. of Management	88
- Danielle Puccino,'14	89
- Leo Porth,'13	103
Usha Rao, Dept. of Chemistry	90
- Amy Dougher,'15	91
- Megan Forman,'14	91
- Christopher Millet,'13	91
- Michael Montemarano,'13	91
- Michelle Piotrowski,'13	91

Agnes Rash, Dept. of Mathematics	92
- Elisa Miller,'13	93
Rommel Regis, Dept. of Mathematics	94
- Kimberly Kanakos,'15	95
Mark Reynolds, Dept. of Chemistry, Chemical Biology	96
- EuTchen Ang,'13	97
- Michael Desciak,'14	97
- Nicholas Murry,'13	97
- Avery Vilbert,'13	97
Eileen Sabbatino, Dept. of Special Education	98
- Kelly Lawton,'13	99
Josephine Shih, Dept. of Psychology	100
- Stephanie Scalice,'13	101
George Sillup, Dept. of Pharmaceutical & Healthcare Marketing	102
- Leo Porth,'13	103
- Danielle Puccino,'14	89
Jean Smolen, Dept. of Chemistry/ Environmental Science	104
- Drew Kaneps,'13	105
- Jessica Kesler,'12	106
- Andrew Kusterbeck,'14	105
- Luke Serensits,'14	106
Karen Snetselaar, Dept. of Biology	107
- Adeline Fagan,'14	108
Suzanne Sorkin, Dept. of Music, Theatre & Film	109
- Nicole Benzing,'14	110
Cathleen Spinelli, Dept. of Special Education	111
- Jennifer Wilson,'13	112
Clint Springer, Dept. of Biology	113
- Jessica Jean,'13 Lincoln University	114

- Amanda Laznicka,'14	115
- Megan Smith,'14	116
A.J. Stagliano, Dept. of Accounting	117
- Brandon Talisesky,'14	118
Paul Tefft, Dept. of Biology	119
- Alyse Ameer,'14	120
- Samantha Atchison,'14	120
John Vacca, Dept. of Education	121
- Ellen Taylor,'13	122
Richard Warren, Dept. of History	123
- Kelsey Kostelnik,'14	124
Jim Watrous, Dept. of Biology	125
- Edith Adjei-Danquah,'15	126
- Victoria Atchison,'14	127
- Catherine Elorette,'14	128
- Lauren Kozlowski,'15	129
Dennis Weeks, Dept. of Art	130
- Madelon Crosson,'13	131

Supporters of Student Research at Saint Joseph's University

The students, faculty and staff wish to express their gratitude to the following individuals and companies whose generous gifts and grants have supported student research and scholarly activities at Saint Joseph's University:

Dr. Anne Marie Borneman,'08
Mr. John P. Borneman,'80
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The students, faculty and staff also wish to express their gratitude to the following companies and groups who have generously supported the annual Sigma Xi Student Research Symposium at SJU:

The McGroddy Frontiers in Science Seminar Series
IBM
The Office of the Dean, CA&S,
The Office of the Provost



David Allan
Department of Marketing
Co-Director Music Industry
Program
Saint Joseph's University

Ph.D. Temple University

Research Interests: Music, Media
and Marketing

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)

Popular Music's Significance in Advertising

Kelsi Dana, '13

Faculty Mentor: David Allan
Department of Marketing

Supported by 1851 Records



The music industry has evolved drastically over the years; some have stated that it is diminishing. I would not agree with this, revenue just simply is being made elsewhere. No longer is the money in album sales its now in advertising. Dr. David Allen has stated “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”. Dr. David Allen and I have researched this extensively the last few months. My research is focused specifically on the past decade and whether or not popular music has become more or less prevalent in commercials and the effect it has had on advertising.

To support my research on popular music in advertising, I have coded all of the superbowl commercials over the last decade. I used a specific coding sheet which has multiple sections. These sections include everything from demographics to describing the music incorporated. I would watch the commercial then decide if popular music was present, if so then I would describe the artist, type of music, product relevance, also narrative relevance. I watched a total of 656 commercials. From 2002 to 2012 the percentage of commercials with popular music increased from only 9% to over 50%. My findings made it apparent that when advertising and popular music are joint forces it is very affective. With the joining of these two things many job opportunities come available due to the increase in demand for brand association with music. To go along with my research, I had the pleasure of working alongside product managers in the company 2 CK Productions and also alongside vice president of Capitol Records, Craig Davis. I've acquired very insightful knowledge and information, which I will carry on with me into my future career in the music industry.



Paul J. Angiolillo, Ph.D.

Department of Physics
Saint Joseph's University

Ph.D. University of Pennsylvania

**Research Interests: Organic Conductors
and Semiconductors, Materials Physics**

The 21st century, in all probability, will witness a revolution in the electronics industry. Since the end of World War II, doped silicon has been the material, which virtually every electronic device is predicated. The “size” of transistors has shrunk from centimeters in 1948 to approximately 50 nm in 2012. This decreasing trend in the size of the fundamental features of electronic devices based on silicon technology cannot be sustained due to a number of quantum phenomena, which dominate the physics at nanometer length scales. The past 20 years has seen the establishment of a new area of discovery research and promising technology - that of nanoscale molecular electronics that exploit π -conjugated organic materials. Much of this development has been spurred by attempts to mimic or model the highly efficient electron and energy transfer processes typified in green plants and photosynthetic organisms.

This lab has historically used electron paramagnetic resonance (EPR) spectroscopy to probe both charged states (polarons) and neutral excited triplet states in a unique class of organic semiconducting materials. Recently, however, the lab has been utilizing EPR spectroscopy to study radiation-induced radicals in biogenic calcite from several species of extinct cephalopods. These radical systems have been found to be useful in dating the fossilized material. These spin systems may be used to further glean a more fundamental understanding of the dynamics (rotation and vibration) of polyatomic ions in crystal lattice sites.

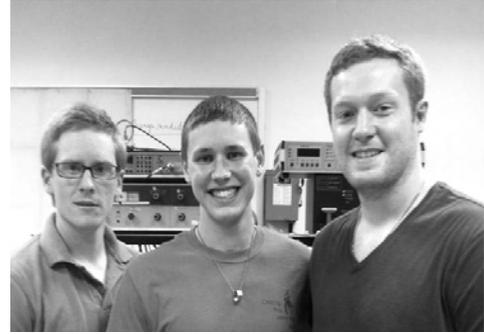
Just in the past year, the lab has been also looking at the fundamental physics of friction. Despite the common nature of friction, it remains largely unexplained especially the transition from static to kinetic friction and the evolution of stick-slip motion. It appears that the dynamics of systems exhibiting stick-slip frictional motion span many length scales, from the movement of nanometer-scale surfaces to the movement of the Earth's tectonic plates. We have developed a mesoscopic model system employing the commonplace hook-and-loop (Velcro) fastening system. When placed in shear, Velcro exhibits many of the hallmarks of stick-slip motion seen in other systems and, moreover, is accompanied by acoustic bursts that are related to the slip events. Over the past year, we have explored how the Velcro model system behaves with respect to the classical Amontons-Coulomb laws and have discovered stark contrasts with the accepted classical laws.

Electron Spin Resonance of Radiation Induced Radicals in Calcite from Ancient Squid

Nick Travaglini, '13

Dan Flynn, '13

John Mike Devany, '14



Faulty Mentor: Paul Angiolillo
Department of Physics

Supported by the SJU Summer Scholars Program, the Department of Physics and the Howard Hughes Medical Institute

Millions of years ago, a biogenic calcite bone called a *rostrum* formed within some species of squid toward the posterior end of its body. The rostrum, resembling a torpedo shape, acted as a ballast allowing the squid enhanced maneuverability through the water. As it grew, different chemical species of like charge to the calcium and carbonate ions could be substituted into the calcite structure. Such chemical species as SO_2^{2-} , SO_3^{2-} , CO_3^{2-} and Mg^{2+} were gleaned from the nutrients it took in from its environment. After the squid died and its body decayed, sediment collected over top of the rostrum and through permineralization, it fossilized.

Lying on the ocean floor, the rostrum was bombarded with radiation. When struck with enough energy, paired electrons in the outermost shell could separate trapping one in a potential energy well. Due to the unpaired electron, the resultant atom or molecule is called a *free radical*.

The cephalopod species examined in this study are *Belemnopsis bessina*, *Cylindroteuthis puzosiana*, and *Neohibolites minimus*. The samples range in age from 65-155 million years old. Electron paramagnetic resonance spectroscopy (EPR) was used to characterize the spin systems within the calcium carbonate lattice and ultimately date the fossilized material.

Isochronal annealing was performed in 25-degree increments from 50-500°C at 30 minute intervals. Absorption spectra were then taken after each annealing. Through the process of annealing, trapped electrons within the rostrum gain enough energy to escape their potential wells allowing them to re-pair with other annealed electrons. These trap depths can be determined using the isochronal annealing profiles.

A previously published study showed that the SO_2^- isotropic signal began to anneal out at 300 °C (Angiolillo, 2008); new results show that within the rostrum of *Cylindroteuthis puzosiana* the SO_2^- signal began to anneal out at a much higher temperature of 375°C. Additionally, an annealing profile as well as a power saturation was taken of CO_2^- isotropic. Further work includes taking a full temperature profile of each of the three cephalopod species.

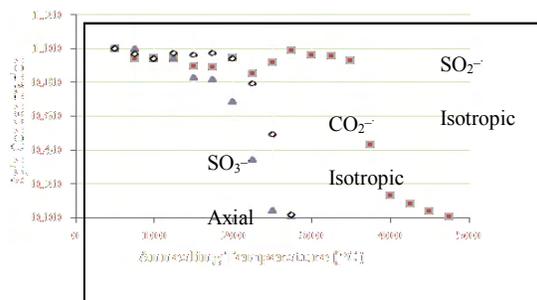
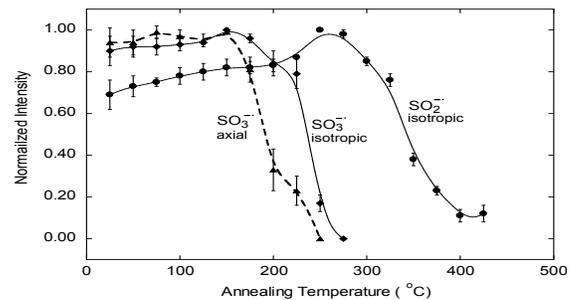


Fig. 1 Annealing data for *Cylindroteuthis puzosiana*



Angiolillo, P.J., Graneto, N., 2008, Characterization, Stability and Origin, *Radiation Physics and Chemistry*, v. 77, p. 545

Stick-Slip Dynamics in Velcro®

Cara Esposito, '15

Faculty Mentor: Paul J. Angiolillo

Department of Physics

Supported by the Howard Hughes Medical
Institute



Friction, a concept typically introduced in a high school or college level physics course is a prevalent phenomena that goes, for the most part, unrecognized in the course of everyone's daily life. It controls the movements of nanomachinery and the dynamics of Earth's tectonic plates.

Friction is the force that opposes motion of fluid layers, solid surfaces, and material elements. There are two types of friction. The first, static friction, is the frictional force encounter before the object begins to move, while kinetic friction, the second type, is the frictional force encounter while the object is in motion. In order to understand stick-slip motion in friction, the classical laws that friction seemingly follows should be explained. The Amontons- Coulomb laws are the foundation of the study of friction; these two laws explain that the frictional force and applied load are directly related, the frictional force is independent of contact area, and the kinetic friction regime is not affected by velocity. Stick-slip motion is when an object does not slide smoothly across a surface. This start-stop motion causes fluctuations in the frictional forces.

In this study, I embarked on a journey to further delve into the use of Velcro® as a mesoscopic model for stick-slip dynamics. Since Velcro® is a hook-loop system, we determined it would be a prime example of stick-slip motion. Multiple trials were conducted while the hook bottomed Velcro® slid across the looped section of Velcro® in a shearing motion. These experiments helped better understand the dynamics of stick-slip motion. Though there were difficulties in using such a complex system, it was discovered that the stick-slip motion of Velcro® follows the classical law set forth by Coulomb i.e. the system showed the frictional force is independent of the velocity but system violates Amontons's law and demonstrated a linear dependence of the frictional force with area. A graph of the frictional force as a function of load showed that instead of a linear fit expected, which would depict a constant coefficient of friction, the system showed an power law functional dependence. The slope of the linear graph should be the coefficient of friction however the curve depicts the non-constant behavior for coefficient of friction for Velcro®. The system also yielded that the frictional force as a function of area was a linear fit. Both of these concepts are in stark contrast to the classical laws established by Amontons.

Future studies will probe aging and relaxation in this system. These experiments will examine the ability for the Velcro® to attach and detach itself and attempt to detect if the Velcro® will have the same strength after being pulled and rested for a certain period of time.

The Acoustics of Stick-Slip Motion Using Velcro® as a Model System

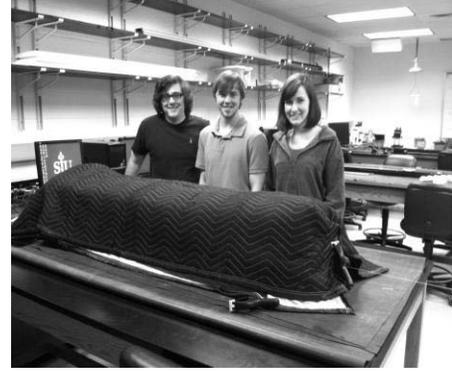
Miles Radziwanowski, '15

Leslie Morrow, '15

Sebastian Parra Hurtado, '15

Faculty Mentor: Paul J. Angiolillo

Department of Physics



Supported by the Howard Hughes Medical Institute and the
Department of Physics

Friction, a force that opposes motion, is a commonplace phenomenon that despite centuries of inquiry and research still remains largely unexplained. Classical friction laws, such as Amontons-Coulomb friction law, state that frictional force is directly proportional to the load or the normal force on an object and is independent of contact area. The ratio of the frictional force F to the normal force N is constant and is equal to the coefficient of friction μ . Additionally, the kinetic force is independent of sliding velocity. Moreover and interestingly, the interaction between the surfaces of objects produces a sound. The sound that comes from dry friction, known as acoustic emissions (AE), can help further the understanding of friction, especially when in stick-slip motion. Stick-slip motion is the spontaneous jerky motion between two surfaces when in relative motion; this motion may be periodic, chaotic or random. Studies in stick-slip motion help to understand the movements of tectonic plates, machine parts, nanomechanical motion, and can even be applied to the financial market.

Velcro was used as a mesoscopic model system to represent stick-slip friction on nano, micro, and macroscopic levels. Its hook and loop system imitates the interaction between asperities on seemingly smooth surfaces. The velcro hooks were cut into areas of 1, 2, and 4 cm² and were adhered to blocks using epoxy. The velcro loop track was placed in an anechoic chamber and microphones were spaced out over the track to record the sound generation of the stick-slip motion. A force sensor was placed on the Velmex (in a sound deadening chamber) and was attached to the blocks by a hook and fishing line with a spring constant of about 2000 N/m.

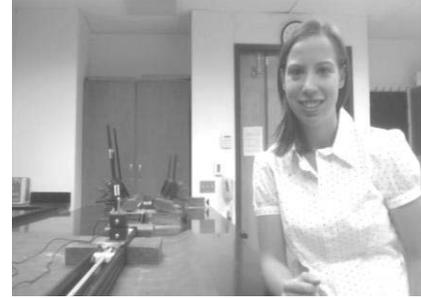
Because both acoustic and force data was being taken it was absolutely mandatory that the two sets of data were time synchronized. Time synchronization turned out to be one of our biggest obstacles. At the start two computers were used and no computer program could faithfully synchronize the two data sets. In the end, to achieve time synchronization the experimental set up was rearranged and the force and acoustic data were ran through the same interface.

Once our data was synchronized, we found that the beginning of the initial slip was visible in the audio data a few milliseconds before each drop in the force graph. Frequently, precursor events were visible in the acoustic profile where it is not clearly in evidence in the force-time profile. These two factors together could prove to be very useful in predicting slip events in not only this system, but in geophysics, and other areas of stick-slip motion. Furthermore, organizing the acoustics data can be a daunting task, so we have begun to bin the data using threshold values so computer programs can recognize AEs. The next step in the process is to take these AE and corresponding drop in force, get an energy distribution from this data. The data should show similarities to the Gutenberg-Richter scale for earthquake data.

Non-Classical Frictional Behavior of Velcro[®]

Lisa Mariani, '14

Faculty Mentor: Paul Angiolillo
Department of Physics



Supported by the Howard Hughes Medical Institute

Friction is the force that opposes motion, and friction exists in two forms, static and kinetic. Static friction opposes the potential for motion. In order to achieve motion, or sliding, a force larger than the maximum static frictional force must be applied to an object. Once an object is sliding, the force that opposes motion is kinetic friction. Kinetic friction is smaller in magnitude than static friction. Classically, friction is described by the Amontons-Coulomb laws. From Amontons, we get the direct relationship of friction with respect to applied load and the independent relationship of friction with respect to apparent contact area. The applied load is the force provided to the top of the system upon which the friction is acting, and the apparent contact area is the macroscopic measurement, as opposed to the real microscopic contact points, of the contact surface. From Coulomb comes the independence of friction with respect to the driving velocity of a system. Friction acts on both systems that slide smoothly and those that experience starting and stopping. The starting and stopping of sliding is known as stick-slip motion. Stick-slip motion is characteristic of processes such as the wearing of machine parts and the interaction of Earth's tectonic plates.

We have developed a unique model system using Velcro to study the dynamics of the static and kinetic regimes of stick-slip friction. Velcro is a hook and loop system that exhibits all of the hallmarks of stick-slip motion when in shear. The interaction of the hooks and the loops provides a model for the microscopic real contact points in systems. Therefore, we define our contact area as the number of hooks involved in the sliding. Our investigation begins with an analysis of the conformity of our system with the Amontons-Coulomb laws. We see a classical behavior of the independence of the frictional force with respect to driving velocity across three orders of magnitude. The classical behavior, however, ends there. We see non-classical behavior when varying the applied load and the hook number. Rather than an independent relationship, the data evinces that the frictional force obeys a linear relationship with respect to hook number. The slope on this relationship is 0.14 for static friction and 0.066 for kinetic friction. With respect to applied load, there is a power law dependence of the frictional force. This power law dependence shows that the coefficient of static and kinetic friction is not a constant of the material. In addition, the coefficient seems to reach a constant at higher loads. This implies a certain critical load that, when surpassed, causes the material to have a constant coefficient of friction, and therefore, a linear frictional dependence on the applied load. Furthermore, the ratio of the maximum static friction to the average kinetic friction is a constant. Finally, the way in which the amount that the frictional forces fluctuate in the stick-slip kinetic regime with respect to hook number follows a power law similar to that of a random walk, with an exponent of .44. The basic nature of friction and the transition from static to kinetic friction remains a conundrum, and these results have provided us with the possibility of gaining an insight into the nature of friction and stick-slip motion.



Catalina Arango
Department of Biology
Saint Joseph's University

Ph.D. University of Massachusetts

Research Interests: Environmental
Microbiology and Bacterial Gene
Regulation

Bacteria are my passion. I am fascinated by the sophisticated mechanisms that bacteria use to control their gene expression in response to environmental conditions, and most of my research is directed towards understanding these mechanisms. For example, some bacteria are able to “choose” the most energetically favorable carbon source when there is more than one available in the environment and use it first. 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! I use the bacterium *Sinorhizobium meliloti* as a model organism to study catabolite repression. My students and I are trying to understand how catabolite repression works in *S. meliloti* by studying a specific group of genes, the *mela-agp* operon, which are necessary for the utilization of certain sugars. We hope that by learning more about how catabolite repression affects these genes, we can gain understanding of how it controls other genes. We are also 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.

The symbiotic relationship of *S. meliloti*'s and alfalfa provides the opportunity to study another aspect of gene regulation. In this case, each organism may affect the regulation of genes in the other one as both respond to the environment. I am trying to find out how an increase in atmospheric CO₂ will affect this interspecies conversation and its outcomes, plant nodulation and nitrogen fixation.

Determining the effect of higher atmospheric [CO₂] on the symbiotic relationship of *Sinorhizobium meliloti* and alfalfa

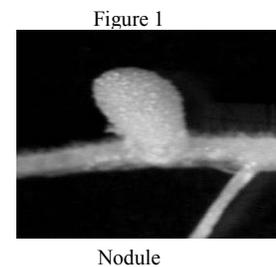
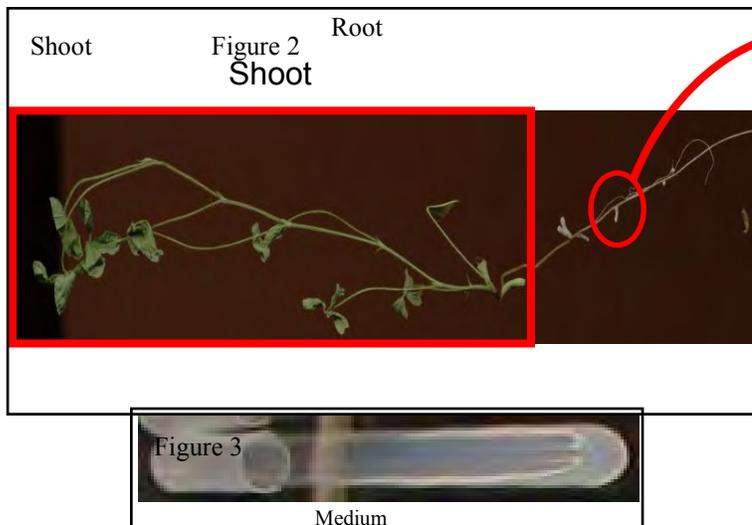
Andrés Raúl Fernández Vizcarrondo, '14

Faculty Mentors: Catalina Arango, Clint Springer
Department of Biology



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

Alfalfa (*Medicago sativa*) plants, establish a relationship with bacteria (*Sinorhizobium meliloti*) that becomes beneficial for both. In this symbiotic relationship, the plant develops nodules (Figure 1) in the roots (Figure 2) to house the bacteria. The bacteria obtain carbon from the plant, which is crucial for the development of any life form, while the alfalfa plant obtains a new source of nitrogen through the bacterial process of nitrogen fixation. Nitrogen fixation transforms the unusable form of nitrogen from the air (N₂) into ammonium (NH₄), which is a usable form of nitrogen that the plants can use to develop and grow. The purpose of this project is to determine if higher levels of atmospheric CO₂ concentrations affect symbiosis. We are monitoring the number of nodules, shoot biomass (Figure 2), nitrogen fixation efficiency and nodule structure under conditions of ambient (400 ppm) and elevated (900 ppm) levels of carbon dioxide. We are also assessing whether two *S. meliloti* mutants (*nodL* and *phbA*), when a strain of a bacteria does not function the same way as its most common strain, are affected in a similar way as the wild type (Rm1021), the most common strain of the bacteria. To evaluate nodule number, nodule structure and shoot weight, we are growing plants in nitrogen-free medium (Figure 3) at ambient (400 ppm) CO₂ concentrations or at elevated (900 ppm) CO₂ concentrations, inoculating them with the *S. meliloti* strains, monitoring nodule number weekly, and harvesting them after 2 or 4 weeks. To evaluate nitrogen fixation efficiency some plants are grown in medium with isotopically labeled nitrogen (¹⁵N, a different form of nitrogen). The nitrogen isotope labeling will allow us to estimate the proportion of nitrogen that is being fixed by the nodule as a measure of nitrogen fixation efficiency. Preliminary results showed an increase in shoot mass but a decrease in nodule number when plants inoculated with the wild type were exposed to elevated CO₂ concentrations. In contrast, the *phbA* mutant exhibited an increase in both shoot biomass and nodule number. Because these results were different than expected, we are conducting experiments to confirm them, and also to evaluate nodule structure and nitrogen fixation efficiency.



Carbon Catabolite Repression in Cave Bacterial Isolates

Bryan Hennessy, '12,'13

Faculty Mentor: Catalina Arango
Department of Biology



Supported by the Howard Hughes Medical Institute and the National Science Foundation

Carbon catabolite repression (CCR) is a regulatory mechanism that enables bacteria to utilize the most energetic carbon source, when two carbon sources are present together in the environment. A common mechanism to regulate CCR is the phosphotransferase system (PTS), which in many cases serves as a global regulatory system. The objective of the project is to examine for the occurrence of catabolite repression in bacterial isolates from the deep subsurface Lechugilla cave, and to correlate it with the presence or absence of genes encoding for several of the key PTS proteins. Isolates identified and correlated to surface counterparts by 16S rRNA identification include *Brevibacterium casei*, *Streptomyces flavus*, *Rhodococcus erythropolis*, *Sphingomonas pseudosanguinis*, *Paenibacillus lautus*, *Pseudomonas stutzeri*, *Achromobacter sp. SY8*, and *Ensifer adhaerens*.

CCR was evaluated through observation of a diauxie in broth cultures or by β -galactosidase detection in colony growth, when two carbon sources were available. A diauxic growth curve is characterized by an exponential phase in which a primary carbon source is used, then a lag is exhibited followed by another exponential phase in which a secondary carbon source is used (Figure 1). β -galactosidase, when expressed turns colonies blue. β -galactosidase is expressed when the secondary carbon source lactose is being used, and delayed appearance of blue coloration can indicate the occurrence of CCR (Figure 2). Primary carbon sources evaluated were glucose and succinate, while secondary carbon sources evaluated were lactose, raffinose and galactose.

We hypothesize that the presence of genes for the PTS proteins correlates with the occurrence of catabolite repression. Presence of genes for these proteins is being verified through PCR analysis using primers specific for PTS genes. The rationale is that cave bacteria persist in an environment with minimal nutrient resources, thus catabolite repression may contribute to the optimal use of the limited resources available in this particular environment.

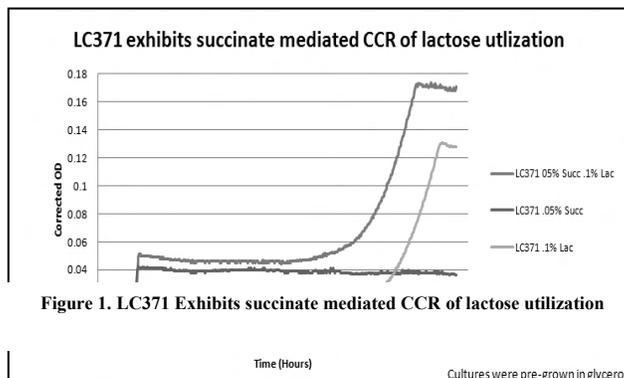
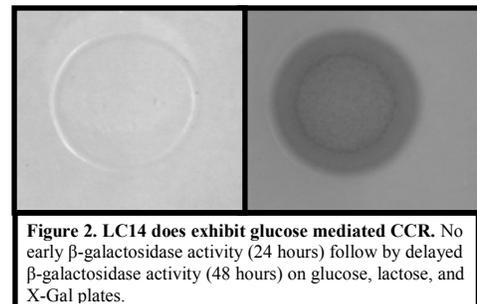


Figure 1. LC371 Exhibits succinate mediated CCR of lactose utilization



Investigating the regulation of the *Sinorhizobium meliloti melA-agp* promoter

Andrew Shaffer, '14

Lianette Pappaterra, '15

Faculty Mentor: Catalina Arango
Department of Biology



Supported by the Howard Hughes Medical Institute and the John P. McNulty Scholars Program

Heterotrophic bacteria are bacteria that use organic carbon compounds as food. Most heterotrophic bacteria can utilize a variety of compounds as carbon sources, but in some cases these carbon sources are not used simultaneously. Instead, bacteria may exhibit carbon catabolite repression (CCR), in which they preferentially use one carbon source over secondary sources. The bacteria will first use the source that is best for their metabolism and growth, and then use the other available sources.

The bacterium that we study, *Sinorhizobium meliloti*, exhibits succinate-mediated CCR, meaning that succinate is used first when *S. meliloti* is grown on two different carbon sources. In order for this to occur, the genes that code for the proteins that bring the secondary carbon sources into the cell and break it down must be “turned off” in the presence of succinate, but “turned on” when succinate is not present. This gene regulation occurs through regulatory proteins that bind to the DNA and either enhance or repress gene expression.

This summer, we studied the *agp-melA* operon. This is a catabolite repression-controlled operon that encodes proteins involved in the metabolism of the secondary carbon source raffinose. Our goal is to elucidate how regulatory proteins interact with the *agp-melA* operon. One of our research objectives was to locate the sequences of the *agp-melA* promoter where regulatory proteins bind. To do this, we screened a library of random mutants that have point mutations in that promoter region and selected the ones that show altered regulation. A second objective was to look for protein partners of the regulatory proteins. Since it is known that the proteins of the phosphotransferase system (PTS) partner with regulatory proteins of CCR in other organisms, PTS mutants of *S. meliloti* were screened for differences in regulation when the quantity of available regulatory proteins was modified. We have identified mutants of interest as well as possible PTS partners, but confirmation of our findings is needed.



Tetyana Berezovski
Department of Mathematics
Saint Joseph's University

Ph.D. Simon Fraser University

Research Interest: Mathematics Teacher Education, primarily Mathematical Knowledge for Teaching, Pedagogical Content Knowledge, and issues of Technology in mathematics teaching and learning.

My line of research is related to advancing and improving the mathematical knowledge of teachers through various professional avenues, such as professional development, coursework, collaborations, summer institutes, and teacher support initiatives. My research aims to understand how prospective and practicing teachers learn mathematics, and how mathematics educators can enhance teacher learning. Consequently, I am interested in how mathematics can be taught, and how to prepare prospective and practicing mathematics teachers to become highly competent and effective in their profession.

Witnessing an increasing influence of technology on our lives, led me to believe that incorporating technological tools into education might change our perspectives on the ways we teach and learn. Thus, my research program associated with technology-related issues in education is primarily based on my belief that generational shifts bring new avenues and exciting opportunities for educational research. With shifts in technology, some of our knowledge becomes obsolete - creating the need for new more suitable knowledge (that may not be familiar to us). To continue the research, we need to gain a better understanding of what the up-coming generation of students needs to know (or knows already), how they learn and process new information, and how does technology affect their thinking, learning, and cognitive interactions. Perhaps, understanding these phenomena would allow a finer definition of cyber learning, and consequently develop new models of teaching, namely “cyberteaching”, specifically in mathematics.

Investigation into Mathematical Knowledge for Teaching

Sarah Bell, '13

Josh Bargiband, '12

Faculty Mentor: Tetyana Berezovski
Department of Mathematics



Supported by the SJU Summer Scholars Program

In the summer of 2011, Saint Joseph's University offered a Summer Institute for practicing mathematics teachers in the School District of Philadelphia. As a part of this institute, teachers were enrolled in MED 611, Geometry for Teachers: From Problem Solving to Proofs. It was a research-designed course focused on the improvement of Mathematical Knowledge for Teaching (MKT) geometry. As a part of the Summer Scholars Program, we investigated and explored the data collected in this course.

To begin our research, we had to establish an appropriate framework for the evaluation of the data. The data consisted of teachers' reflections to the assigned mathematical tasks and pre- and post-test results. We focused on two dimensions of MKT, namely Subject Matter Knowledge (SMK) and Pedagogical Content Knowledge (PCK). We classified the teachers' reflections by the type of purpose (mathematical or instructional) that they identified for each particular task.

We then compared the classified reflections to the results of the pre- and post-test. The test consisted of NAEP questions, which were used to assess the change in PCK; and GRE questions, which were used to assess the change in SMK. With respect to teachers' knowledge, our initial conjecture was that teachers who tend to focus on mathematical purposes of the assigned tasks would exhibit greater growth within SMK and those who tend to focus on instructional purposes of the tasks would show substantial change within PCK.

When analyzing the conjecture through the designed framework, we found that the results do not contradict our conjecture, yet are not statistically significant to support it. This result could be due to the fact that our sample size was relatively small. However, the results are promising with respect to the potential of the framework as a research tool. In the future, we plan to refine this framework and analyze a larger set of data.

Shapes of Domes through the Mathematical Eye

Lisa Chen, '14

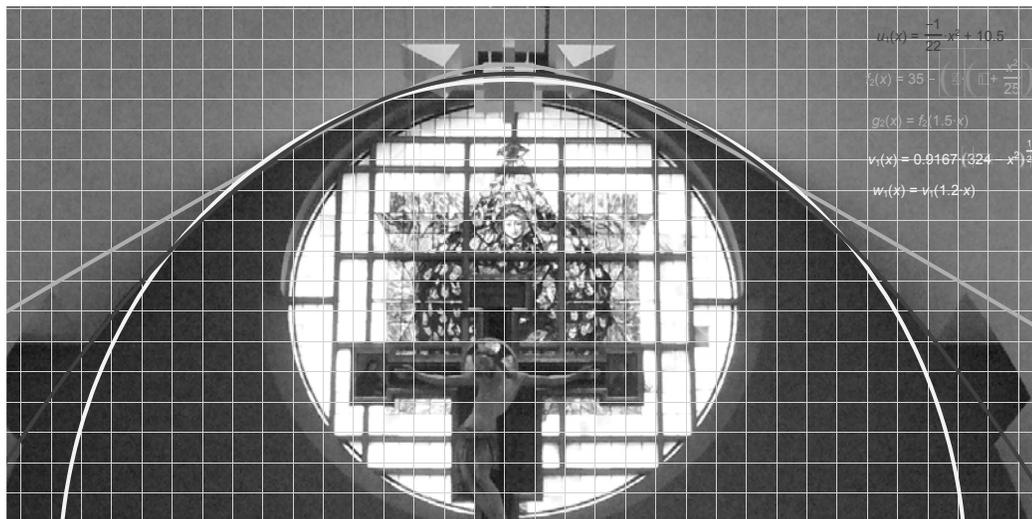
Faculty Mentor: Tetyana Berezovski

Department of Mathematics

Supported by the SJU Summer Scholars Program



This summer I photographed various domes around the Philadelphia area, and learned about their geometric shapes, using dynamic software called the Geometer's Sketchpad. I also learned algebra of conic sections, including the transformations of conic graphs. The major focus of my work was to study the geometry of various shapes of domes, including onion-shape and conic domes. While working on my project, I began to understand how various representations of functions are connected, in particular equations and graphs. Sometimes, different types of conics can represent the same image. Thus, I had to experiment with different graphs to find the best-fit function. Below, is the picture of the Saint Joseph's Chapel that has all three conics plotted: parabola, hyperbola and ellipse.



While working on this project I also reflected on my own process of learning, recording my efforts, errors and successes. I tried to explain my thinking, and evaluate the cognitive potential of this project. This meta-cognitive aspect of my study helped me to realize why students find the concept of conics difficult. I plan to continue this study in the future and design meaningful learning activities for students that would help them to understand the concept of conics and functions.



Frank Bernt
Department of Teacher Education

Ph.D. Educational Psychology
Temple University

Research Interests: Spiritual
Development; Prosocial Behavior;
Moral Education; Tests and
Measurement

Educational assessment is generally assumed to relate primarily or solely to academic or cognitive outcomes; this is in spite of the fact that most schools (and certainly Jesuit ones) explicitly include moral, social, and character goals in their mission statements.

Because measuring affective educational outcomes carries a number of obstacles and “yeah, buts” with it, the fact is that most educational leaders and teachers don’t spend much energy in determining whether their efforts at character formation and moral development are effective, nor in how they might change programming and pedagogy to effect desired affective learning outcomes.

William Popham, a leader in the field of educational assessment, insists that we “measure what we treasure.” He further argues that assessment, when done well, improves instruction. It stands to reason that more intentional efforts to measure our success in “teaching matters of the heart”—both during the teaching process and when the dust has settled—is an essential and very practical element of the Ignatian *magis* to which we are committed.

I worked with two students this summer in the area of affective assessment. Scott Pyzik worked with administration and faculty at the newly-formed Cristo Rey School in North Philadelphia, to explore how efforts to integrate character formation with English literature might be assessed and improved on an ongoing basis. Lauren Mifsud worked closely with PSIP (Philadelphia Service Immersion Program) coordinators and student leaders on campus to see how its impact might be assessed and to explore ways of enriching that program’s assessment component.

Assessment of the Philadelphia Service Immersion Program (PSIP)

Lauren Mifsud, '14

Faculty Mentor: Frank Bernt
Department of Teacher Education



Supported by the SJU Summer Scholars Program

The Philadelphia Service Immersion Program (also known as PSIP) is an optional, pre-orientation program for incoming freshman. The goal of this program is to introduce incoming freshman to SJU's Jesuit values of social justice and service to others. The program began five summers ago, in 2007. Each year the program is led by one student intern and two student coordinators. These three student leaders then select multiple students to lead the incoming freshman to different service sites. During the program, groups of students are taken to one service site by their student leader, at which they volunteer for the duration of PSIP.

The students are also introduced to a variety of historical and cultural destinations in Philadelphia as well. This is done through PSIP's "Philly Destination" program. During this portion of the program, each group of students is taken to a different destination, chosen and led by a Saint Joseph's University faculty member. Not only do the students get to experience the history and culture of Philadelphia, but they also get to meet an SJU faculty member. They are provided with the opportunity to ask any questions that they may have about the academics that they will be faced with during their freshman year.

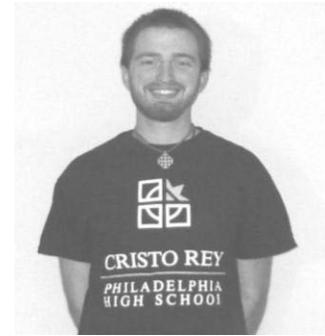
My project focused on providing the PSIP committee with a way to assess the program that has developed over the past five years. I read multiple sources regarding how to design survey studies, by several authors including Arlene Fink, Delbert Miller, and Gary Henry. I then constructed four separate surveys that the PSIP committee will be able to use at the completion of this year's program. These four surveys will assess the experience of the participating students, the participating "Philly Destination" faculty, the service site coordinators, and the student leaders. It is with the surveys that I have created, that the PSIP committee will be able to better evaluate the program, to help it improve year after year.

The Significance of Character Formation within the Cristo Rey Classroom

Scott Pyzik, '14

Faculty Mentor: Francis Bernt
Department of Teacher Education

Supported by the SJU Summer Scholars Program



Throughout the nation, there are twenty-five Cristo Rey schools that focus on educating financially disadvantaged young men and women in urban environments. Throughout the summer months, I have been able to work alongside the faculty and staff of the newest member of the Cristo Rey community: Cristo Rey Philadelphia High School. This Catholic, college preparatory school will welcome its inaugural freshmen class with the start of the academic year in August 2012. One of the main advantages of the Cristo Rey school model is the hands-on, work-study program that allows students to obtain work experience, while receiving financial assistance to offset the cost of tuition. Although endorsed by the Oblates of St. Francis de Sales and the Sisters of the Immaculate Heart of Mary, a strong foundation in Ignatian pedagogy can be seen as a fundamental aspect of the Cristo Rey Network since the Society of Jesus founded the first school in Chicago in 1996.

As an English major with an interest in high school education, I wished to research the topic of how Cristo Rey Philadelphia and other schools within the Network focus on superior academics while striving to foster the moral development of their students within the classroom. By combining scholarly, textual research with real-life experience, I was able to delve further into my research by utilizing Ignatian pedagogy. Through attending and participating in weekly faculty and staff development meetings at Cristo Rey Philadelphia, conversing with various teachers from the Cristo Rey Network all along the East Coast, to assisting in coordinating and co-teaching a class during CRPHS's "Day One" orientation, I have been able to visualize connections in each situation that point towards the goal of allowing the character of the student to grow and form. For example, the students already are being asked to look inwardly and reflect on their own lives through their summer reading of the book "Monster", the story of Steve Harmon, an African American, teenager, accused of assisting in murder and robbery.

Although each Cristo Rey School has its unique method of approaching the goal of "cura personalis" or "care of the individual", I have been able to appreciate one solid aspect of Cristo Rey Philadelphia: having faculty and staff, alike, use their lives as examples of what it means to have fully developed morals and character. Along with reflecting on the analytical and experiential research, my final work will view the first steps of Cristo Rey Philadelphia alongside other schools in the Network. This will allow me to analyze their methodology and to perceive Cristo Rey Philadelphia's future areas of strengths and shortcomings in nurturing and developing the whole individual, the whole student.



James Boettcher

Department of Philosophy
Saint Joseph's University

Ph.D. Boston College

Research Interests: Contemporary
Social & Political Philosophy

For several years now, my primary research program has been to investigate an ethics of liberal-democratic citizenship in light of the fact of enduring religious and philosophical pluralism. At the center of the philosophical literature on this topic are a number of arguments for and against proposed moral requirements of citizenship and deliberation. Along these lines, I have attempted to defend an interpretation of the “idea of public reason,” initially developed by American political philosopher John Rawls (1921-2002). Some of the main questions addressed in this area of my work are as follows:

- What kind of justifications do citizens and government officials owe one another for their exercise of coercive state power?
- Should liberal-democratic states remain neutral with respect to religious doctrines, perfectionist values and substantive ethical conceptions of the good? If so, how should the meaning of state neutrality be specified?
- To what extent may government officials and/or ordinary citizens rely on religious doctrine in publicly discussing, advocating or voting for matters of coercive law and policy? Do officials and/or citizens violate any moral requirements of citizenship when they rely solely on religious grounds in their political activity?
- If there are (non-legal) normative requirements to exercise restraint with respect to religious doctrine in political deliberation and decision-making, what is the moral status of requirements of this sort? Are such requirements duties, virtues or supererogatory ideals? How much weight should they carry, especially when they appear to conflict with other obligations or expectations?

A second set of research interests began with a course on “Toleration and Multiculturalism” that I developed at Saint Joseph’s and taught each fall from 2006 to 2011. The work associated with this course contributed directly to papers published or forthcoming on the following topics: (1) racial injustice and ideal theory in political philosophy, (2) the status of minorities within minority groups, and (3) immigration policy and the need for a shared civic-political identity.

**Exploring Political Philosophy:
A Critique of Libertarianism**
Gia Montemuro, '13

Faculty mentor: James Boettcher
Department of Philosophy

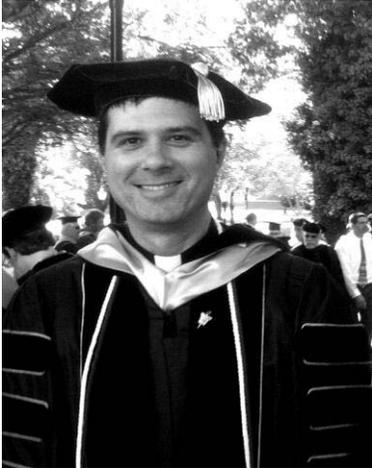
Supported by the SJU Summer Scholars Program



In the most general philosophical sense liberalism is the theory that treats liberty as the fundamental political value and as central to the justification of political authority. Upon the creation of the United States of America, the Founding Fathers expressed a number of liberal ideals in the Constitution. Indeed, some of these ideals can be described as fundamentally libertarian in nature. Though the American experiment has been successful on the whole thus far in protecting the liberty of its citizens, libertarian and liberal theories are not without their critics.

The research completed this summer consisted of reading a number of primary and secondary texts and articles that focus either on defending or critiquing liberalism, the general theory to which libertarianism belongs. Texts which defend the liberal or libertarian view included J.S. Mill's classic On Liberty, Robert Nozick's Anarchy, State, and Utopia, as well as an excerpt from Isaiah Berlin's iconic essay "Two Concepts of Liberty." Background reading also included John Locke's Second Treatise on Government. One text offers a different path than classical liberalism, but nevertheless agrees that freedom is paramount is John Rawls' Justice as Fairness. The goal in reading these classic texts along with articles and commentaries from the secondary literature was to give me a broad understanding of the strong attributes as well as the difficulty of certain points within liberal theory.

After completing the reading required for this research project, I then engaged in writing an article-length paper critiquing a few important tenets of libertarian theory. Parts of the paper provided a specific interpretation of libertarianism, justice, and legitimacy. The criticisms addressed in the paper include concerns with the ability of non-governmental agencies to provide services to the public, the ability of a libertarian society to maintain stability and legitimacy, and the difficulty of protecting individual citizens' rights. The overarching theme of the paper was the impracticality of the theory of libertarianism. By completing this research, I plan to submit the text to an undergraduate conference and possibly a journal.



John M. Braverman, S.J.

Department of Biology
Saint Joseph's University

Ph.D. University of California,
Davis

Research Interests: Evolutionary
genetics in viruses and plants

Two different individual organisms from the same species often differ in their DNA. I want to know why. So the basic scientific question unifying my research on diverse organisms is: “What explains their genetic variation?”

This summer, my Summer Scholar and I studied the bounty of viruses found in soil. The dirt all around us on the SJU campus and near our homes contains a virus called phage. A special freshman biology lab called Phage Safari had already pioneered SJU research on virus. We took this research into the finest scale. To do such fine scale research, we had to have a lot of viruses. To work with large samples, we are developing a faster method to obtain DNA from soil samples. It is faster because it skips the step of culturing viruses.

Meanwhile, we also studied two very small regions of the virus genome. Fortunately, DNA sequence data is publically available in the databases. We obtained and classified that data for analysis. At these two places, genes, really, we found moderate levels of structuring (or differentiation) between different locations in the U.S.

All the research can help narrow down why viruses differ at the genetic (DNA) level. 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?

From this summer's research, thanks to the diligent and quality work of my summer scholar, we have an excellent foundation from which to answer these important scientific questions of evolutionary biology.

Variation in Mycobacteriophage Due to Differences in Geography

Caitlin Callaghan, '13

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



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

The objective of my research is to describe genetic differences in mycobacteriophage associated with location, and to then explain this observed genetic variation. Mycobacteriophage are viruses that infect bacteria. These phage are found in soil, even in your own backyard. While there have been previous studies on mycobacteriophage, there have been no studies of the DNA sequence variation within individual genes of the mycobacteriophage. To study the genetic variation of mycobacteriophage, I studied two genes found in phage, the *Major Tail Protein (MTP)* and the *Tape Measure Protein (TMP)* genes.

To begin my research, I designed primers. A primer is an oligonucleotide sequence that matches the section of DNA that you are trying to study, so that you can make many copies of it. In my case, I made primers for the *MTP* and *TMP* genes. This required me to obtain the already sequenced phage from a database and align their genes. I then designed primers to amplify the *MTP* and *TMP* genes of the new mycobacteriophage.

To obtain new mycobacteriophage, I went into the field and collected random soil samples. I then isolated DNA from the soil samples. Next I performed a Polymerase Chain Reaction (PCR) using the previously designed primers to make many copies of the *MTP* and *TMP* genes from the phage. The PCR product with the amplified genes was then purified and sent out for sequencing.

Another part of my research included bioinformatics. I aligned the *MTP* and *TMP* genes of already sequenced mycobacteriophage and performed tests for selection to ensure that there was genetic variation and then to try to explain the methods for this genetic variation. These tests include ones that pair the aligned genes and examine how many differences there are between their nucleotide sequences, calculate ratios of changes in the nucleotide sequences that lead to similar or different amino acid sequences, and correlate these genetic variations with the mycobacteriophage's geographic location.

One important result from this summer was sequencing a gene which no one had ever seen before, and it was a very high quality sequence. This was for a phage isolated in the lab, and it meant that phage DNA was successfully being collected directly from soil. Using the tests explained earlier, genetic variation was found as well as evidence for selective constraint, meaning that these genes are maintained over time, working with the force of natural selection. As to correlate this variation with geographic location, a comparison of database samples from across the U.S. showed a small amount of structure among different populations. Getting these results was important because it illustrated that we can complete the entire research objective from start to finish.



Audre Brokes

Department of Philosophy
Saint Joseph's University

Ph.D. University of Washington

Research Interests: Epistemology,
Contemporary Analytic Philosophy

My current research focuses on the nature and justification of inference, both deductive and inductive. Currently, I am trying to understand what justifies a certain kind of probabilistic inference known as direct inference, in which a definite probability statement is inferred from an indefinite probability statement.

I have general interests in problems in current analytic epistemology, the work of Wilfrid Sellars, and feminist theory.

Royce on the Entities of Mathematics

Kelly Cox, '13

Faculty Mentor: Audre Brokes
Department of Philosophy

Supported by the SJU Summer Scholars Program



Bertrand Russell's most important early work on the foundations of mathematics is his *Principles of Mathematics* published in 1903. Predating his landmark *Principia Mathematica* by almost a decade, the *Principles* contains, nevertheless, the fundamentals of what came to be known as 'Logicism' – the view that “mathematics and logic are identical.” (*Principles of Mathematics*, Preface to Second Edition, 1931) The influence of Russell's views is hard to overstate: the publications of the *Principles* and later the *Principia* revolutionized the philosophical approach to the foundations of mathematics and logic and continues to drive scholarly inquiry today.

While Russell's views on logic and the foundations of mathematics have received wide attention in 20th and 21st century philosophy, the views of his immediate historical predecessors have received considerably less. This is unfortunate, for even at the time of its publication the *Principles* was thought by many to owe more to the work of philosophers in both the British Idealist and American Pragmatists schools than Russell, himself, allowed. In the United States, the work of C.S. Pierce and Josiah Royce (with which Russell was known to be familiar) has been overlooked as a result of the ascendancy of Russell's approach to logic. Most interesting, perhaps, is that Pierce and especially Royce were actively engaged in their own projects concerning the foundations of mathematics at the time the *Principles* was published, and both Pierce and Royce responded to Russell's revolutionary work (in published and unpublished accounts) and grappled with its implications. As a consequence of the influence of Russellian Logicism, however, many of these interesting pieces have not received the scholarly attention that they, arguably, deserve. This project is a step toward ameliorating this omission by examining one of Josiah Royce's works, the unpublished “What Sort of Existence Have the Entities of Mathematics,” which Royce composed in 1907.

The paper is held at the Josiah Royce Archives at Harvard University. My project involves the examination and evaluation of this unpublished manuscript and is, thus, both a philosophical and an historical/scholarly enterprise. I argue that Royce's views on the nature of mathematical entities, a central concern for Logicism, are both historically and philosophically important. In particular, Royce's views foreshadow later work done in modal logic and offer significant insights into the state of the debate concerning mathematical entities at the time of its publication. Moreover, and more generally, Royce's work helps us develop a fuller appreciation of the significance and impact of Russell's early logical inquiries – the inquiries that were to drive the study of logic throughout much of the 20th and into the 21st Century.



Tom Buckley
Department of Modern &
Classical Languages
Saint Joseph's University

Ph.D. University of Pennsylvania

Research Interests: Contemporary
German Crime Fiction

My research interests have shifted over the course of my career. Initially, I did research in the field of literature and science, which explores the interrelations between these two fields. In particular, I focused on the discourse between both fields from mid-19th century German realism until the Turn of the Century. At present, I have been working on contemporary German crime fiction. My specific focus in this instance is the inclusion of Nazi/World War II themes within post-unification (after 1990) German crime fiction. Such inclusions would have been unthinkable in the immediate decades following World War II. In addition, I have been investigating how this development relates to the German memory discourse, which has emerged in the 1990s. The memory discourse looks at the broad spectrum of German experiences during the 1930's and 1940's, essentially the Nazi period, and incorporates German Nazi and wartime experiences, not publically discussed in the past, such as the suffering of Germans during the Allied aerial bombings and the expulsion from the eastern territories. Another recent post-unification phenomenon I have been investigating is the portrayal of immediate post-WWII culture, particularly the late 1940's, in contemporary German crime fiction.

My research interests bears little direct connections to the work my summer scholar, Gillian Clark, is pursuing this summer, namely an investigation of German economic development after World War II. This is more of a teaching interest of mine, as I have taught Business German in the past and have included economic issues in other courses I have taught.

Die Wirtschaftsentwicklung von Deutschland nach dem Zweiten Weltkrieg

Gillian Clark, '13

Faculty Mentor: Thomas Buckley

Department of Modern & Classical Languages

Supported by the SJU Summer Scholars Program



Germany's economic performance throughout the twentieth century is truly remarkable. After WWI (1914-1918) Germany was left in shambles especially with the harsh terms of the Treaty of Versailles signed in 1919. Germany was blamed solely for WWI despite the many other countries who also played a part. The terms required of Germany were: reparations ultimately plunging the country into debt, loss of territory and more. Between WWI and WWII, Nazism was on the rise with the main goal to "make Germany the most dominant power in Europe, and to gain revenge for the German defeat in WWI". WWII (1939-1945) once again left Germany in shambles with the bombing raids and destroyed factories, cities, and transportation system.

The face of Germany changed significantly as Berlin was divided into 4 zones along with the creation of East & West Germany. With communism on the rise, the Soviet Union ruled over East Germany. Russia refused aid from the Marshall Plan, which was money allocated to help destroyed countries in the aftermath of WWII. Collectivization was implemented turning private farms into public property under the name of the government. In 1948, the Soviet Union imposed the Berlin Blockade shutting off access to the other 3 zones in Berlin, which prompted the Berlin Airlift. East Germany cut off most relations with West Germany, as they attempted to create their own identity. West Germany has a very different story, as they accepted help from the Marshall Plan, which rebuilt the devastated country. A new currency, the Deutsche Mark replaced the collapsed Reichsmark. Longer working hours were imposed, along with other improvements to heighten the economy's efficiency. Given West Germany's impressive economic development during the 1950's, this time period is known as the *Wirtschaftswunder*, the economic miracle.

Due to the vast differences in the two Germanys, millions and millions of East Germans fled. The increasing numbers led to the construction of the Berlin Wall in 1961 to keep the East Germans within the territory. This physical barrier symbolized the Iron Curtain of Communism, separating countless families and friends until 1989. A year later in 1990 Germany officially unified.

Germany has emerged as one of the most powerful countries in the world, and the number one economic powerhouse in Europe. Despite the turbulent economic crises in the 20th century, Germany has managed to come out on top.



Janée N. Burkhalter

Department of Marketing
Saint Joseph's University

Ph.D., Marketing, Georgia
State University

Research Interests: New media, marketing communications, niche markets of consumers, responsible business practices 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.

Greenwashing in Marketing for Cosmetics

Lauren Bogen, '13

Faculty Mentor: Janée Burkhalter

Department of Marketing

Supported by the SJU Summer Scholars Program



Over the past few years, one can notice the frequency of companies “Going Green”. When a company promotes this idea, it is the perception of the customer that the company has altered their products, services, production, transportation, or advertising in such a way that it positively impacts the health of the environment in one or more ways. Unfortunately, some of these companies have not implanted anything more than a creative marketing strategy aimed at persuading their target market of a connection to the growing green trend. An astonishing 95.5% of all products with green claims are greenwashing.

Although the popularity of the green trend decreased slightly during the recession, recent growth in the economic sector has increased the spending of green products significantly. Also contributing to the increased spending on green products is the rising spending power of Asian Americans and Hispanics. From the research that I have gathered, the popularity of green goods will continue to flourish. I focused my project on one of the most interesting segments of the green market, namely cosmetics. During my project, I collected recent print, television, and social media advertising for green cosmetics on a national and international level. Then, I examined each one closely to determine if one or more forms of greenwashing occurred.

There numerous kinds of greenwashing. However, I focused on seven provided by Terra Choice. The seven include the hidden trade-off, no proof, vagueness, false labels, irrelevance, lesser of two evils, and fibbing. Within the cosmetics advertisements I examined, greenwashing was rampant. That is not to say that all companies use greenwashing. Companies with honest green claims generally had an environmental focus from the birth of their company. The reasons why greenwashing is so common in the cosmetics segment is due to the lack of consumer awareness, corporate negligence, advertising puffery, and a lack of legal restrictions.

The objectives of my project are to inform consumers regarding the dangers of naïvely accepting green claims in cosmetic advertising, encourage research of current and future cosmetics with the help of third parties such as Good Guide or EWG, and ultimately inspire citizens to request legislation that would prohibit the use of certain toxic ingredients and ban greenwashing. Thankfully, fundamental steps to limit greenwashing on the personal, corporate, and legal levels have been taken by wary scientists and consumers. I sincerely hope that my powerpoint and literary review will contribute to eliminating greenwashing in cosmetics permanently.

The Importance of Marketing Ethics in an Organization

Grace Gunnels, '14

Faculty Mentor: Janée Burkhalter
Department of Marketing

Supported by the SJU Summer Scholars
Program



There has been growing research interest in the area of business ethics. The story that sparked my interest in this topic was the Penn State Scandal from November 2011. When I found out about the scandal, I was intrigued to see how Penn State's community (faculty, alumni, current students, and other members) would react and how Penn State's reputation and image would be affected. My goal for my Summer Scholars project was to examine the many different aspects of ethics in marketing to fully explore why it is important to behave ethically, how to behave ethically, and how a company can recuperate from an unethical decision. To achieve this goal, I researched relevant topics in marketing ethics and then created a website targeted towards students entering the workforce who need to learn and understand the importance of ethics as well as business people who are already in the workforce that may want to learn more about ethics. Once the website was completed, I produced a teaching note designed to give instructors detailed directions on how to use my website to teach the material to an audience. Throughout the process of completing my project, I have learned how to judge how ethical an advertisement is, the importance of the presence of a code of ethics in a company and how to use it as an employee, how important it is for a manager to act ethically for the sake of the business, how consumers view ethical decisions made by businesses and how important a positive ethical reputation is, useful ethical frameworks that can help anybody guide themselves through an ethical dilemma, the brief psychology of ethical behavior, how to distinguish if your business is at risk for behaving unethically, and how to deal with an ethical scandal through public relations. After completing my research, I conclude that behaving ethically is a crucial part of being successful in business because it leads to customers and stockholders being able to trust you and employees enjoying working for you. I have gained a great deal of practical experience and knowledge from my Summer Scholars project including learning the ins and outs of completing research, creating an educational website, and preparing an in-depth teaching note. It is my hope that with the website and teaching note that I created, more business people will learn as much about ethics as I did, and will be able to apply what they learn to real life situations. To see my Summer Scholars project, please visit my website at www.bitly.com/marketingethics.

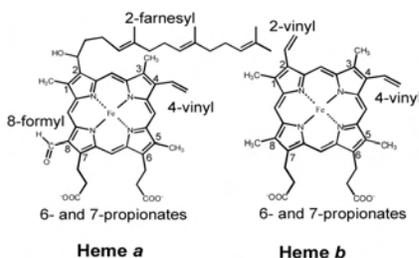


Jose F. Cerda
 Department of Chemistry
 Saint Joseph's University

Ph.D. Michigan State University

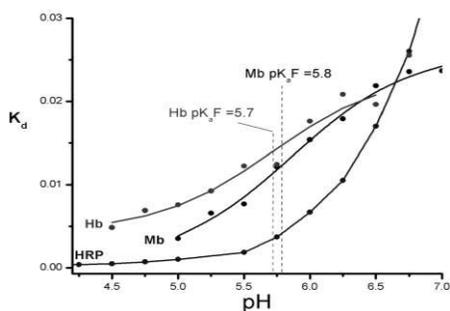
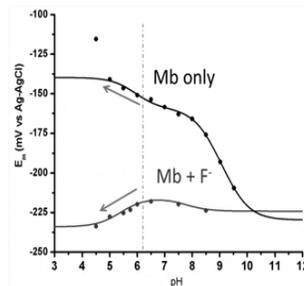
Research Interest: Spectroscopic and Electrochemical Studies of Redox Proteins and Heme Model Compounds

My research objective is the study of the electrochemical properties of redox proteins and redox cofactors. This summer my group specifically study heme proteins (myoglobin, hemoglobin, and horseradish peroxidase) and heme model compounds. Heme cofactors are found in various types of heme proteins, which perform a wide range of key biological functions. These proteins have the ability to utilize the same cofactor for very different 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, a membrane enzyme that generates an electrochemical gradient across the mitochondrial membrane for the production of ATP. Although numerous studies have been performed on heme proteins, quantification of protein-heme interactions is typically difficult because specific heme-proteins interactions are hard to isolate within the protein. One way of studying interactions to the heme is by using heme model compounds dissolved in aprotic solvents.

Another approach in understanding protein-cofactor interactions is to use fluoride binding in heme proteins. Research studies performed in other labs have used fluoride ion as a probe of the heme cavity of proteins. The spectroscopic property of the heme-bound fluoride ion is sensitive to protein-fluoride interactions. In our study, we also used fluoride binding and focused on the pH dependence of the reduction potential (E_m) of the heme-bound fluoride complex (right figure) and the dissociation constant (K_d) values (bottom). The two figures show two important findings with regards to the pH dependence behavior of heme proteins in the presence of fluoride ion: 1) upon decreasing pH, the midpoint potential (E_m) of the myoglobin-fluoride complex decreases at pH below 6. This is an indication that the heme-bound fluoride ion stabilizes the oxidized state of the protein.



This stabilization is caused by the presence of a hydrogen bond between the fluoride ion and a nearby histidine. Such stabilization of the ferric state of the heme is absent when fluoride is not used. 2) In addition, the pH dependence of the dissociation constant K_d is sensitive to the presence of hydrogen bonding to the heme-bound fluoride ion. Myoglobin and hemoglobin both have a nearby histidine that becomes protonated in the pH 5 to 7 region when fluoride is present. On the other hand, the nearby histidine in horseradish peroxidase is not ionizable in this same pH range.

Fluoride Binding in Heme Proteins

Kate McGovern, '14

Victoria Angelucci, '14

Faculty Mentor: Jose Cerda

Department of Chemistry



Supported by the Anna K. and Bernard M.

Hillman Summer Research Fellowship, the Chemistry Alumni

Scholarship Fund, and the SJU Summer Scholars Program

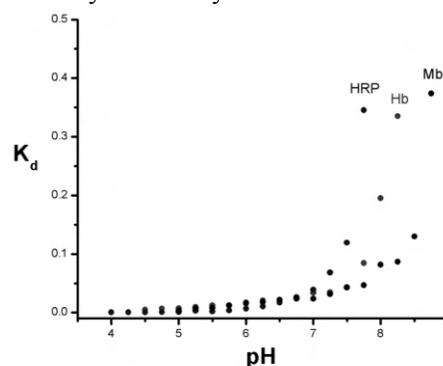
This summer we worked with Dr. Cerda on fluoride binding in heme proteins. Our goal was to measure the dissociation constant (K_d) for fluoride ion binding in three heme proteins: myoglobin, hemoglobin, and horseradish peroxidase. We also wanted to understand how the pH of the solution affects fluoride binding in heme proteins. Hemoglobin and myoglobin are heme proteins with similar functions, in that, they both bind oxygen. However, horseradish peroxidase is a heme protein that can catalyze the reduction of hydrogen peroxide to water and couple this reaction to the oxidation of a substrate. The difference in the function of these two types of heme proteins is dictated by the amino acid residues that surround the heme cofactor in these proteins. For example, hemoglobin and myoglobin contain a distal histidine that is involved in the stabilization of heme-bound oxygen. On the other hand, horseradish peroxidase relies on a distal histidine and an arginine for its function. Previous studies performed by other labs have demonstrated the use of fluoride ion as a probe of the heme cavity. The spectroscopic property of the heme-bound fluoride ion is affected by interactions provided by the nearby amino acids.

In our study, the dissociation constants (K_d) were measured using UV/VIS spectroscopy. We looked at the changes in the UV/Vis spectra of the heme protein with the addition of sodium fluoride. A plot of the absorption of the heme protein-fluoride complex vs. added concentration of sodium fluoride was used to determine the K_d from pH 4.0 to 8.0. K_d is the concentration of fluoride needed so that approximately half of the sites in the heme protein are occupied by fluoride. The higher the K_d value, the lower the affinity between the heme protein and fluoride. One significant similarity in all heme proteins upon fluoride binding is that the K_d increases sharply at some relatively high pH. This is due to the fact that hydroxide comes in and displaces the heme-bound water.

Hydroxide ion is known to be a stronger heme ligand than water. Hence, fluoride competes against hydroxide, instead of water, which makes it more difficult to bind to the heme protein.

At pH 7 and below, the K_d values in hemoglobin and myoglobin are pH dependent according to equation shown below the graph.

This model takes into account the deprotonation of the distal histidine in hemoglobin and myoglobin. K_{aF} is the acid dissociation constant of the histidine in the presence of fluoride, and K_{aH_2O} is the acid dissociation constant of the histidine in the presence of a heme-bound water ligand. For myoglobin the pK_{aH_2O} value is 4.36 and the pK_{aF} is 5.9. For hemoglobin the pK_{aH_2O} was determined to be 5.0 and the pK_{aF} was 5.7. The fit was attempted for horseradish peroxidase; however the model did not fit. We believe that this is due to the absence of an ionizable group in this pH region. Our results agree with other studies that have shown that the histidine is not involved in the interactions of the heme-bound fluoride ion in horseradish peroxidase.



$$K_d = \frac{[H_2O]_{(distal)}}{[F^-] + \frac{[H_2O]_{(distal)}}{K_{aF}}}$$

Understanding the pH Dependence of the Reduction Potential of Myoglobin in the Presence of Fluoride

Margaret Roeder, '13

Danielle Houchins, '13

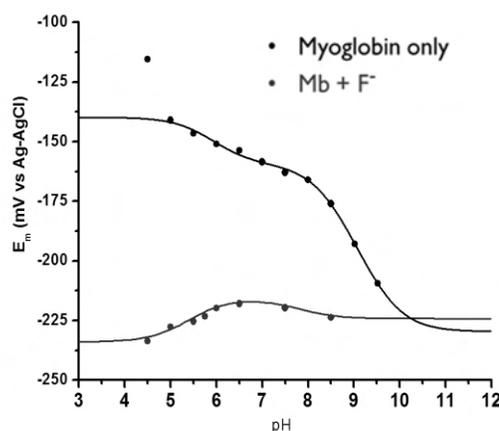


Faculty Mentor: Jose Cerda
Department of Chemistry

Supported by a Gift from Anne Marie and Jay Borneman, '80, the Chemistry Alumni Scholarship Fund, and the SJU Summer Scholars Program

This summer, we worked with Dr. Cerda on the study of pH dependence of the reduction potential of myoglobin in the presence of fluoride by using UV/Vis spectroelectrochemistry. Many heme proteins catalyze a wide variety of biologically important oxygenic processes. However, the main role of myoglobin involves storing oxygen. The reactivity of the heme iron is important in the function of the protein because oxygen only binds to the heme when the protein is in its reduced ferrous state. When myoglobin is in its ferric state, a water molecule is coordinated to the oxidized heme iron. One of the main goals of our research involves replacing the water molecule with a fluoride ion to understand the behavior of myoglobin in the oxidized state, in the absence of the coordinating water ligand. Since fluoride ion can coordinate to the heme in its ferric state and not in the reduced state and due to its small size, it is an ideal ligand to replace the water molecule. Specifically, we are interested in the electrochemical properties of myoglobin in the presence of fluoride ion.

Our spectroelectrochemical experiments provide evidence of the protonation of the distal histidine in the heme pocket of myoglobin. We used the absorbance values of the reduced and oxidized myoglobin to calculate the midpoint potential of myoglobin in the presence of fluoride at various pH values. For this, we used the Nernst equation to obtain the midpoint potential values. A plot of the midpoint potential of myoglobin only vs pH shows a decrease in the midpoint potential as the pH is increased. This is caused by the replacement of the heme-bound water by hydroxide at high pH. The graph of the midpoint potential of myoglobin in the presence of fluoride vs pH provides evidence that the distal histidine starts to protonate below pH 6. Hydrogen-bonding to the coordinated fluoride ion is achieved between pH 4.5 and 6.0. For this reason, there is a decrease in the midpoint potential of myoglobin with fluoride, whereas with water the heme midpoint potential increases at pH below 6. We also found that myoglobin only is unstable at pH 4.5. However, the protein is more stable with fluoride ion, most likely caused by the stabilization of the heme with the coordinated fluoride ion which has hydrogen bonding interactions with the distal histidine.



The Investigation of the Electrochemical Properties of Hemes in Aprotic Solvents

Mary Malloy, '14

Brady Werkheiser, '13

Faculty Mentor: Jose Cerda

Department of Chemistry

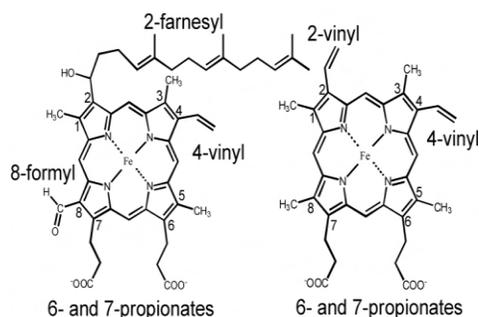
Supported by the SJU Summer Scholars Program



The objective of our research was to study and determine the hydrogen-bonding interactions to the peripheral groups on heme *b* and heme *a* in aprotic solvents. To perform this study, we first needed to determine a ligand that can axially coordinate to the heme iron in aprotic solvents. Without the use of a ligand, heme exists as a 4-coordinated system which aggregates in any medium. Heme aggregation is a problem in our study because it makes it harder to measure isolated interactions. Good heme model compounds are those in which the heme iron is sixth coordinate. We began our search with five imidazole derivatives; 4-(1H-Imidazol-1-yl)aniline and 4'-(Imidazol-1-yl)acetophenone, 1-phenylimidazole, 4-phenylimidazole and imidazole. After titrating heme *b* solutions with these ligands, we

calculated their dissociation constants. From the dissociation constant values, we were able to determine that 1-phenylimidazole is the best coordinating ligand for hemes in dichloromethane and benzene. We then focused on the study of the hydrogen bonding interactions to the propionate groups on heme *b* and heme *a*. We used UV/Vis spectroscopy to follow the changes in the absorption spectra of the hemes upon addition of hydrogen-bond donor compounds such as alcohols. When alcohol was introduced to our heme *b* solutions, there was no overall change in the UV/Vis spectra. We also did not observe a change in the UV/Vis spectra of heme *a* upon addition of the alcohols. This indicates that hydrogen-bonding to the peripheral groups of the hemes in their oxidized state (Fe^{3+}) are inexistent in the presence of alcohols such as phenol and 1-propanol. Additionally, cyclic voltammetry was used to study the interactions to the heme peripheral groups in the reduced state (Fe^{2+}). Under our conditions, we found no modulation in the heme reduction potential in the presence of the alcohols. Specifically, the potential changes were never greater than 20 mV, which represents a negligible change upon addition of the alcohols.

In the future, we will continue this study by using more acidic alcohols for the hydrogen bonding interactions or better hydrogen bonding compounds that can serve as heme receptors.



Heme a

Heme b

Naturally-occurring heme cofactors.



Susan Clampet-Lundquist

Department of Sociology
Saint Joseph's University

Ph.D. University of Pennsylvania

Research Interests: Cities,
Families, Social Policy

Over the past decade, I have talked to adults and teenagers who live in low-income neighborhoods about neighborhoods, housing, jobs, risk behavior, and school. Sociologists argue that you cannot look at an individual without understanding their context, and as an urban sociologist, I come from the perspective that place matters. Specifically, one's neighborhood matters a great deal when it comes to the types of opportunities that young people have as they are growing up.

In the 1990s, the federal government authorized an experimental demonstration -- Moving To Opportunity (MTO) -- to study what happens when low-income families are given a chance to move out of concentrated high poverty neighborhoods and into low-poverty neighborhoods. I have been involved in following up families in Baltimore, one of the five MTO sites. Along with a research team, I collected in-depth interview data in 2003 and 2010 from adults, teens, and young adults whose families signed up for MTO. Their stories speak to what it has been like for them growing up in some of the poorest neighborhoods in Baltimore.

This summer, the scholar who worked with me compiled detailed case studies of over 50 individuals for whom we had interview data at both points in time. This type of longitudinal qualitative data is rare, and bringing it together in an organized and thematic way has been valuable for my ongoing research project. My research partners and I will be writing a book from these interview data about how young people from economically-disadvantaged backgrounds make the transition into early adulthood. These case studies have provided us with the ability to look at their trajectories over time, offering insight into strategies that have allowed some of the youth to find a modicum of success, despite the poverty, poor-quality schooling, high unemployment, and community violence that they have had to deal with.

The Transition into Early Adulthood: Risk and Resilience Among Low-Income Youth

Casey Callahan, '13

Faculty Mentor: Susan Clampet-Lundquist
Department of Sociology



Supported by the SJU Summer Scholars Program

The Moving to Opportunity study was an initiative that was created by the Department of Housing and Urban Development to give families living in high-poverty areas the possibility to move to less impoverished neighborhoods. In 2003 five cities in the United States were selected to be a part of this study including Baltimore, Boston, Chicago, Los Angeles, and New York City. For my research, I focused solely on participants who were living in Baltimore. Families that opted to participate in the study living in one of these five selected cities that had children were randomly selected to receive vouchers that would enable them to move to neighborhoods that had a poverty rate that was less than 10%.

This summer, under the guidance of Dr. Clampet-Lundquist, I examined interviews that had been conducted as part of the Moving to Opportunity Study. I looked at interviews that had been conducted in two data collection periods, one in 2003 and one in 2010. In 2003, youth (14-19 years old) and adults in MTO families were interviewed about risk behaviors, their education, mental health, family situation, as well as several other topics. For some of the families, the teachers of children (8-13 years old) were interviewed.

In the summer of 2010 150 youth (15-24 years old) in MTO families were interviewed as part of a follow-up study. For over 50 of the youth, we had information about them from the first data collection period in 2003. I used the unique qualitative information from the two interviews to make longitudinal case studies about the youth. Upon reading these interviews there were many common themes that ran throughout participants' stories. One commonality for children and youth was the abundance of their fathers or male figures being absent due to incarceration. An astounding amount of children reported having their relationship with their father affected because of his history with the criminal justice system. An incongruity that I saw appear in the child interviews was teachers' desires for an increase in parental involvement, but an inability to do so on the parents' part because of a lack of flexibility in their employment situation. Another theme I saw was the seemingly inescapable presence of drugs in many of the urban neighborhoods. Some of the participants who had once sold drugs mentioned the possibility of going back to that lifestyle if they had to in order to support their family. The interviews that have been conducted as part of this study provide valuable insight into the individuals who live in our cities urban neighborhoods.



Peter A. Clark, S.J., Ph.D.
Departments of Theology &
Health Administration
Director-Institute for Catholic
Bioethics
Saint Joseph's University
Ph.D. Loyola University of Chicago

My research this summer focused on implementing the Mercy Health Promoter Model designed by the fellows and staff of the Institute of Catholic Bioethics for the Nigerian community in Philadelphia. As of March 2010, 11.2 million undocumented immigrants were living in the United States, virtually unchanged from a year earlier according to the new estimates from the Pew Research Center. Estimates show that there are at least 50,000 undocumented African immigrants living in West Philadelphia, constituting eight percent of the total immigrant population. The increase in foreign-born peoples and their need for health care is a complicated issue facing many cities, health systems and hospitals. Over the course of the past few years Mercy Hospital of Philadelphia has treated increasing numbers of foreign-born African patients. The majority have been presenting in the late stages of disease, which has made treatment more complex and costly.

To meet the needs of this growing population, the Mercy Hospital Task Force on African Immigration designed a program that centers on the Third World concept of "Health Promoters" This program is intended to serve as one possible proactive solution for hospitals to cost-effectively manage the care of this growing percentage of foreign-born individuals in the population. This notion of a "Health Promoter" program in Philadelphia is unique as one of those rare occasions when a Third World concept is being utilized in a first world environment. It is also unique in that it could serve as a paradigm for other hospitals in the United States to meet the growing need of health care for the undocumented population. The implementation of the Mercy Health Promoter Model is a joint venture between the Institute of Catholic Bioethics, the designer of this model, and the Mercy Health System of Philadelphia. This pilot program will be targeted to the Nigerian community of Philadelphia. The Nigerian community was selected because it is well-organized and has a stable basis at St. Cyprian's parish in West Philadelphia. Initial meetings have been arranged and we are in the process of identifying, with the Nigerian community leaders, potential individuals who will be selected as the health promoters. The hope is that this model could serve as a paradigm for other Catholic hospitals nationally in the care for the most vulnerable members of our society—the undocumented. This pilot program has been endorsed by the Catholic Health Association of the United States and they are very interested in monitoring the implementation, success and evaluation of this model.

Arsenic and Bacteria Removal Through Slow Sand Filters and *Eichhornia crassipes*

Alex DeBernardo, '14

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

Supported by the SJU Summer Scholars Program



Unsafe drinking water is defined as unconsumable water containing biological or chemical pollutants that often cause illness and disease in developing nations. Pathogenic bacteria and arsenic are two common contaminants in water that cause avoidable illnesses. Slow-sand filters are a proven and simple technology that relies on straining and attachment to a previously formed biofilm to remove microorganisms. Water hyacinths have been shown to absorb arsenic from water at high rates, and the water hyacinths can potentially be used to reduce arsenic concentration from water.

The objective of the project is to design and test a biosand filter incorporating *Eichhornia crassipes* (water hyacinths) that can remove both bacteria and arsenic from water. In the past, we tested a biosand filter of our own design for elimination of bacteria, and it achieved removal rates above 99%. We have now introduced modifications to the design to incorporate either live hyacinths or dried plant material. We are testing these two new designs together with two control filters that do not include plants.

The project will have three stages: evaluation of the effect of plant material in the bacterial removal effectiveness of the filter, assessment of the behavior of a similar ion (phosphorus) in the filter, and finally assessment of arsenic removal. To ensure sustainability, we will look to micro finance this project so that filters will be implemented in a developing country with high arsenic pollution.

Medical Tourism in India: Low Cost, High Risk

Dominic J. Gatta, '14

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

Supported by the SJU Summer Scholars Program



This past summer of 2012, Dominic Gatta represented the Department of Catholic Bioethics at Saint Joseph's University, under mentor Father P. Clark SJ, in researching the growing public health issues of medical tourism.

Medical tourism is a vastly growing medical phenomenon in which patients from around the world travel internationally in search of inexpensive, quick, easy, non-emergency health care procedures ranging from plastic surgery to fertility treatments. This act, labeled medical tourism, is a rapidly growing alternative to health care that has brought about many medical, legal and ethical issues in the United States.

One such medical tourism country is India and has been for over the last 5 years, the center of medical tourism. India is specifically known in the medical tourism field for its specialties in cardiovascular, neurology/spine, orthopedic, oncology and weight loss surgeries. Because of the “business” that it has created with the paying tourists, India is not only expanding in medical tourism, but other countries are imitating their medical entrepreneurship, adding to the growing medical tourism business.

This past summer, Lawyer Kevin Capuzzi, Dr. A. Ayodeji, Father P. Clark and I have researched medical tourism and developed a legal, medical and ethical analysis. We have researched the growing issues of medical tourism and how it affects the patients, the foreign residents and health insurance: while it surfaces as an overall public health issue. We have deemed medical tourism in a whole an unsafe act. After research, we have also concluded that it cannot be stopped, but rather should be regulated.

Along with the legal, medical and legal analysis, I have also created “guidelines” to enhance safe medical tourism. These guidelines pertain to medical tourists, educating them on the potential health risks they face and educating them on the nature of their medical travel.



Renee Dobson

Department of Music, Theatre & Film
Saint Joseph's University

MFA Ohio University

Research Interests: Musical Theatre
Performance

My research interests have included musical theatre performance for the past twenty years. As an Equity performer, I have performed in numerous roles in musicals in professional regional theatre and as a director/choreographer I have directed and choreographed professional productions of musicals. Each production requires specified research on the style and the time period prior to the start-up of the formal rehearsal process.

Summer Scholars Project: In May of 2012, my student, Patrick Bishop (Theatre/Film major with Musical Theatre concentration) embarked on a unique and challenging journey into the world of professional musical theatre. He began a professional residency at The Fulton Theatre in Lancaster Pennsylvania where he participated in a professional rehearsal process and production as a performer in the ensemble of The Fulton Theatre's production of the musical *Miss Saigon* by Claude-Michel Schonberg and Alain Boublil.

The first three weeks of the process consisted of rehearsals six days per week for eight hours per day. The rehearsal process involved learning complex vocal lines of music as well as intricate choreography. By the fourth week, the production entered previews for an audience and officially opened on Thursday June 7 for a five week run at eight performances each week. Patrick & I met each week to discuss his progress and the development of his personal working process as an actor.

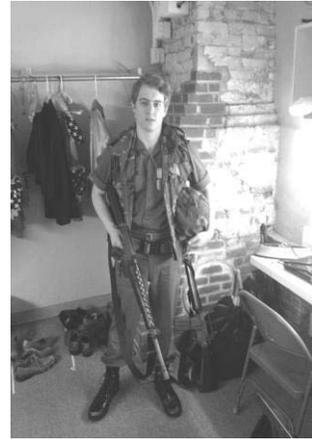
During this process, Patrick was able to develop the discipline and stamina it takes for a professional stage performer to execute a performance with consistency eight times each week. In addition, as a member of the ensemble, his "track" in the production included playing five different roles in various scenes: an officer in a club in Vietnam, a tourist in a club in Bangkok, a Viet Cong soldier, an embassy worker in Saigon and an escort in "The American Dream" sequence.

With this experience, Patrick officially began his candidacy in Actors Equity Association's *Equity Membership Candidate* program which will extend to him the opportunity to attend professional Actors Equity auditions in New York City and Los Angeles, and to become a member of the professional stage actors union (Actors Equity Association) and the professional film/television union (SAG/AFTRA).

Professional Theatre Performance Experience Patrick Bishop, '13

Faculty Mentor: Renee Dobson
Department of Music, Theatre, & Film

Supported by the SJU Summer Scholars Program



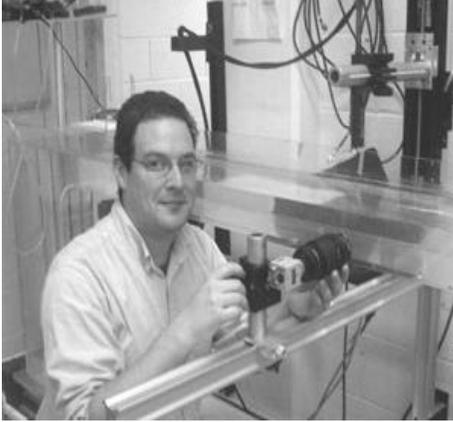
With the aid of the Summer Scholars program, I took part in a professional production of *Miss Saigon* at The Fulton Theatre in Lancaster, PA. The eight-week process consisted of

2 weeks of 8 hour a day rehearsals, 1 week of technical rehearsals and previews, and 5 weeks of performances with 8 shows performed per week. With this project I was able to become an Equity Membership Candidate and start earning points towards my Equity Card. This Equity Membership Candidacy now allows me to enter into Equity Principal Auditions, which puts me in a stronger position for my career as I prepare to graduate from Saint Joseph's University.



In this production of *Miss Saigon*, I played several different characters throughout the show. I was able to expand on my acting skills by developing character lines for each person I played, making them all different and unique from one another. Once each character was developed, it was important for me to create strong relationships on stage with the other actors' characters. Working with professionally experienced performers and building relationships with them on and off stage helped strengthen my abilities.

In theatre, networking plays a strong role in the development of a career. I was able to make several connections at The Fulton Theatre that will help as stepping-stones for my career. These contacts, including experienced professional directors, actors, musicians, designers, and crewmembers, will not only help me, but will help the Saint Joseph's Department of Music, Theatre, & Film by providing us with current professionals in the field to give master classes in specialized aspects of theatre and to also be used as resources for other students to help further their careers.



Dr. Jonathan Fingerut
Department of Biology
Saint Joseph's University

Ph.D. University of California

Research Interests: Dispersal
Ecology of Fruit Flies

Research in my laboratory normally centers around the larvae of black flies, the ubiquitous bane of campers and outdoors enthusiasts throughout most of North America. In particular, we focus on their dispersal (one-way movement in the environment) and how flowing water interacts with their behavior to determine their distribution.

This summer, however, we (myself, Dr. Scott McRobert and Kristina Orbe) decided to answer a similar question using a different model organism. Fruit flies are an equally ubiquitous group of flies whose genetics, behavior and sensory abilities have been well characterized. What is not known to the same extent is how they interact with the natural environment, including even simple things such as “how far does a fruit fly, fly?”. Answering just that question was the goal of this Summer’s research.

Just as their aquatic cousins the black fly must contend with flowing water moving them about in streams, so must fruit flies contend with wind, and other physical conditions, that can shorten or lengthen their exploration of the surrounding environment in search of food. To determine how things like wind, topography and weather might determine the “home range” of a fly we first needed to be able to track flies, which is no small feat (no pun intended).

The summer was taken up trying to find the best way to tag, releases and recapture known populations of flies. Now that we have a basic protocol (see Ms. Orbe’s writeup) we hope to be able to start *in-situ* experiments next summer that will vary the flies’ environment and determine how that affects the distance that they fly in search of food.

Such research is more than academic. In recent years a new pest species that feeds on crops such as blueberries, the fruit fly *Drosophila suzukii*, has entered our region with possibly devastating effects to the industry. To date we know that they have travelled through human intervention across the country, but little to nothing is known about how they spread on their own. By characterizing how far they fly in a given period of time, and how the environment can effect that behavior, we may be able to at least predict their spread, and at best do something to slow it down or limit it, saving both the economic and gastronomic impacts of their infestation.

Mechanisms to Study the Active Dispersal Patterns of *Drosophila melanogaster*

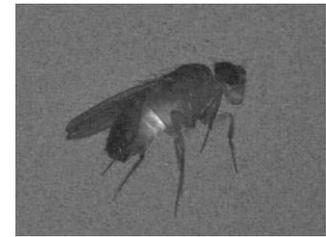
Kristina Orbe, '14

Faculty Mentor: Jonathan Fingerut
Department of Biology



Supported by a Gift from Nick Nicolaidis, '87
and the SJU Summer Scholars Program

My research this summer has been on the feeding behavior of fruit flies. Though I worked with *Drosophila melanogaster*, the common fruit fly, the goal of the project is to eventually better understand the feeding behavior of the invasive pest *Drosophila suzukii*. In late summer 2011 *D. suzukii* was found in Southeast Pennsylvania and Maryland. Often referred to as the “Spotted Wing Drosophila” *D. suzukii* is an invasive pest species that feeds on soft-skinned fruits such as blueberries, raspberries, and strawberries, and in California it has been responsible for an average of 20% of crop loss.



To study the behavior of flies in the natural environment I, needed a way to track their movement. To perform the necessary release and recapture studies, I needed a way discriminate between the released flies from natural populations. A common practice to tag flies is to use micronized dusts that attach to the hairs on the thorax on the surface of the fly, but I wanted to experiment with an alternative method using fluorescein that would be more internalized and therefore more robust. I tried dusting the flies with powdered fluorescein and spraying the flies with a fluorescein solution but found that the most effective way to ensure that all of the flies could be identified was to feed the flies fluorescein in their food media, whereby they fluoresce from their abdomen (above image).

Once I had established a way to tag our flies, the next step was to perform release and recapture experiments. Originally, I wanted to recapture flies that we had released and examine the data to see if there was a spatial pattern in the flies' foraging behavior. However, the project evolved into perfecting the protocol to maximize recapture rates. I attempted four different protocols for release and recapture varying different elements such as the baits used in the traps and the arrangement of the traps. I found that the recapture rates are highest when the traps are placed on the ground and fruit is used as the bait. However, as the flies consume the fruit, they excrete the fluorescein from their abdomen, and they no longer fluoresce. At the end of the summer, I was experimenting with physical barriers between the fruit so that the flies would still be attracted to the scent but unable to consume the fruit.



Next summer, I would like to use the protocol developed this summer to study abiotic effects such as topography and wind currents on the spatial pattern of their feeding behavior, with *Drosophila suzukii*.



Mark Forman
 Department of Chemistry
 Saint Joseph's University

Ph.D. University of Pennsylvania

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, ϕ , 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 pyramidalized 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).

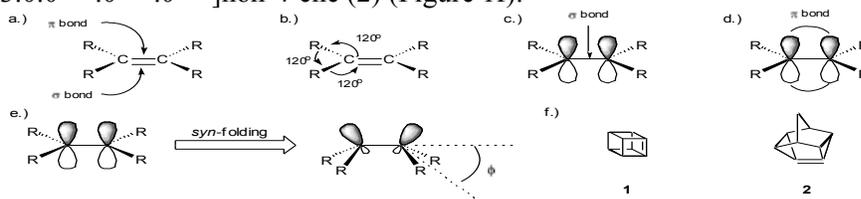
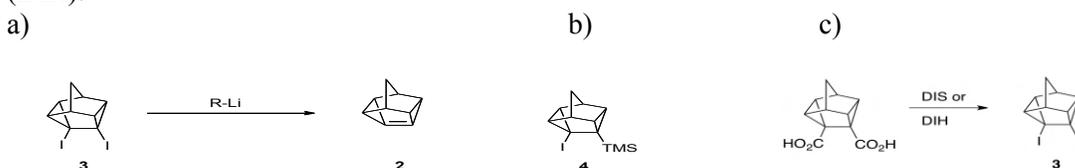


Figure 1

During the summer of 2012, 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 alkyllithium induced dehalogenation of 4,5-diiodopentacyclo[4.3.0.0^{2,4}.0^{3,8}.0^{5,7}]nonane (**3**) leads to **2**. Because pentacyclo[4.3.0.0^{2,4}.0^{3,8}.0^{5,7}]non-4-ene (**2**) reacts with the alkyllithiums, 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 to **2** that does not require the use of alkyllithiums. We also investigated new synthetic routes to diiodide **3** using N-iodosuccinimide (NIS) and 1,3-diiodo-5,5-dimethylhydantoin (DIH).



The Synthesis of Pentacyclo[4.3.0.0^{2,4}.0^{3,8}.0^{5,7}]non-4-ene

Eric Eisenhauer, '14

Elena Montoto, '14

Faculty Mentor: Mark Forman
Department of Chemistry

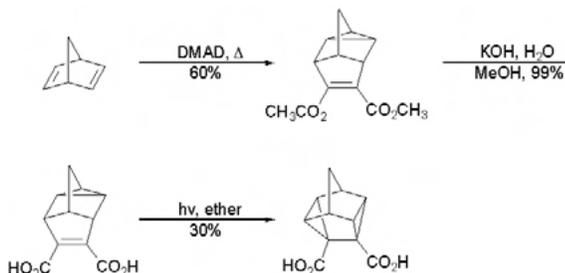


Supported by the SJU Summer Scholars Program and a Grant from the American Chemical Society-Petroleum Research Fund to Dr. Mark Forman

The Forman research group focuses 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 target molecule for our synthesis is pentacyclo[4.3.0.0^{2,4}.0^{3,8}.0^{5,7}]non-4-ene due to its unique bond strain on the carbon-carbon double bond. Ideally, carbon-carbon double bonds 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 in their carbon-carbon double bonds.

Among the various sources of strain that alkenes can experience, pentacyclo[4.3.0.0^{2,4}.0^{3,8}.0^{5,7}]non-4-ene experiences a type of syn-folding, or pyramidalization. This source of strain causes the substituent groups to bend towards each other, creating a tetrahedral geometry rather than the ideal trigonal planar geometry. Therefore, our compound is rendered highly reactive with a lifespan in the order of seconds due to this strain. The short lifespan and high reactivity of this molecule causes difficulty in the synthesis of this compound and is the focus of our research.

One of the main goals during our summer research 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. A primary precursor to our proposed methodology is the pentacyclic diacid shown in the figure. The synthesis of this molecule is a three-step process. 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 was then subject to ultraviolet light which included photochemical cycloaddition to bring us to closed diacid. This photo chemical 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.



As the summer ended, we had synthesized enough pentacyclic diacid to further our research goals for the next school year. We plan to use the closed diacid in our future efforts to synthesize and isolate our target molecule.

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

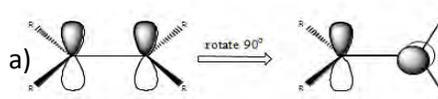
Department of Chemistry



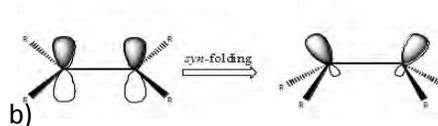
Supported by the William J. Gross, '38 Memorial Research Fellowship, the SJU Summer Scholars Program and the Chemistry Alumni Scholarship Fund

This past summer the Forman research group conducted research on the synthesis and study of the effects of bond angle distortion on the structures and properties of alkenes, specifically pentacyclo[4.3.0.0^{2,4}.0^{3,8}.0^{5,7}]non-4-ene.

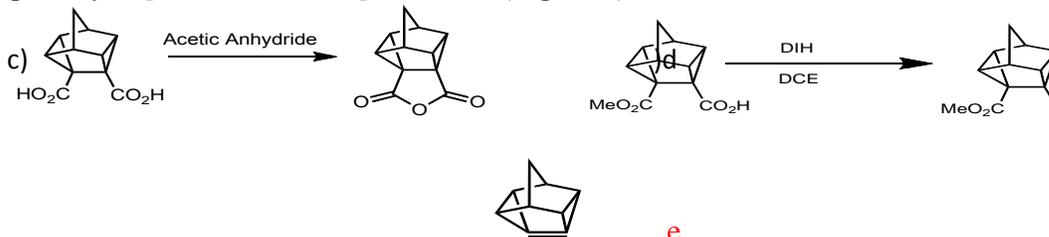
Alkenes are a class of organic molecules that contain the carbon-carbon double bond. The carbon-carbon double bond of an alkene ideally has bond angles of 120°, and any deviations from this ideal angle cause enhanced reactivity and unique properties of the alkene. The first of two main deviations is a twisting distortion of the alkene double bond (**Figure a**).



The second main type of distortion in alkenes is referred to as pyramidalization and results from a syn-folding of the R group substituents (**Figure b**).



This past summer, we worked towards the synthesis of create pentacyclo[4.3.0.0^{2,4}.0^{3,8}.0^{5,7}]non-4-ene by improving important procedures that have been used in the past. The first involved creating an anhydride (**Figure c**) using acetic anhydride and microwave heating. We then attempted to synthesize our diiodide product using a new method. This new method required only one step, wherein the past it was multiple steps. After running the reaction multiple times and studying the product using gas chromatography/mass spectroscopy, nuclear magnetic resonance, and column chromatography, it was shown that the reaction did not work. The next reaction that we worked on this summer involved synthesizing an iodo-ester product from an acid ester (**Figure d**). After studying the resulting product it was shown that we did find a more efficient way to create the iodo ester product. Our future goals are to use the iodo ester in the synthesis of diiodide which is then used to create pentacyclo[4.3.0.0^{2,4}.0^{3,8}.0^{5,7}]non-4-ene (**Figure e**).





Kazuya Fukuoka
Department of Political Science
Saint Joseph's University

Ph.D. University of Georgia

**Research Interests: Collective
Memory and Nationalism**

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.

Handprints of Horror, Heedlessness, and Hope: A Study of Child Abuse Increase in Vietnam

Rachel Sellers, '14

Faculty Mentor: Kaz Fukuoka
Department of Political Science



Supported by the SJU Summer Scholars Program and the International Relations Program

One of the most serious problems in the contemporary global society is the inability of the society and international community to protect children from abuse. The child abuse rates continue to increase worldwide. What is most appalling is the rapidity with which they rise. My research focuses on child abuse in Vietnam where a child is thirteen times more likely to be abused since 2005 and 25% of the entire child population is abused in 2011. Why is child abuse increasing substantially faster in Vietnam compared to the region?

Scholars assert that child abuse occurs in any society due to at least one of four factors: An inadequate social work system, deficient legal rights for children, socioeconomic status of the child and cultural norms that promote violence, specifically corporal punishment. I hypothesize that these four factors work together to explain the increase in Vietnam.

Both qualitative and quantitative data assess the adequacy of the social work system in Vietnam. The Children's Rights Index measures the legal rights in Vietnam. The three indicators of child poverty rate, street children, and economic stress on families account for the socioeconomic status of a child. Finally, the laws and prevalence of corporal punishment in society determine the cultural acceptance of corporal punishment. The data analysis of this study largely affirms that these four factors combine to explain why Vietnam has such a stark increase in child abuse.



Richard J. George
Department of Food Marketing
Saint Joseph's University

Ph.D. Temple University

Research Interests: Consumer
Behavior and Customer Service

My research stream has been dedicated to consumer behavior and customer service. Recently, I completed a year-long research project titled: *Mature Millennials v Mature Baby Boomers: Foodservice Attitudes and Behaviors - Similarities, Differences, and Opportunities*. In addition, I have authored a book titled: *Winning Customer Rules*. Last year one of my summer scholars focused on the issues relating to the posting of calories on menus. Answering the question of does it make any difference in terms of consumer decision making? Another summer scholar focused on childhood obesity and developed *Food Fun: A Nutrition Education Toolkit*. This summer, Lizzie Sclafani continued the trend of focusing on consumers needing assistance. Her work is intended to help consumers depending on Supplemental Nutrition Assistance Program (SNAP) and Women, Infants & Children (WIC) to make better choices regarding product options and nutritional well-being. Lizzie's summary captures the problems confronting these consumers. Her solution of using Social Media to address the issues of purchasing and preparing nutritional foods, including links to easy recipes as well as information for stores that accept these benefits, will give those who are less fortunate a chance to maintain a sustainable diet. In addition, the anonymity associated with Social Media interactions saves consumers the embarrassment often associated with receiving such benefits. This is a terrific example of using technology to solve every day real consumer issues. Lizzie has recognized the challenges posed to recipients of SNAP and WIC benefits and has conducted research that will make a difference.

Social Media: “SNAP” Into Action

Elizabeth Sclafani, '13

Faculty Mentor: Richard George
Department of Food Marketing

Supported by the SJU Summer Scholars
Program



This past year, I was selected to participate in the Walmart Scholars Program. This was the first year SJU had decided to begin this endeavor and I was lucky enough to gain insight into the Food Retailing World. As a team, we were assigned to figure out ways Walmart could keep their key products in stock during high voucher redemption periods. This problem was stemming from the fact that SNAP (Food Stamps) and WIC (Women, Infant and Children) benefits were being loaded on the first of the month. Those who receive benefits tend to make a one-stop shop because they find it easier than making multiple monthly trips. As I researched more and more into the project I came to realize that many shoppers and employees were unaware of which items were SNAP and WIC approved. It was hard for customers to get what they needed, causing them to leave the store. It is also challenging for those who receive benefits to keep a sustainable diet. This problem is not one to be taken lightly, as over 45 million Americans are currently on SNAP benefits, as well as around 50% of mothers and newborns on WIC.

As an SJU Summer Scholar, I researched the idea of Social Media sites for those enrolled in government-assisted food programs. Under the guidance of Dr. George, Food Marketing Department chair, I compiled research to help these programs flourish with healthier choices. The Social Media element aims to teach purchasers how to eat nutritional foods with the benefits they receive, by being interactive with the sites. Links to easy recipes as well as information for stores that accept these benefits, will give those who are less fortunate a chance to maintain a sustainable diet. Another dilemma can be embarrassment. Many do not want others to know they are receiving benefits, so they tend to not ask questions about the program. The Social Media sites could have the ability to send questions anonymously. Smartphone usage is high in low-income areas due to the low cost of cell service today, making access to these sites quick and easy. Also many programs have begun to provide affordable high-speed Internet access to those less fortunate.

During the summer I visited 10-15 stores in the Philadelphia, Main Line and South Jersey Area. I noted the shopping patterns, demographics, and ease of the store layout to get an idea of how an experience of a shopper would be in that specific place. Dr. George was very helpful in my research because of his background in Food Marketing trends. Unfortunately I do not have the power to change how these government programs go about their production. However, I do feel like my research can provide powerful suggestions that can be looked at and considered by a government body. It may also give some of these individuals an education they may have never been able to receive elsewhere. Since Philadelphia and South Jersey have a mass amount of poverty, these programs are in high demand. If this can help the less fortunate to provide a healthier future for themselves and their children, I feel as if it is a no-brainer investment of time and resources.



Paola Giuli

Department of Modern & Classic
Languages
Saint Joseph's University

Ph.D. in Comparative Literature,
Rutgers University

Research Interests: Eighteenth-
Century Culture, Italian Cinema, Gender Studies, Literary
Theory

My research interests are mainly in the field of Italian intellectual history. My latest publications focus on eighteenth-century Italian academic and cultural life, with particular attention to the Roman *Accademia degli Arcadi*, the most influential academy of eighteenth-century Italy. Open to poets, painters, antiquarians, collectors, as well as mathematicians, philosophers, theologians, lawyers and physicians, *Arcadia* spearheaded professional networking and scientific cooperation together with social and aesthetic reforms.

At present I am working on two articles and a book. One article studies the relationship between the curia and the Roman academy, especially as regards Prospero Lambertini's (future Pope Benedict XIV's) early years in Rome (1700-1708), while a second article studies the influence of an Arcadian classicist aesthetic on Prince Leone Strozzi's cabinets of curiosities. Through archival research, my book shows that *Arcadia* promoted a new code of literary and academic sociability, that allowed women to become poets, translators, dramatists, essayists, memorialists, journalists, historians, and even university graduates, professors, and poet laureates for the first time in European history. In so doing, my work challenges unquestioned cultural and gendered assumptions of much literary-historical discourse on the value of Italian eighteenth-century academies, and *Arcadia* in particular.

A second research interest of mine is cinema. I am particularly interested in the history of Italian cinema from neorealism to the present, and in the cultural analysis of the production, circulation, and reception of movies. In the context of the 2012 SJU Summer Scholar Program, student Joe Logozzo and I explored the representation of young people (18-35) in Italian movies produced in the years 2000-2010. We focused especially on movies addressing young people's unemployment, arguably the most formidable challenge to Italian society today. With youth unemployment hovering around 30%, Italy is facing a bleak future. The study of these movies, together with blogs, reviews, works of criticism, and statistical data on young people's demographics (education, employment, family status) allowed us to draw a few preliminary conclusions regarding the import of this phenomenon, its perception by the public, its representation by directors, and its impact on Italian symbolic imagination.

The Young and the Restless: Youth in Contemporary Italian Cinema and Society

Joseph Logozzo, '13

Faculty Mentor: Paola Giuli
Department of Modern & Classical Languages

Supported by the SJU Summer Scholars Program



Unemployment of Italian men and women between the ages of 18 and 30 has reached 28.9% in 2012 and it seems that it has never been less than 20% at any time in the last thirty years. Unemployment is an endemic problem that affects young people's ability to become independent and form families. For my project, I analyzed Italian films produced in the years 2000-2010, in order to determine how prominent directors portrayed the effects of unemployment on Italian young people's lifestyles and family relations. These movies also provide evidence of the prevailing opinions regarding the social and economic factors which caused youth unemployment to become a substantial problem. In order to obtain a broader understanding of the phenomenon and its reception in contemporary Italian society, we also studied film blogs and film criticism. Finally, by studying statistical reports, we were able to compare cinematographic representations and their reception to objective data regarding young people's lifestyles, e.g., the percentage of unemployed youth over the years; their geographical distribution; their distribution by age, level, and type of degree.

Filmic representations emphasize nepotism as a major cause of unemployment and underemployment. Because jobs are offered based on personal connections ("raccomandazione") rather than merit, job productivity may be affected when the hired applicant lacks the education and qualification required for the job. At the same time, companies may utilize qualified individuals as a source of free labor to increase productivity. For example, university graduates may accept unpaid internships as professors "assistants" and take on some of the professor's responsibilities, such as teaching, in hopes of securing a position in the future. Most movies also make reference to Italy's "brain drain." The implementation of *raccomandazione* combined with inadequate employment opportunities and consequent overqualification prompts many youths to search for employment abroad. The draining of youthful, intellectual minds is contributing to the declining economy, since the nation is losing its brightest individuals, capable of proposing innovative ideas and of improving the nation.

Unethical practices, such as *raccomandazione*, are difficult to prove and investigations are at times hindered by complacency at the political and judicial level. Although there have been many attempts by international organizations, such as OECD (Organization for Economic Cooperation and Development), to combat corruption and reduce unemployment in Italy, their efforts have been fruitless because the Italian government is ineffective in implementing the legislation. By analyzing the economies of different countries, Italians can gather different perspectives and methods to better their own economy, such as employing advancements in transportation and the education system. Although the path to change is long and difficult, Italians must not give up because "by changing nothing, nothing changes" (Tony Robbins).



Peter Graham
Department of Chemistry
Saint Joseph's University

Ph.D. University of Virginia

Research Interests: CO₂ Activation

As part of nature's carbon cycle, photosynthesis converts atmospheric carbon dioxide into carbohydrates which provide cells with energy and the chemical building blocks needed to synthesize other compounds. Since the industrial revolution, humans have relied on fossil fuels to provide energy and the chemical building blocks needed for the manufacture of everything from plastics to pharmaceuticals. This reliance on fossil fuels has broken the balance of the global carbon cycle by concentrating carbon in the atmosphere. The development of alternative chemical processes that use carbon dioxide as a chemical building block would ease this imbalance. Not only would such processes decrease the reliance on petroleum raw materials, but they would also consume excess carbon dioxide by converting it to useful chemicals. This would provide an economically viable way to mitigate carbon dioxide emission by chemical industry, and could become an important facet of ultimately restoring balance to the global carbon cycle.

Carbon dioxide is an attractive alternative carbon starting material for a number of additional reasons. Unlike petroleum or natural gas, carbon dioxide 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.

In my laboratory we are investigating transition metal complexes which might catalyze the reaction of carbon dioxide with other simple molecules such as ethylene, hydrogen, or methanol. To this end, my students and I are synthesizing a variety of compounds containing the transition metals tungsten and molybdenum that can coordinate carbon dioxide and activate it towards such reactions. Gaining a better understanding of how such metal complexes interact with carbon dioxide is paramount to developing new catalysts for carbon dioxide utilization.

Synthesis and Reactivity of Tungsten Carbon Dioxide Complexes

Robert Carden, '14

Faculty Mentor: Peter Graham
Department of Chemistry

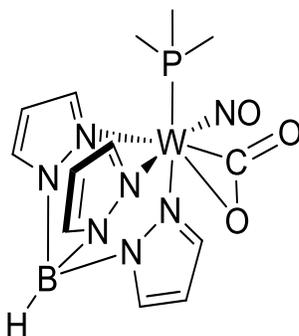
Supported by a Gift from Anne Marie and Jay Borneman, '80 and the Chemistry Alumni Scholarship Fund



In today's society there is a very heavy dependence on carbon-containing fuel. Many of the starting materials used in chemical industry also 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 improving the synthesis of and examining the reactivity of tungsten-CO₂ complexes. The tungsten-CO₂ complex I have synthesized this summer can be seen in **Figure 1**. This summer, while optimizing the synthesis of the tungsten-CO₂ complex I have also examined how this complex reacts in the presence of various types of reagents, including dienes, electrophiles, and nucleophiles. Overall, my research over the summer has shown the potential for the use of such complexes in a catalytic cycle which can help to use CO₂ as the building block for higher-grade chemical products.

In the future, my goal is to explore the reactivity of such complexes with ethylene, hopefully leading to a coupling of the ethylene and CO₂ to lead to the formation of a higher grade product from the CO₂. Additionally, I have begun to explore the possibility of synthesizing similar tungsten complexes containing different ligands.



The Synthesis of CO₂ Complexes of Molybdenum

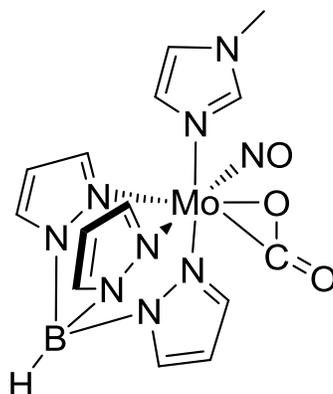
James Ohane, '14

Faculty Mentor: Peter Graham
Department of Chemistry

Supported by the Joseph B. Leach, '99 Memorial Research Fellowship and the Chemistry Alumni Scholarship Fund



CO₂ is an abundant compound that is produced through the use of fossil fuels, deforestations, across many different types of industries, and human activity. Since CO₂ is the most abundant among greenhouse gases, a way of reducing CO₂ emissions is needed. One way of mitigating CO₂ is to develop new chemical processes that consume CO₂ to give useful products. The problem in dealing with CO₂ is that it is very stable. However, the use of a transition metal can help overcome this stability. The purpose of this project is to couple a molybdenum metal complex with carbon dioxide as a first step toward making CO₂ a viable carbon feedstock. The synthesis of a molybdenum-CO₂ complex could allow for chemistry to be done to carbon dioxide to transform it into higher value products, not only will this reduce carbon emissions, it will also provide useful products for chemical industries across the board. This project proved promising as a new molybdenum-CO₂ complex was synthesized as shown in the figure below.





Heather Hennes

Department of Modern &
Classical Languages
Saint Joseph's University

Ph.D. Florida State University

Research interests: Space and
place in colonial Latin America;
Icons of independence in Latin
America

My research is situated in colonial and nineteenth-century Latin America. I teach a course titled *Commonplaces of Colonial Experience*, in which we study a variety of spaces that were assigned value through human experience to become meaningful places during and subsequent to the colonial period. Most recently I am researching the many ways in which the Jesuits helped articulate, transform and represent spaces and places during this period.

At the same time, the Latin American Studies Program, of which I am the current program director, has recently launched an initiative to build a signature library collection on the Society of Jesus in Latin America, past and present. During a conversation with Emily Smith about her transformative experience studying abroad in El Salvador, it became clear that we shared an interest in the work of the Jesuits in Latin America and a common desire to understand their influence on a deeper level. Through her research Ms. Smith is helping me identify important resources to acquire for our library collection, particularly about the influence of the Jesuits in Central America during the 20th and 21st centuries.

My interest in her topic is also personal. I owe much of my own spiritual and intellectual growth to the guidance of the Jesuits at John Carroll University in Cleveland, my alma mater. At Saint Joseph's I have been fortunate to join colleagues in a powerful Faculty Immersion Experience in Bolivia, an experience that has also influenced my scholarship and teaching. Working with Ms. Smith has helped me to better understand and appreciate the work of the Jesuits in the Americas.

The Society of Jesus: Influence and Politicization in El Salvador

Emily Smith, '13

Faculty Mentor: Heather Hennes
Department of Modern & Classical
Languages



Supported by the SJU Summer Scholars Program and the Latin American Studies Program

In the fall of 2011, I was fortunate to study abroad in El Salvador. The program, run through Santa Clara University, and pertinently named *Casa de la Solidaridad*, aims to educate students on the challenges faced by a developing country, both through academic inquiry and through authentic and loving relationships built with the Salvadoran people. My semester at the Universidad Centroamericana (UCA) was greatly influenced by the presence of the Society of Jesus, as well as the omnipresent mark of the Salvadoran Civil War. The time that I spent in El Salvador fostered within me a deep passion for the Salvadoran people and their difficult history of social injustice, prompting me to study the Jesuit influence and politicization in El Salvador.

Tension and violence in El Salvador rose in the early 1970's. The aggression between the military-led government and the FMLN, a coalition of left-wing guerilla groups, culminated in civil war in 1979. The war lasted for twelve years, concluding with peace accords in 1992, after countless numbers of people had disappeared and more than 70,000 people were murdered. The war was characterized by fierce brutality on both sides and rampant violence throughout the country. In the early hours of November 16, 1989, six Jesuits priests, their housekeeper and her daughter were murdered on the campus of the UCA in San Salvador. For Catholics both in El Salvador and in the international community, this event signaled a new level of savagery. It underlined the hostility that the military and their civilian supporters felt towards the Jesuits.

In the wake of Vatican Council II, which aimed to address interactions between the Roman Catholic Church and the modern world, the Society of Jesus implemented significant changes in their approach towards the rest of society. Specifically, the Jesuits made an unwavering commitment to promote social justice and to defend the rights of the poor and marginalized. This pledge cost them significant support from the upper and middle-classes. In the context of El Salvador, it is evident that the realignment of the Jesuit mission and priorities alienated them from right-wing political parties, the military, and paramilitary groups, who falsely characterized them as having communist inclinations. Ultimately for the Jesuits in El Salvador, their upstanding ethics and preferential option for the poor directly led to both their politicization and fateful persecution.

Through my experience in El Salvador and my research, I have developed a deeper understanding of the Jesuit commitment to combating social injustice. This has led to my profound gratitude for the Jesuit mission both at large and at Saint Joseph's University. The University's mission of influencing the historical reality in which it exists, and in which it serves, stems directly from ideals that form the core of the Jesuit identity. With the help and guidance of my faculty mentor, Dr. Heather Hennes, I plan to display my research concerning the Jesuit politicization in El Salvador in the new Post Learning Commons this coming fall. I will also assist in preparing student groups traveling to Central America by providing them with a context for their experience.



Elizabeth Jaeger
Department of Psychology*
Saint Joseph's University

Ph.D. Temple University

Research Interests: Early care and Education

Researchers in the Child Development Laboratory (CDL) conduct both basic and applied research related to early care and education (ECE). In terms of applied research, we conduct evaluations of interventions that aim to improve the quality of ECE, which is vital in preparing young children to succeed in school. Specifically, our evaluation research has examined the impact of resources, such as professional development, technical assistance, and funding for capital expenses, on the quality of ECE services throughout the Philadelphia region. More recently, we have partnered with public and private entities in the U.S. Virgin Islands to help collect data to be used to make improvements to the ECE system in the territory.

Undergraduate and graduate students in the CDL are also engaged in basic research to better understand how parent's beliefs about early literacy affect their literacy practices and their choices regarding ECE. This research has focused on immigrant populations in the Philadelphia as well as West Indian parents in the U.S.V.I. For such parents, deeply rooted cultural beliefs (i.e., parental ethnotheories) may shape definitions of "quality" ECE that differ from those espoused by ECE professionals in the U.S. Such beliefs need be understood before efforts to improve ECE quality and outcomes in children in these communities can be meaningfully undertaken.

* *Department of Special Education beginning in Fall 2012.*

West Indian Parents' Literacy Beliefs and Practices: Relationship to Children's Literacy Outcomes

Lina Muktar Mohageb, '12

Faculty Mentor: Elizabeth Jaeger
Department of Psychology



Supported by the SJU Summer Scholars Program

The literacy beliefs and practices of West Indian parents remains a relatively unstudied area, leaving room for many assumptions about parenting in West Indian families. The present summer research project expanded on a previous study in this area conducted by a graduate student in the Child Development Laboratory. I spent one month recruiting participants and collecting data on the island St. John in the U.S. Virgin Islands to research if there is a correlation between parents' literacy practices and beliefs and the literacy outcomes of their children.

The study procedures consisted of a parent interview and the assessment of children's literacy and language skills. The interview tool, developed in the previous study, contained questions on general parenting (e.g. How do you like to spend time with your children?), literacy beliefs (e.g. At what age do you think children learn how to read?), and literacy practices (e.g. How often do you read with your child?). The participants were also asked a number of questions concerning their family, educational and work background.

We expanded the previous study to not only interview parents, but also assess the literacy outcomes of their preschool-aged children (3-5 years of age). After researching different child literacy assessment tools we settled on the Record of Oral Language (ROL) and the Test of Early Reading Ability (TERA). The assessments are designed so that children who are not yet fluent readers also can be assessed on their reading abilities (emergent literacy skills). In the ROL a child is asked to repeat sentences the assessor says (e.g. Sally is riding her bike), exactly as is. In the TERA the child is asked to look at pictures in a book and answer questions about them. For instance, the child is asked about lowercase and uppercase letters, word recognition, assessed on the child's knowledge of how to hold a book the right way, where a sentence starts and ends, simple logo recognition, and pairing words with pictures.

Once we had the material in order we recruited participants by putting up posters, and handing out flyers. An incentive of 20 dollars and a children's book were offered for each parent and child that chose to participate. In total I recruited 13 participants. I have not yet analyzed the results but will spend the 2012 Fall semester doing this as an Independent Research project.

Beyond learning much about how to conduct research in the field, the trip itself was a great learning experience. For instance, as a researcher, I realized that you cannot study a population without first-hand experience of that population. And, being accustomed to a convenient lifestyle, it was a contrast to have to conserve water during bathroom visits, experiencing buses that run hours off schedule, and other "inconveniences". But it made me more present –having to conserve natural resources made me more aware of every action I made, and waiting for the bus a couple of hours gave me more time to interact with people, or to sit on the beach, reflect and take in the view. These are all lessons I will carry home with me.



Virginia Goulding Johnson
Department of Teacher Education
Saint Joseph's University

Ph.D. University of Delaware

Research interests: Development of
thinking in teachers

One need look no further than the nightly news or a daily newspaper's headlines to see the pervasiveness of violence in our society. This societal problem becomes a school problem when young students imitate the aggressive and violent characteristics of the adult world. Part of my scholarly interest in schools and positive climates has focused my interest on the benefits of teaching children strategic nonviolent responses to conflict.

Since 1998 I have been involved with a SJU student-created initiative entitled *The Peacemaker Curriculum*. *The Peacemaker Curriculum* is a set of lessons using wide-ranging children's literature (Dr. Seuss) and activities to help children recognize and manage their feelings, respect others' similarities and differences, identify multiple perspectives of a conflict, and resolve conflicts through problem-solving alternatives.

Undergraduate students in my Education courses, particularly those designated as Service-Learning, have ventured into Philadelphia public, parochial and private schools to teach elementary school children these basic tenets of nonviolent conflict resolution. Last spring Ms. Colleen Callahan, an EDU 392 student used the curriculum in working with 6th and 7th graders at a Philadelphia ACESJU school. With her peers, she created additional role plays and activities geared towards the upper elementary/middle school student.

This summer Ms. Callahan began, as a Summer Scholar, to investigate the theoretical frameworks for nonviolent conflict resolution education. She examined descriptive and empirical studies as well as meta-analyses. Her present work is twofold: interviewing practicing teachers on classroom practice and writing a literature review on conflict resolution programs. It is our intent to create a Teacher's Handbook on nonviolent conflict resolution "best practice" and to submit an article for publication.

Resolving Conflicts Nonviolently

Colleen Callahan, '13

Faculty Mentor: Virginia Johnson
Department of Teacher Education

Supported by the SJU Summer Scholars
Program and the Faith Justice Institute



My summer research topic came about after taking Dr. Johnson's course *Social Studies in the Elementary Schools*. This Service Learning class allowed 3 classmates and I to go to a Catholic school in Philadelphia and teach 7th and 8th graders strategies for nonviolent conflict resolution. After the course was complete, I found myself still reflecting on my experience with the students and wanting to know and do more.

I started my research by conducting a literature review on nonviolent conflict resolution. I relied on 3 meta-analyses as well as information provided by commercially produced and empirically grounded programs. The results of the research concluded that teaching students the skills they need to deal with handling conflict in a peaceful manner is a worthwhile experience. There was found to be decreases in both physical and verbal altercations with the use of such programs. My research also found that the best way for students to understand nonviolent conflict resolution strategies is through role-play because it allows for students to use perspective taking. One question raised by the research is at what age group should nonviolent conflict resolution be targeted. Although the research states that older children get more out of such programs, research also states that in no way should younger students be ignored. With mixed results thus far, I intend to research further into this issue of concern.

While looking at what the literature suggests and surveying teachers about classroom strategies, I have begun creating a curriculum handbook that teachers in the Philadelphia area can use to teach nonviolent conflict resolution strategies to their students. The handbook is divided into 8 main topics I have identified in reviewing various programs. Such topics include accepting others, respecting similarities/differences, understanding/handling feelings, communicating affectively, as well as other topics. Each component then has age-appropriate activities that students can complete to enhance their understanding of the material.



Christina King Smith
Department of Biology
Saint Joseph's University

Ph.D. University of Maryland,
Baltimore County

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:

- Do actin dynamics, including actin retrograde flow, play a role in pigment granule motility?
- The signaling molecule, cAMP, stimulates pigment granule aggregation in vitro. What are the targets of PKA?
- What type of myosin motors are in RPE that could effect pigment granule motility, and what is their distribution?

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.

Mechanisms for Pigment Granule Motility 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 the Howard Hughes Medical Institute



The retinal pigment epithelium (RPE) is a cell layer lining the back of the vertebrate eye. RPE cells contain pigment granules and have long apical projections, which surround the cones and rods in the retina. In lesser vertebrates, such as fish, which lack dilatable pupils, the pigment granules in the RPE undergo mass migration from the cell body into the apical projections, surrounding the photoreceptors to protect them from bleaching in the light.

Previous research has shown that the motility of pigment granules in the RPE is actin dependent. Myosins are a superfamily of actin-dependent motor proteins that are responsible for both cell and organelle movement. Previous research has also shown that Myosin VIIa may be partially responsible for pigment granule motility, and Myosin Xb RNA is found in RPE, but not retina, indicating that Myosin Xb may also play a role in pigment granule motility.

To see if Myosin Xb does play a role in pigment granule motility, RPE cells were isolated, a lysate was prepared, proteins were separated using SDS-PAGE, and immunoblotting was performed. Anti-Myosin Xb antibodies were tested to determine if they recognize Myosin Xb protein in RPE cells. The antibody did not bind specifically in the RPE sample, and also bound to multiple proteins from a retina lysate. It was impossible to accurately determine if the antibody was binding to ransom proteins or a Myosin Xb breakdown product.

Besides myosin related movements, we are exploring the possibility that aquaporin water channels are involved in pigment granule motility. Because aquaporins control water flow in and out of cells, it is possible that aquaporin activity causes a change in osmotic pressure that would help drive the pigment granules into the cell body. Previous research has shown that aquaporins are inhibited by heavy metals such as mercury, nickel, zinc, and copper, as well as by pH changes. RPE cells were isolated and plated, then exposed to media with mercury ($HgCl_2$) or media having low pH, then were triggered to aggregate or disperse to test their ability to function in these environments. Preliminary results indicate that mercury irreversibly inhibits pigment granule aggregation, but low pH does not.

By studying pigment granule motility in RPE cells, it is possible to examine intracellular organelle motility and the possible mechanisms involved.

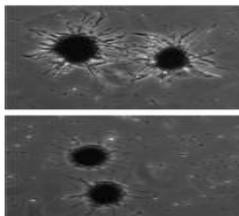


Figure 1: Examples of dispersed (top) and aggregated (bottom) RPE cells.

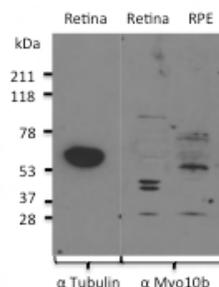


Figure 2: Immunoblot with RPE and retina lysates probed with Myosin Xb antibody. The antibody demonstrates non-specific binding at multiple molecular weights.



Paul Klingsberg

Department of Mathematics

Saint Joseph's University

Ph.D. University of Pennsylvania

Research Interests: Combinatorics;
Graph Theory; Computational
Complexity

My fields of research are *combinatorics* and *graph theory*. In very general terms, combinatorics deals with enumeration of the number of ways to perform a mathematical task (such as choosing a delegation of three people to represent a group of 15 people), and graph theory is concerned with diagrams you make by connecting dots with lines. Since these areas are relatively accessible to undergraduates, they are often sources of undergrad-level research problems, but not all the projects I have directed have been purely combinatorial, because the choice of topic is in large part driven by the student's needs and interests. I have directed projects each of the last five summers. In '06, I directed two summer scholar projects: *The role of invariance in mathematics* (which, among other things, investigated the use of an invariant in a number of combinatorial problems) and *Generalized Möbius Inversion* (which is abstract combinatorics). In Summer '07, I directed a project in another area of combinatorics, *Pólya-de Bruijn Theory*, which deals with enumeration questions in which not all the ways of performing a task count as different. (For example, consider painting the faces of a cube using k colors. Rotating the cube will make some colorings coincide with others.) I directed a project centered on probability theory '08, on stochastic processes and the Black-Scholes formula in '09, on problem solving in '10, and on coding theory and public-key encryption in '12. For more details on these projects, please see the one-page summaries prepared by the students.

Coding Theory and Public-Key Encryption

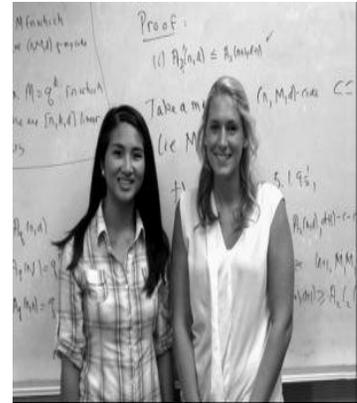
Kaitlin Kelly, '13

Deangela Valdez, '14

Faculty Mentor: Paul Klingsberg

Department of Mathematics

Supported by the SJU Summer Scholars Program



Our project was centered on two loosely-related topics. *Coding Theory* is concerned with minimizing errors when data is transmitted. Clear text is encoded, code words are transmitted, and received words are decoded; the idea is to choose the set of code words so that transmission errors can be detected and corrected but also so that the ratio of data transmitted to data encoded is not too large. These two goals pull the coding in opposite directions—that is, there is a tradeoff between accuracy and efficiency—and the highlights of the subject include precise statements of what forms these tradeoffs must take. Since many of the methods employed treat the code words as vectors over a finite field, understanding this subject requires considerable knowledge of linear algebra and field theory.

Public-key encryption deals with methods to encode and transmit data securely—that is, methods of encoding which are public knowledge but for which the corresponding decoding methods are essentially impossible to discover. (This subject turns on ideas from computational complexity. For example, it is theoretically possible to decode by reverse-engineering the encoding algorithm, but this process cannot be carried out within the lifetime of the universe.) We examined the so-called *RSA Algorithm*, which is still in widespread use, despite being the first such encryption method discovered (in 1978). The RSA algorithm requires two large prime numbers (each one hundreds of digits long), so we also studied methods for producing such numbers (a pseudoprime-generating algorithm and the Agrawal-Kayal-Saxena Algorithm). Understanding how these algorithms work requires considerable knowledge of abstract algebra and of results in computational complexity.

We spent the first part of the summer on the mathematical background: polynomial rings, extension fields, linear algebra, finite fields, *etc.* We then studied coding theory and public-key encryption in detail, at times extending our knowledge beyond our source materials. (For example, while investigating polynomial rings over finite fields, we discovered a closed formula for the product of all of the irreducible polynomials of a fixed degree.)

We both found the project valuable to our mathematical development. It was useful and satisfying to see mathematics that we had encountered piecemeal over a wide variety of disparate courses drawn together, extended, and put to practical use. The project also brought home to us how amazingly broad, deep, and interconnected the mathematical landscape is.



Douglas Kurtze
Department of Physics
Saint Joseph's University

Ph.D. Cornell University

**Research interests: Ocean
circulation and global climate**

The goal of this project is to formulate a simple mathematical model of the large-scale circulation of the ocean and its coupling to the large-scale climate of the earth. This model can then be used to assess the effects of a variety of natural and artificial changes, such as variations in the brightness of the sun and changes in greenhouse gas concentrations.

The Meridional Overturning Circulation, or MOC, is a pattern of flow in the Atlantic Ocean in which water moves northward along the surface, then sinks in the sub-Arctic and returns southward near the ocean floor. The MOC moves a significant amount of heat from the tropics into the northern hemisphere; there is strong evidence that it was weak, or even absent, during the last Ice Age. There have also been some indications that global warming can weaken it.

The MOC is driven by winds blowing across the ocean surface, and by differences in density between the water in different regions of the ocean. Colder or saltier water is denser and tends to sink. The salinity of the water is affected by evaporation and precipitation (with an excess of evaporation leaving it saltier), which is in turn affected by temperature. Winds are also driven by temperature differences. Thus in order to understand the MOC, we need to understand what determines the earth's temperature.

The earth's temperature is set by a deceptively simple balance between the rate at which energy is absorbed from sunlight and the rate at which the earth radiates energy to outer space. Both the input and output, however, are affected by a variety of factors.

The earth radiates infrared light at a rate that depends on its temperature, but greenhouse gases in the atmosphere absorb some of this infrared before it can escape into space. This forces the earth's temperature to rise until the amount of infrared that actually escapes matches the energy received from the sun. How the amount of radiation escaping depends on the surface temperature and the concentrations of greenhouse gases is complicated, and Ryan Stull has been working on calculating it. Significantly, water vapor is a greenhouse gas, so the amount of water vapor in the atmosphere affects the surface temperature, which in turn affects the amount of evaporation that occurs, and so affects the amount of water vapor in the atmosphere. Understanding this feedback will be a key element of the model.

The rate at which the earth absorbs solar energy is affected by the earth's albedo – the fraction of incoming sunlight which is reflected away instead of being absorbed. Among other things, snow and ice contribute to the earth's albedo, so the amount of snow and ice affects and is affected by the earth's temperature. (And clouds contribute to *both* the albedo and the greenhouse effect.) Ocean circulation transports heat from the tropics to the polar regions, and so affects the area covered by sea ice. I have been working with collaborators at the University of Arizona to understand this feedback.

Studying the Greenhouse Effect Using Computational Methods

Ryan Stull, '15



Faculty Member: Douglas Kurtze
Department of Physics

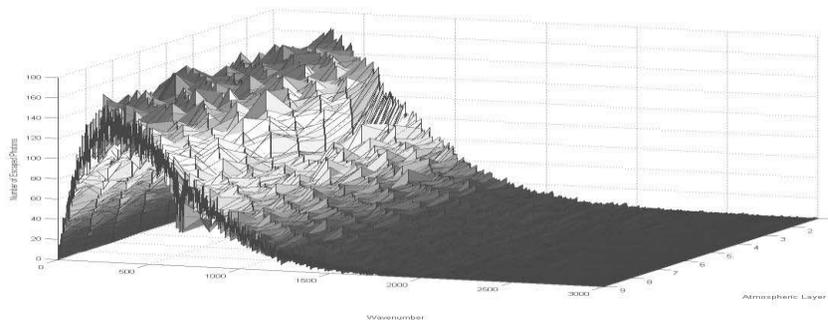
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The Earth's temperature is determined by the balance of incoming radiation from the sun and the outgoing radiation the Earth emits. Simply taking only these two factors into account it can be calculated that the average temperature of the Earth should be approximately 255 Kelvin, which is 33 Kelvin lower than the observed average; this discrepancy is due to the greenhouse effect.

The spectrum of light emitted by an object depends upon its temperature. Since the Sun's temperature is approximately 5800 Kelvin, it emits most of its radiation in the visible spectrum of light. The Earth's temperature is approximately 300 Kelvin, and so emits most of its radiation in the infrared spectrum of light. Greenhouse gasses don't absorb visible light, but do absorb infrared light and so trap a certain percentage of the Earth's outgoing radiation. This trapping of energy by the atmosphere is the greenhouse effect. Important greenhouse gases include CO₂, Water, and Methane. It was the goal of our research to come to a quantitative understanding of the greenhouse effect.

Our work began by formulating and solving a differential equation for the radiation emitted by the Earth, however if the radiation is able to move in more than one dimension the differential equation becomes unsolvable. In order to fix this problem we switched to using a Monte Carlo simulation, in which the absorption properties of the atmosphere are accounted for in the program and simulated photons are launched into it in order to find the fraction that escape. The picture below displays the distribution of escaped photons according to wave number and layer of atmospheric origin.

The parameters of the program can be adjusted to find effect of the greenhouse for any concentration of greenhouse gasses, thus it can then be used in conjunction with the Meridional Overturning Circulation, or MOC, an ocean based climate model which Dr. Kurtze is developing, in order to predict long term climate behavior.





Sally Kuykendall
Department of Health
Services
Saint Joseph's University
Ph.D. Temple University
Research Interests: Youth
Violence

Sally Kuykendall with key stakeholders at the Family Safe Zone Project kick-off event at Saint Christopher's Hospital for Children

The focus of my research is the prevention of youth violence. Youth violence is one of the leading causes of death in the United States with 51,000 fatalities every year. Young people account for most of these unnecessary and horrific deaths. In medicine, doctors use evidence-based treatments, medicines, therapies, and surgeries that have been proven to work. It makes sense to apply the same standards that we use in medicine to social problems. I evaluate youth violence prevention programs to determine how well each program works. In the past, I have evaluated the Olweus Bullying Prevention Program, the Parent Transformations program, the Caregivers Helping to Affect and Nurture Children Early (CHANCE) program, and the National Health Corps Program. Evaluation research requires close collaboration with community organizations, program participants, and key stakeholders in the community.

During Summer Scholars 2012, we evaluated three programs, the Family Safe Zone project at Saint Christopher's Hospital for Children, the Partnering with Parents program at two nurse-managed family practice clinics, and the Philadelphia Department of Public Health Pediatric Champions project. These projects all grew out of the same theoretical foundation-children thrive when they grow up in healthy, supportive families. The brain continues to develop throughout the first 25 years of life. Exposure to traumatic stressors, such as domestic violence or child maltreatment, impacts the developing brain. The brain forgoes healthy development to deal with the immediate threats. Children who are exposed to these adverse experiences go onto repeat the same behaviors as adults. By supporting parents in the challenges of parenting, we can promote healthy childhood brain development and break the cycle of family violence. The Family Safe Zone project educated health care providers on how to recognize and safely intervene in cases of harsh parenting. The project surveyed healthcare providers and parent caregivers to determine how the program changed perceptions and practices.

Partnering With Parents

Kevin Henry, '13

Faculty Mentor: Sally Kuykendall

Department of Health Services

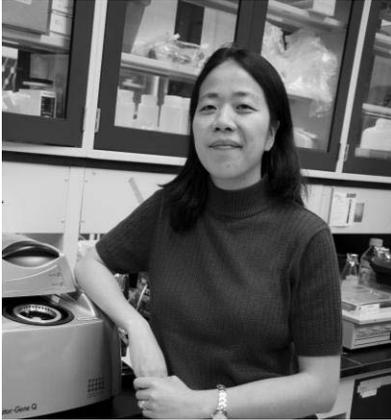
Supported by the SJU Summer Scholars
Program



Child abuse is an issue that is all too prevalent in young families today. The Center for Disease Control and Prevention defines child abuse as “Words or overt actions that cause harm, potential harm, or threat to harm a child.” It is especially common to find child abuse among new parents in today’s society.

Partnering with Parents is a program that is designed to help parents, both new and experienced, in order to help educate them and prepare them for life as a parent. The program helps assess the background of the parents to determine their risk factors for the future and to help them to implement positive parenting strategies. The data for this project was obtained through caregiver surveys during a parenting intervention. The intervention helped guide or answer any questions the parents may have regarding child development. In addition to helping new parents, the project aimed to help medical staff recognize abuse and measures that can be used to ensure protection of children. The project targeted parents the Philadelphia area.

The work I did this summer involved entering data from surveys that were given to parents at various health centers in the Philadelphia area. These surveys asked questions such as ones that dealt with how they believe children should be raised and what their backgrounds consisted of to see what may influence one’s ideals on how to raise children. Surveys completed were also able to help determine one’s stress level. I entered the data electronically and summarized results. I also collected data on hospital policies regarding corporal punishment on the premises of the hospital to help determine current policies to ensure the protection of children.



Julia Y. Lee-Soety
Department of Biology
Saint Joseph's University

Ph.D. University of Pennsylvania

**Research Interest: Telomere
Biology**

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 are able to avoid telomere losses, but cancer cells may inappropriately 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 Npl3, 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; this suggested that Npl3 has a functional role at the telomere. This summer, we examined how critical protein domains in Npl3 might be important for it to work at maintaining the telomere. Npl3 has two the RNA-recognition motifs (RRM) and a region rich in arginines and glycines (RGG). We found that the second RRM was required for Npl3 to rescue the accelerated senescence of telomerase mutants. We also observed that Npl3 has a preference for binding to telomeric DNA, and this binding needed both RRM. 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.

Overexpression of Npl3p Does Not Rescue Senescence in Yeast Cells Lacking Telomerase

Andrea Ito, '14

Faculty Mentor: Julia Lee-Soety
Department of Biology



Supported by the National Institutes of Health and the Howard Hughes Medical Institute

Telomeres are nucleotide repeats at the ends of linear chromosomes that protect coding regions from degradation. Because DNA polymerase cannot fully replicate the telomere ends, telomeres shorten over time, causing cell cycle arrest or senescence. In yeast cells and human stem cells, the enzyme telomerase is constitutively expressed to re-elongate the telomere and prevent senescence. However, expression of telomerase in human somatic cells can contribute to cancerous growth.

Saccharomyces cerevisiae (baker's yeast) serves as a good model for studying telomeres because removal of telomerase expression causes yeast cells to behave like human somatic cells. Yeast cells express an RNA-processing protein Npl3p that is structurally similar to hnRNPA1, a protein found in humans involved in telomere maintenance. We observed that deleting *NPL3* causes accelerated senescence in telomerase-null cells. We are interested in further exploring the role of Npl3p in yeast, specifically if overexpression of Npl3p could prevent faster senescence in the absence of telomerase.

Strains were produced by introducing a control vector (CV_○,●) or plasmids containing high-copy *NPL3* (NPL3-hi □,■) or low-copy *NPL3* (NPL3-lo ▲) into *tlc1npl3* and *tlc1* mutants. A senescence assay was performed in which population doublings and cell concentrations of cultures were tracked. Figure 1 shows that overexpression of Npl3p via expression of the high copy plasmid exclusively (□) or of both the high-copy plasmid and native genes (■) in *tlc1* null cells does not appear to significantly rescue accelerated senescence to a higher degree than in cells expressing normal levels of Npl3p (●,▲). This indicates that in the absence of *tlc1*, the ability of Npl3p to rescue faster senescence is not enhanced by overexpression.

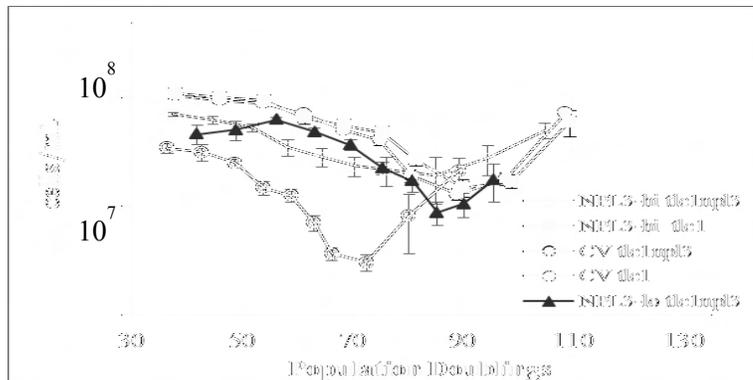


Figure 1: The ability of Npl3p to rescue faster senescence is not enhanced by overexpression. Population doublings were calculated by tracking growth of populations of 2×10^6 cells every 22 hours for 11 days. NPL3-hi n=5, CV n=5, NPL3-lo n=7. Error bars represent the standard error of the mean.

Mutant Npl3p Cannot Rescue Accelerated Senescence in *tlc1 npl3* Double Mutants

Shannon Spencer, '14

Faculty Mentor: Julia Lee-Soety
Department of Biology



Supported by the National Institutes of Health
and the Howard Hughes Medical Institute

Telomeres are guanine rich DNA sequences located at the ends of linear chromosomes that prevent their degradation. DNA polymerase is unable to fully replicate the terminal ends and nucleotides are lost with each round of division causing cellular aging referred to as senescence. Telomerase is an enzyme that helps compensate for DNA polymerase's limitation, but inappropriate expression of telomerase causes telomeres to relengthen, contributing to the formation of cancerous cells. Yeast cells with a mutated *tlc1* gene which codes for the RNA template component in yeast telomerase are unable to maintain their telomeres and senesce early.

Saccharomyces cerevisiae (Baker's yeast) is an ideal model for study because it resembles human somatic cells and contains the protein Npl3p. Npl3p is structurally comparable to hnRNP A1, a protein that has been shown to be critical for telomere maintenance in human cells. Both proteins have two similar RNA recognition motifs, RRM1 and RRM2. Previous research has shown that telomerase-null cells with Npl3p having no RRM1 and RRM2 functions undergo accelerated senescence while cells with Npl3p having only no RRM1 function do not senesce early. We hypothesized that the RRM2 region is therefore critical for Npl3p's function in yeast telomere maintenance.

The main focus of the project was to examine if Npl3p with only a mutated RRM2 region could prevent accelerated senescence in yeast cells. We used a control vector containing no Npl3p (▲ "none"), or plasmids expressing either fully functional wild type Npl3p (● "WT") or Npl3p with a non-functional RRM2 region (■ "RRM2"). The plasmids were introduced into double mutant cells with neither functional telomerase nor Npl3p (*tlc1 npl3*) so the effects of the Npl3p expressed by the different plasmids could be compared. A senescence assay was completed by inoculating haploid cells in SC-URA medium. Figure 1 shows RRM2 mutated cells still senesced quickly. The RRM2 mutated *tlc1 npl3* cells reached their lowest point of senescence after approximately 65 population doublings, similar to the "none" cells which did not express any Npl3p. The rate of senescence was significantly accelerated compared to the WT Npl3p cells which reached their lowest cell density after 90 population doublings. The data indicates that without a functional RRM2 region, which is critical for Npl3p to maintain telomeres in yeast, *tlc1 npl3* cells are unable to rescue accelerated senescence.

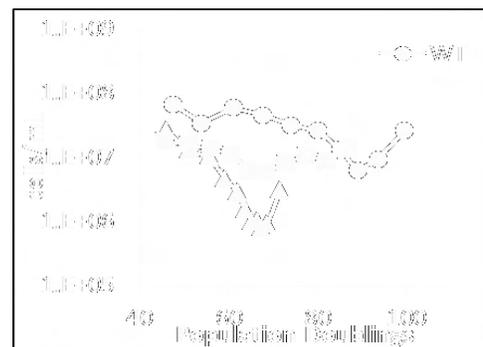


Figure 1: Npl3p with no functional RRM2 cannot prevent faster senescence in *tlc1 npl3* cells.
TLCl1/tlc1::LEU2, NPL3/npl3::Kan^r diploid cells were transformed with plasmids expressing WT *NPL3*

genes, SNK-*NPL3* genes, or none (control). Haploid cells were maintained in SC-URA medium. Population doublings were calculated every 22 hours for 11 days. WT n=4, SNK n=5, none=3; error bars represent standard error of the mean.



Alison Lewin

Department of History
Saint Joseph's University

Ph.D. Cornell University

Research Interests:
Medieval, Renaissance

This year's Summer Scholars Project, working with Ed Foley, has in many ways returned me to my own roots in history. As an undergraduate, I was very unwillingly backed into a class in Roman History, at the strong insistence of my Classics advisor (my neurobiology advisor did not object). Having hated history in high school, I found myself surprisingly fascinated by this kind of history, one that required students to engage with primary sources, to understand historiographic traditions, to question evidence, and to see that events in the past could be just as contentious now as they were in their own time. (Ask any two scholars, "Did Rome fall?" and you will get at least three answers!)

While pursuing my scientific studies, I kept adding more and more courses in ancient history to my schedule. After a few detours that occupied my twenties in various ways, I found myself wanting to learn more about history and even to think of teaching it someday. Rather than pursue ancient history directly, however, I decided to add another layer, that of the Italian Renaissance. Because the Renaissance was the rebirth of antiquity, I was able to keep my old favorite works and topics, to view them from new perspectives, and to add previously unfamiliar authors and questions to my historical studies. I have, for example, examined the words and actions of Cosimo de' Medici in light of Augustus' *Res Gestae* to evaluate the extent to which Cosimo consciously imitated this first Roman Emperor. Teaching ancient Roman and Greek history at SJU has been enormously enjoyable and enlightening for me as well as for my students.

Mr. Foley's project, evaluating a biography of a Roman elite, Agricola, as related by his son-in-law Tacitus, is challenging on several levels. First, reading any ancient source is problematic, because of the strong authorial traditions that shaped any serious work, and because of the lack of external materials to validate a source's claims. Second, the work focuses on Agricola's tenure as imperial governor of Britain. Little is known about actual government in the Roman provinces, especially so early in the Principate (as the first centuries of imperial government are called), so it is difficult to assess the extent to which Agricola's decisions and actions were typical. Third, Britain was itself a newly acquired province, so no time-honored traditions would have influenced Agricola's governance there. Mr. Foley's work raises more questions than it answers, but does offer plausible conjectures based on the evidence available. For ancient historians, that is the best outcome we can hope for.

Rethinking Agricola: Understanding Roles and Relationships of Roman Influence in Britain

Edward Foley, '13

Faculty Mentor: Alison Lewin
Department of History

Supported by the SJU Summer Scholars Program



The Roman Empire was far greater than the emperor, than the legions, than the city of Rome itself. The empire was instead a complex organization filled with countless political agendas, economic constructs, and social norms. But perhaps most importantly it was a system of imperial and senatorial provinces connected to a central government. This summer I ventured to better understand one of these provinces because they are often forgotten about and their importance underrated. I studied Roman Britain under the governorship of Gnaeus Julius Agricola, 77CE-85CE. I chose Agricola and Britain because they are often forgotten, and the importance of the island is often underrated. Understanding Britain during the rule of Agricola gives modern historians a better example of how the provinces were managed, and why the island was so important to imperial economics.

I have found many themes during my research. First is the nature of the imperial government in the provinces. Depending on the type of province, governors served at the pleasure of the emperor or the Roman senate, typically no more than three to four years. Under Agricola, who served for eight years, rebellious tribes were at last pacified, and large scale Romanization of the island occurred. The most visible sign of Romanization still visible today is the network of Roman roads. Second is the changing role of the aristocratic elite, or *nobiles*. Many wealthy sought greater fortunes in the provinces, especially Britain. They would build their villas in the provinces instead of in the bustling cities. Native aristocracies also gained increasing influence in Roman provincial affairs. A new breed of elites was also granted membership in the Senate, a source of political tension for the Emperors, particularly Domitian.

A third theme I've discovered was the style and composition of a Roman biography. The only known written source for Agricola is his son-in-law, Tacitus, who himself was a great historian and Senator. Tacitus' *The Life of Agricola* often exaggerates the number of troops in battle or the quality of a person's character. These biases make it very difficult to discern the truth in some matters. But most of Tacitus' version is trustworthy, to some extent. This trait correlates to the fourth theme, that of Tacitus' own political and literary positions. For example, Tacitus despised the imperial government and longed for the return of republicanism, an attitude that colored much of his writing.

The final theme is the relationship between Agricola as a governor and general under the Emperor Domitian. Based on his childhood experiences, Agricola should have despised the emperors, but instead he overcame obstacles like civil war in 69 CE to become a leading military tactician and brilliant political leader. Tacitus notes that this could have sparked conflict and tension with Domitian, whose own political and military career was slowly being overshadowed by Agricola's greater success.



Edwin Li
Department of Biology
Saint Joseph's University

Ph.D. University of Rhode Island

Research Interests: Membrane Protein
Structure

My research area focuses on understanding the physical and chemical principles governing the interaction of membrane proteins. Of particular interest is the interaction of fibroblast growth factor receptors (FGFR1-4) and mucin 1 (MUC1). FGFR3 is a single-pass membrane protein that regulates cell growth, differentiation and motility. Over-expression and mutations in FGFR3 have been associated with several forms of cancer. Likewise, over-expression of the membrane protein MUC1 has been associated with cancer. It is well known that FGFR3s interact with each other as a mechanism to propagate signals across the membrane. Recent studies have also shown that MUC1s interact with each other.

Due to the difficulties in obtaining NMR structures of membrane proteins, interactions of membrane proteins 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 physico-chemical principles behind these interactions may lead to the design of better therapeutics with high specificity.

Structural Studies of FGFR3 Dimerization in Eukaryotic Cells

Bernadette Eichman, '14

Faculty Mentor: Edwin Li
Department of Biology

Supported by a Gift from Nick Nicolaides, '87



Fibroblast growth factor receptors (FGFRs), FGFR1-4, a family of receptor tyrosine kinases (RTKs), are involved in cell growth, differentiation, survival, and skeletal development. Composed of an extracellular domain, a transmembrane domain (TMD) and an intracellular domain, these proteins exist in a monomer-dimer equilibrium in the plasma membrane. Ligand binding to the extracellular domains stabilizes the FGFR dimer, resulting in cross-phosphorylation of the intracellular tyrosine kinases domains, initiating signaling cascades.

Previously in Dr. Li's lab, ToxR assays have been used to determine if there are differences in the structure of FGFR3 wild-type (WT) and A391E mutant transmembrane domain dimers. The A391E mutation has been associated with a cranial disorder. The ToxR assay is carried out using a chimeric protein with the TMD of interest, and uses enzymatic activity as a reporter of TMD-TMD interactions in bacterial membranes. This assay has shown that when the G382I substitution is introduced in both WT and A391E TMDs, their relative changes in enzymatic activity are significantly different from one another. The G382I mutation does not change the level of enzymatic activity in the WT TMD. However, this substitution in A391E TMD results in a significantly different level of enzymatic activity. These results suggest that the structure of WT TMD dimer is different from the one formed by the A391E TMD.

My project this summer was to verify if the G382I substitution has the same effect in full receptors expressed in mammalian cells. In order to do this, mutagenesis was performed to introduce the G382I mutation into plasmids encoding WT and A391E FGFR3. To observe the effects in dimerization, 293T cells were transfected with plasmids encoding WT, A391E, WT_G382I, and WT_A391E_G382I receptors. Fluorescence immunostaining was carried out to verify that WT and all mutant FGFR3s were localized in the membrane. Crosslinking experiments and Western blots were performed to detect the degree of dimerization.

Dimerization of MUC1 Transmembrane Domain

Gina Montone, '14

Faculty Mentor: Edwin Li
Department of Biology

Supported by a Gift from Nick Nicolaides, '87



Mucin 1 (MUC1) is a membrane protein that has a large, heavily glycosylated extracellular domain, a single alpha helix transmembrane domain (TMD), and a short cytoplasmic domain. MUC1 has already been shown to interact with itself, forming dimers, especially when it is overexpressed in cancer cells. However, it is still not certain which part of the MUC1 protein is involved in the homodimerization.

The ToxR assay is used to measure the interactions of transmembrane domains using a chimeric protein with the TMD of interest. The ToxR assay measures dimerization by measuring the activity of an enzyme. The expression level of the enzyme is a reporter of the strength of interaction between transmembrane domains. Therefore, a high enzyme activity correlates to high expression, which indicates strong interaction. The ToxR assay was used to determine if there was any interaction in the transmembrane domains of MUC1. Plasmids that expressed chimeric proteins containing different lengths of the MUC1 transmembrane domain were used in the ToxR assay.

Using ToxR assays it was found that plasmids expressing the MUC1 TMD showed a relatively higher amount of activity than plasmids expressing Δ TM, a chimeric protein without a TMD. These results suggest that the transmembrane domain is involved in the dimerization of MUC1. Also, it was found that the plasmid with the shortest transmembrane domain (24 amino acids) showed the highest amount of activity. It has been recently been shown by others that a CQC sequence on the cytosolic side of the TMD is necessary for the dimerization of MUC1, so a ToxR plasmid was recently cloned containing the CQC sequence and will be further tested using ToxR assays.

Effects of G380R, G382D, and A391E Peptide Mutations in the Dimerization of FGFR3 Transmembrane Domains

Meghan Muretta, '15

Faculty Mentor: Edwin Li
Department of Biology



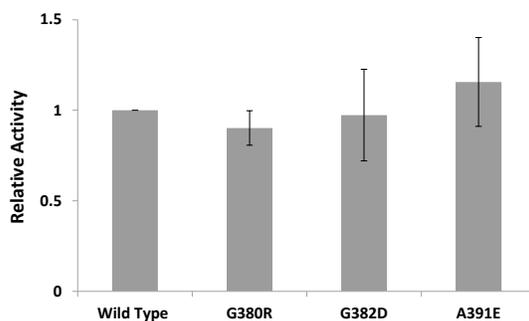
Supported by the Howard Hughes Medical Institute

Fibroblast growth factor receptor 3, FGFR3, is a single-pass transmembrane protein. FGFR3 consists of three domains: an extracellular ligand binding domain, a transmembrane domain, and a cytoplasmic domain. FGFR3 is important to study because it is critical in bone development and maintenance. Mutations found in the transmembrane domain of FGFR3s have been known to cause many skeletal diseases and some cancers. The objective of this experiment was to study the effects of three pathogenic mutations (G380R, G382D, and A391E) in the dimerization of the transmembrane domain of FGFR3 using ToxR assays.

The G380R mutation is known as the genetic cause for achondroplasia, the most common form of dwarfism. Studies using Western blots show no change in the degree of dimerization of the transmembrane domain of FGFR3. The G382D mutation has been identified in a patient with multiple myeloma, a type of blood cancer. Not much previous research has been done with this mutation, but dimerization is expected to increase. Lastly, the A391E has been identified as the genetic cause for Crouzon syndrome, a premature ossification of the skull in the coronal area. Previous studies with this mutation have shown an increase in the degree of dimerization.

The ToxR assay is a method for measuring homodimerization of transmembrane domains (TMDs) in bacterial membranes. The assay measures the strength of transmembrane helix interactions by measuring enzymatic activity. High enzyme activity indicates high levels of expression of the enzyme which indicates a high degree of dimerization. In this experiment, the ToxR assay was used to compare the three pathogenic mutations to the wild type FGFR3 transmembrane domain.

Preliminary results suggest that the three mutations do not have a significant effect on TMD-TMD interaction. More experiments are needed to confirm the results.





Benjamin Liebman

Department of Economics

Saint Joseph's University

Ph.D. University of Oregon

Research Interests:

International Trade

My research investigates the impact of trade policies that the United States uses to protect domestic firms threatened by foreign competition. There are various legal avenues that U.S. firms can turn to in order to obtain trade relief, and I'm interested in a number of issues related to these policies. In one study, I investigate which industries are more successful in obtaining protection from U.S. policy makers. My statistical results suggest that firms located in voting districts of influential members of congress were more likely to be granted trade relief.

I have also investigated the degree to which protectionist policies actually aid industries threatened by foreign competition. Results from a recent paper focusing on the U.S. steel industry suggest that protection has less of an impact than other forces in benefiting U.S. firms. For example, the tremendous economic growth of China, which has been part of a global increase in the demand for steel and other commodities, was far more important than trade protection in boosting the health of the U.S. steel industry.

Another area of my research deals with some of the unintended consequences of trade protection. These include the higher cost that some industries face when trade protection is imposed. For example, when the U.S. steel industry obtains protection from imports, steel prices rise, and U.S. auto companies and appliance makers are suddenly faced with higher costs. Moreover, foreign countries facing U.S. trade barriers sometimes retaliate against the U.S. by imposing their own protectionist policies on U.S. products. For example, the E.U. threatened to impose extra taxes on Harley Davidson motorcycles if the protection granted to the U.S. steel industry by President George W. Bush wasn't removed. In general, I find international trade policy to be such a rich area of study with so many issues to explore.

The Effect of Section 337 International Patent Infringement Cases on Market Prices

John Rafferty, '13

Faculty Mentor: Benjamin Liebman
Department of Economics

Supported by the SJU Summer Scholars Program



As the international marketplace has expanded, the need for protection against unfair trade practices has become vital. Section 337 of the Tariff Act of 1930 is a trade policy that protects the United States from certain unfair trade acts—specifically cases that involve the infringement of U.S. intellectual property rights by foreign firms. Other unfair acts addressed under Section 337 comprise of copyright infringement, misappropriation of trade secrets, trade dress, and false advertising. Unlike patent infringement amongst domestic firms, Section 337 investigations are conducted by the U.S. International Trade Commission. If a firm is found to be in violation of infringement, the ITC can issue exclusion orders that instruct U.S. Customs to stop infringing imports from entering the United States. Cease and desist orders can also be delivered against any guilty firms. Since the passing of Section 337, there has been a steady increase in the number of international patent infringement cases. In 1972, only three investigations were performed, which jumped to 69 in 2011. This increase of Section 337 use shows how many firms are looking to this legislation for patent security.

In the first stage of this project, the current Section 337 cases were broken down and the possible effects the outcomes of these cases may have on market prices were analyzed. The cases spanning from 1995 to 2010—a total of 383—were used in this study. A total of 51 different countries were involved in these cases. It was found that the most frequent countries were all from East Asia: China, Taiwan, Japan, South Korea, and Hong Kong. The overall outcomes of these cases were also derived. In 20.1% of the cases, the ITC found that there was no violation. 14.6% of the cases concluded by the domestic firm withdrawing their complaint. Furthermore, 25.62% resulted in an exclusion order while 42.6% of cases ended in a settlement.

After this information was gathered, it was possible to analyze how the outcome of these cases affected market prices. A standard equity capital market event study method was used to examine firm-specific wealth surrounding the outcome of Section 337 cases. In order to see the possible effect of the outcomes, stock prices between the window 14 days before and 14 days after the termination of the investigation were observed. The results were that, on average, there was a negative impact, as firms experienced a fall in their stock prices after the Section 337 case was ended. Even though the majority of firms were affected negatively, some firms experienced a rise in stock prices.

The second stage of this research will be continued into the fall semester. The goal will be to assess what determines different market responses after Section 337 cases, such as: firm size, Research and Development, assets, and debt.



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 turtles and we currently house a number of assurance colonies containing some of the world's most endangered species. In addition we are involved in a long-term study to catalog the turtle community at the John Heinz Wildlife Refuge.

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*.

Initiation of a Long-Term Study to Mark and Monitor Turtles at the John Heinz National Wildlife Refuge

Maria Galassi, '12

Faculty Mentor: Scott McRobert
Department of Biology



Supported by the Howard Hughes Medical Institute, and the John P. McNulty Scholars Program

The John Heinz National Wildlife Refuge is a natural wildlife refuge administered by the U.S. Fish and Wildlife Service. It is located in Philadelphia and Delaware Counties, PA approximately 1 mile from the Philadelphia International Airport. The refuge was established by an act of Congress in 1972 to protect the last 200 acres of freshwater tidal marsh in Pennsylvania. The refuge is home to many species of turtles, including state-listed threatened Eastern Red-bellied Turtles (*Pseudemys rubriventris*), Eastern Painted Turtles (*Chrysemys picta*), Common Snapping Turtles (*Chelydra serpentina*), Common Musk Turtles (*Sternotherus odoratus*), and invasive Red-eared Sliders (*Trachemys scripta elegans*). This summer was spent forming a collaboration between John Heinz National Wildlife Refuge and Saint Joseph's University to begin a long-term mark-recapture study that will help determine population sizes for all turtle species within the refuge.

The first phase of this project involved finding the nesting sites most frequently used. This provides us vital information about where we can collect Eastern Painted Turtle eggs next spring to raise the hatchlings in the Biodiversity Lab at Saint Joseph's University. These turtles will be added to a species database, including details such as length of incubation at a certain temperature and size (weight, carapace length, and plastron length at hatching). Half of the turtles within each clutch will be released at the site their nest was excavated within 2 weeks of hatching. The other half of the turtles within each clutch will be maintained within the Biodiversity Laboratory for period of one year, and then released at the site their nest was excavated. During their year in the laboratory, the growth rates of these animals will be carefully monitored. Recapture data from this study would provide information on the potential benefits of a 'head-starting' program.

The second component of this project included performing turtle surveys. I traveled throughout the refuge with binoculars to observe turtles basking. The location, species, and number of individuals were recorded as well as environmental data such as survey time, air temperature, wind speed, wind direction, and tide level. These data will allow us to prepare for capturing and marking adult turtles, which will begin in the fall. This process will involve trapping adult turtles, inserting PIT tags (Passive Integrated Transponders), and recording weight, carapace length, plastron length, and sex. Overall, this information will be added to a database that will continue to grow for decades to come.

Shoaling Behaviors in Nlgn *Danio rerio* Olivia Martino, '15

Faculty Mentor: Scott McRobert
Department of Biology

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



Although a group of fish are usually referred to as a school, a shoal would be a more accurate name for the grouping of fish. A school is a group of fish that swim together in a synchronized fashion, moving in the same direction and turning simultaneously, while a shoal is any simple social grouping of fish. Important benefits of shoaling behaviors are increased success in finding food and protection from predators.

This summer I studied the shoaling behaviors of Nlgn *Danio rerio*, a species more commonly known as the zebra-fish. Nlgn stands for Neuroligin, a membrane protein on the postsynaptic membrane of a nerve cell that mediates signaling across the synapse. Mutations in Nlgn genes have been linked to autism which, in humans, can lead to abnormal social interactions. The work I performed this summer is part of an on-going study to determine whether zebra-fish that express mutant Nlgn genes demonstrate abnormal shoaling behavior.

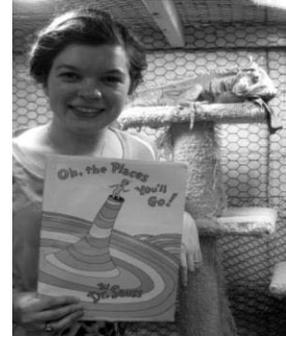
Studying the shoaling behaviors of fish is fairly easy. Test tanks are divided into thirds by adding two glass panes and test fish are placed in the center compartments while "target" shoals are placed in the outside compartments. The test fish is then observed for 600 seconds and the amount of time this fish spends near each side of the compartment is recorded. Increased time spent near one compartment over the other indicates the test fish's preference for the shoal in that compartment. The fish I tested over the summer showed a preference for shoaling with wild type zebra-fish over a different species of fish. The test fish spent $271(\pm 14.5)$ seconds shoaling with 5 wild type zebra-fish and spent $84(\pm 11.5)$ second with 5 Tetra fish. Further research and more tests will be conducted to determine if the shoaling behaviors of these fish are abnormal.

Human recognition in a green iguana (*Iguana iguana*), or Dr. Seuss for Lizards

Leigh Anne Tiffany, '15

Faculty Mentor: Scott McRobert
Department of Biology

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



In previous studies in the Saint Joseph's University Biodiversity Laboratory, a male green iguana (*Iguana iguana*) named Fido was tested for his ability to recognize specific humans as evidenced by the performance of territorial behaviors. In this study, members of the Biology Department acted as targets for Fido while students monitored the lizard's behavior. Each human subject entered the laboratory, took a seat in front of Fido's cage



and read to him from Dr. Seuss's *Oh the Places You'll Go*. Each reading took approximately six minutes, and the book contained notes that directed the reader to perform certain tasks during the reading session, such as standing up or making eye contact with the lizard. Fido's territorial behavior was monitored as a count of the number of head bobs the lizard gave during each session. The results showed that his response toward Dr. McRobert

(the lab's principle investigator) was significantly greater than the response toward any other reader.

This summer I replicated the "Fido Experiment" with Nate, an adult green iguana who currently resides in the Biodiversity Laboratory. As in the earlier study, human subjects, primarily students and faculty who are not frequent visitors to the Biodiversity Laboratory, read *Oh the Places You'll Go* to Nate, and followed the signals found throughout the book identical to those used with Fido. Conditions were kept as constant as possible for each reading. Further tests must be conducted before statistics are to be run, though potential comparisons include mean head bobs for men versus women and between different age ranges. Once enough data has been collected and statistics have been run, we will reassess and consider expanding the "Nate Experiment."



Randall M. Miller
Department of History
Saint Joseph's University

Ph.D. Ohio State University

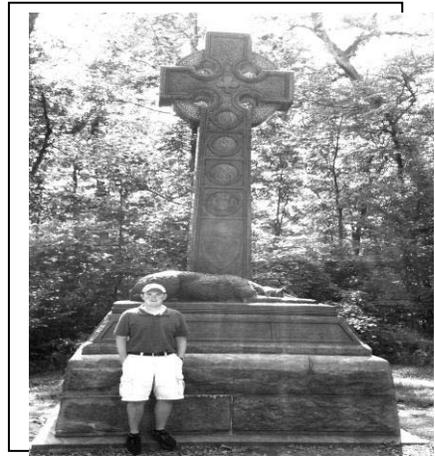
Research Interests: American social, political, and regional history, with special interests in the eighteenth and nineteenth centuries.

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, soldiers and the home front during the Civil War, Lincoln and leadership, 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 (especially in urban settings), urban transformations (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 push 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). Most recently, I have been exploring several topics related to home fronts in wartime and politics and religion, and I recently co-authored a book on the northern home front during the Civil War. I also am developing a seminar on the phenomenon of home fronts during wartime. Such interest neatly dovetails with James Kopaczewski’s investigation of the Irish in Philadelphia during the Civil War era, for he has been working through manuscript materials, newspapers, and other nineteenth-century sources to discover how the war informed and was informed by Irish Catholic interests and identity in Philadelphia. In doing so, he is providing the first sustained inquiry into the question of the ways immigrant/ethnic, religious, and local institutions and experiences shaped the Irish Catholic world(s) in America’s second largest city during the Civil War period.

**Irish Immigrants of Philadelphia:
Migration, Community, and the Civil War**
James Kopaczewski, '13

Faculty Mentor: Randall Miller
Department of History

Supported by the SJU Summer Scholars
Program



Irish immigrants flocked to antebellum America in search of opportunities, namely economic and political opportunities, which were often denied in Ireland. The Irish built dynamic communities in Northeastern and Mid-Atlantic towns where unique challenges, such as nativism and questions of identity, greeted the immigrants. These challenges in many ways helped to define the Irish experience in antebellum America; however, the American Civil War began to rapidly and profoundly change the Irish experience. It is at this juncture where we focused our work, which aimed at identifying and explaining Irish involvement on the battlefield and on the home front. Specifically, we were interested in how the Irish community in Philadelphia approached, affected, and capitalized upon the Civil War. We set the case study of the Irish in Philadelphia into a comparative framework, in order to explore the broader immigrant experience in urban America.

To achieve our goals, we went on a rigorous program of primary and secondary source analysis. Through reading letter collections (e.g. William White Papers, Robert O'Reilly Papers, and the Patrick Reilly papers) of Irish Philadelphians fighting in the Civil War, we attained an understanding of why the Irish Philadelphian soldier fought. In most cases, men cited religious conviction, fear of being seen as a coward, and the lucrative bounties offered to volunteers as the main reasons for enlistment. Secondary readings helped to color the Irish in America by examining Irish migration patterns, Irish identity, and the development of Irish dominance in political and religious realms. Furthermore, Catholic newspapers (i.e. Philadelphia Catholic Herald, Boston Pilot) offered a distinct view of Irish Catholic sentiments.

We hope to continue to develop our understanding of the Irish in Civil War Philadelphia and move towards our ultimate goal of publication.



Catherine Murray
Department of Psychology,
Gender Studies Program
Saint Joseph's University

Ph.D. University of Pennsylvania

Research interests: Gender differences
in achievement

Throughout my career, I have focused my research efforts on trying to understand the role gender plays in people's behavior and lives. 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. For this reason, the research I conduct includes both men and women with the focus both on similarities as well as differences between women and men as well as differences within each group. In many areas, within- gender differences eclipse between-gender differences suggesting the importance given gender in our society is often exaggerated and unwarranted. Over the years, the specific focus of my research has shifted. One of my current research interests concerns gender and work-family attitudes and behavior.

While gender has become less of a determining factor in the schoolhouse and the workplace, the home and family remain highly gendered institutions. Both summer scholars focused on questions related to the reasons for this, albeit from differing perspectives and with different research methodologies.

Josephine Bahn, a history major was interested in second-wave feminism and the Woman's Movement that developed in America in the '60s and '70s. Her work focused on why the Women's Movement emerged and in what ways it succeeded and failed vis-à-vis its goal of achieving full gender equality. Inevitably, she encountered the issue of work-family balance and the difficulty most working women continue to face due to their primary responsibility of caring for the home and children. Dual commitments to work and family often result in women finding themselves in a lose-lose situation. Ms. Bahn came to a better understanding of why this continues to be the case.

Elizabeth Keenan, a sociology major and gender studies minor, was interested in the psychological and social factors that contribute to the work-family choices men and women make. An extensive literature review led to a focus on the expectations young men and women have about their future lives in the areas of marriage, work and family and the possible factors that contribute them. Specifically, despite the fact that current students, both male and female state a preference for an egalitarian family, neither expects that they will have one. Why? A questionnaire designed to study male and female students' expectations as well as preferences for different adult life scenarios and the factors and the role each plays in these expectations and preferences will be administered as part of an independent research project Ms. Keenan will conduct this fall.

Is Domesticity Dead: The Second Wave of Feminism and the Women's Liberation Movement

Josephine Bahn, '13

Faculty Mentor: Catherine Murray
Gender Studies Program

Supported by the SJU Summer Scholars Program
and the Commission on the Status of
Women(COSW)



The beginning of the 1950s showed most women in America working in the home without much opportunity for meaningful activities outside of it. Second Wave of Feminism created a social and political movement that would come to define the 1960s and beyond. The desire for a more a meaningful life would provide the fuel spurring women to go against social norms of the day. In doing so, women faced opposition in the mainstream media, from their male counterparts, possible employers, and the like. Experts argue that the opposition women faced led to their further demands for equality.

Many attribute the Women's Movement that dominated the 1960s-1980s in America to the writings of Betty Friedan, especially her book *The Feminine Mystique*. A basic tenet of the Women's Movement was that equality for women would only be achieved if women fully participated as workers in the market place. Women responded to it by entering the labor force in increasingly greater numbers, including women with children. This resulted in most women finding themselves working "a double shift", responsible for maintaining the household and caring for the children, while maintaining a career.

My goal was to analyze how the Second Women's Movement began and the reactions that leaders of the movement elicited from other women across the country. Through research, I was able to pinpoint hot spots of issues that women across the nation were commonly feeling. The work of Betty Friedan ultimately resulted in the attempt to pass an Equal Right's Amendment (ERA) to the constitution. Its narrow defeat was viewed by many as representing a watershed event in the Women's Movement in America. Many credit its nemesis to Phyllis Schlafly, who was able to engender sufficient opposition to the ERA to defeat it by focusing on the threats to women and their families the ERA posed.

The remnants of the controversy about the proper place of women in society represented by the writings of Friedan and Schafly are evident in the modern "executive mother." Provision of childcare outside of the home was integral to women's liberation from the home. Some Second Wave Feminists believed that in order to achieve full equality, women would have to be considered an "ideal worker" like their male counterparts, unencumbered by outside responsibilities. Continuing childcare responsibilities due to the failure to develop alternative childcare options in this country have prevented women from doing so. As a consequence, many today view the revolution initiated by Friedan and other second wave feminists as unfinished.

Student Expectations of Future Work-Family Balance

Elizabeth Keenan, '13

Faculty Mentor: Catherine Murray
Gender Studies Program

Supported by the SJU Summer Scholars Program



I spent this summer working on a literature review of sociological and psychological research that focused on the topic of gender and work-family balance. As a result of this literature review, a questionnaire was developed that will be used in a study that will be conducted in the fall. The primary goal of this study is to determine the similarities and differences between female and male students' expectations of careers, family roles and marital relationships and the potential influences that contribute to these expectations. In her research on this topic, Gerson (2010) found that college-age men and women today differ in how they view family, work, and relationship responsibilities. She reports that currently, the vast majority of men desire to be the primary breadwinner while still constructing a relationship at home that allows them to be a part of the caretaking of children. Although espousing more egalitarian than traditional family preferences, young men's aspirations for what Gerson terms a "neo-traditionalist" home-work structure leaves much to be desired for women who crave a more equal home life, in terms of sharing of household as well as child care responsibilities, as well as a more independent lifestyle outside of the home. Deutsch, Kokot, & Binder (2007) conducted a study exploring college women's expectations of the likelihood of experiencing 6 different life scenarios including, e.g., egalitarian, scaling back work, "supermom," and role reversal and factors including gender ideology, career commitment, and anticipated family relationship dynamics contributing to these expectations. We plan on replicating and extending the Deutsch et al. study by sampling a more typical female college population and administering the questionnaire to men as well as women.

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Stephen J. Porth, Ph.D.
Associate Dean and Executive Director
of Graduate Business Education
Professor of Management
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*.

Pharmaceutical & Healthcare Marketing: An Industry Ethics Review

Danielle Puccino, '14

Faculty Mentors: Steve Porth

Dean's Office HSB, Department of Management

Dr. George Sillup

Department of Pharmaceutical & Healthcare

Marketing



Supported by the SJU Summer Scholars Program

The Pharmaceutical industry has grown to be one of the most lucrative and developed industries in the world. Companies of all sizes have made huge strides in pharmacologic advancements, finding cures for life-threatening diseases, and contributing countless research towards unmet medical needs. Despite the positive recognition, however, the industry has also grown to be viewed in a controversial light, as it has been criticized for a wide-variety of unethical conduct. These issues include but are not limited to, drug safety and shortages, high drug prices and religious concerns with the Healthcare Reform. 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* were then filtered through our methodology. Determining factors we used to categorize these articles include whether they were front page or editorial news, whether the headlines and actual article content was negative or positive, and which companies and products were being mentioned. We monitored this information using excel spreadsheets and an access database we call EthicsTrak™. By examining this information, we were 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.

When all of the articles from the year are analyzed, Dr. Sillup and Dr. Porth use our carefully gathered research to write their annual article which is published in the *Pharmaceutical Executive* magazine. The article combines the research and their insight to make conclusions about the current ethical situation of the pharmaceutical industry. Working with Microsoft Excel and contributing to a very developed Access database has greatly improved our computer analyzing skills. More importantly, this project has given us a hands-on experience and an opportunity to really learn about our field of study. In hopes to one day be a part of the industry, it is very meaningful to have knowledge of the happenings, both positive and negative, that go on in these companies. The knowledge and awareness gained through our extensive summer research project will greatly benefit me in my upcoming year of classes, and the experience will help me in any future interaction with the industry.



Usha Rao

Department of Chemistry
Saint Joseph's University

Ph.D. University of Rochester

Research Interests: Environmental
Chemistry of Water, Sediments, and
Soil

My research in environmental chemistry is focused on the study of pollutants such as metals, agricultural pollution and radionuclides in water, sediments, and soil.

During this past summer, we analyzed the levels of metals in a large network of rivers draining Pennsylvania, in particular, the Susquehanna River watershed which comprises most of the drainage for the Eastern portion of the state. 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. In addition, since the Susquehanna River drains some of the most agriculturally productive land in the U.S., it receives agricultural runoff contaminated with nitrogen and phosphorus. 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 and nutrients in the water and sediment in 18 river sites in the region. This project is expected to be a multi-year project, focusing on the concentrations of various metals and other pollutants in aqueous and sedimentary phases.

The Presence of Metals and Nutrients in the Water and Sediments of the Susquehanna River Watershed of Pennsylvania

Amy Dougher, '15

Megan Forman, '14

Christopher Millet, '13

Mike Montemarano, '13

Michelle Piotrowski, '13



Faculty Mentor: Usha Rao
Department of Chemistry

Supported by the Joseph B. Leach, '99 Memorial Research Fellowship, the Barbelin Scholars Program, the Department of Chemistry, and the Chemistry Alumni Scholarship Fund

For the past three years, we have been analyzing the concentrations of metals and nutrients in the Susquehanna River watershed, an EPA-designated “American Heritage River” system that forms 50% of the inflow of the Chesapeake Bay. The Susquehanna River and its tributaries are the largest source of industrial and agricultural pollution to the Chesapeake Bay. Anthracite coal mining in Northeastern Pennsylvania has long been a source of acidity, turbidity increases, and metals influx to the Susquehanna drainage basin. In addition, since the Susquehanna River drains some of the most agriculturally productive land in the U.S., it carries a large load of nitrogen and phosphorus from agricultural runoff. 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 N, P, Ni, Zn, Fe, Ca and Cu in the water and sediment at 18 sample locations in the region. 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. Phosphorus concentrations are relatively low (<0.1 mg/L) in these rivers. However, given the large volume of water that reaches the Chesapeake Bay from the Susquehanna River and its tributaries, total phosphorus loads to the Chesapeake Bay from the Susquehanna River are high and contribute to eutrophication. Nitrogen analyses for water samples are pending.



Agnes M. Rash

Department of Mathematics
Saint Joseph's University

Ph.D. University of Pennsylvania

**Research Interests: Great
Mathematical Discoveries**

As one of the new courses that satisfy the first year experience for students, this course introduces students to some of the great ideas in mathematics and to the mathematicians who made these great discoveries or created new theories. Students choose readings from an extensive reading list relevant to a variety of topics, including but not limited to historic information, modern applications of mathematics, biographies, careers using mathematics and other topics. With the explosion of technology and information available in the internet, it becomes more difficult to keep current and discern which of the available materials are valuable for students to explore. Examples of topics include in the course are designing secret codes, optimal scheduling problems, mathematics and the arts, the value of algorithms and prime numbers, and historical perspectives.

Elisa's research this summer included perusing the enormous collection of writings on the internet, explain the mathematics behind television game shows, find suitable venues for field trips, and in general compiling a large collection of supplementary resources to accompany the existing reading materials that are already in place.

The research completed by Elisa will provide students with the tools necessary to obtain the following goals:

- Improve their ability to read texts on unfamiliar topics and be able to summarize the content;
- Improve their ability to research an unfamiliar topic using library and internet sources;
- Expand their knowledge of how mathematics and mathematicians play an important role in society;
- Improve their ability to write using precise mathematical language.
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Great Mathematical Discoveries

Elisa Miller, '13

Faculty Mentor: Agnes Rash

Department of Mathematics

Supported by the SJU Summer Scholars Program



Writing and mathematics. on first instinct, it would seem that the two have almost nothing in common. Words and numbers, prose and proofs- the list goes on. However, mathematical literature is abundant, and can actually inspire those who read it to pursue careers, or at the very least create an appreciation for the subject that is so prevalent in our everyday lives.

My research this summer consisted of compiling a number of supplementary resources to accompany articles and other reading material put together by my mentor, Dr. Agnes Rash for a First Year Seminar; however, Dr. Rash thought that the course materials needed to be updated, in order for her students to better relate to the material.

As one may guess, it can be a daunting task to compose writing assignments on topics that seem ungraspable or simply just uninteresting. But what many fail to realize, as far as mathematics goes, is that nearly any interest can somehow be tied back to mathematics. Take art, for instance the work of M.C. Escher. If a student's interests are in sports or gambling, they can easily find a plethora of articles written on probability or statistics related to their interests. Perhaps a student's interests lie in nature- a simple Google search on the Fibonacci sequence will quickly reveal how frequent the sequence shows up in natural occurring phenomena such as the reproduction of bees or the growth pattern of pinecones or conch shells.

A few particularly interesting supplements I came across included the examination of popular game shows, such as Deal or No Deal and Let' Make a Deal, the YouTube videos of Math-musician Vi Hart, and the fairly new interactive website, the Khan Academy. The goal of implementing other sources of information is to emphasize to students that mathematics is not simply the memorization of formulas or the theory behind a concept. It is a subject that can find a place in nearly everything. Mathematics is often described as the universal language, and it is crucial that student's understand why the subject has been and continues to be such an important part of society.

The research I conducted this summer not only opened my eyes to a slew of interesting mathematics literature written for the general public, but further increased my passion for the subject that I already had such a strong appreciation for.



Rommel G. Regis
Department of Mathematics
Saint Joseph's University

Ph.D. Cornell University

Research Interest: Optimization

My research focuses on the development of algorithms for the optimization (i.e., minimization or maximization) of mathematical functions arising from computationally expensive computer simulations. The typical problem setting is that we are given a computer program whose inputs are the numerical values of decision variables and whose output is a single number that represents a measure of system performance or cost. When this program is run, a time-consuming simulation is performed that could take a few minutes to many hours before the output is obtained. The goal of the optimization algorithm is to determine the values of the input variables that maximize or minimize the value of the output. In many practical applications, this computer program is a black-box in the sense that the mathematical relationship between the input and the output is unknown. This type of optimization problem is important because it can be found in many real-world engineering applications, including aerospace, automotive, environmental and medical applications (e.g., intensity modulated radiation therapy for cancer treatment). Many traditional and popular optimization techniques and most commercial optimization software at present are ineffective for this type of problem. Because the simulations are expensive, only a relatively small number of them can be performed when attempting to find the optimum setting of the input variables. The challenge is to design efficient algorithms that are able to find good solutions given the limited computational budget.

When the black-box function to be optimized is computationally expensive, a natural approach is to build inexpensive surrogate models (also known as response surface models) for the expensive function and learn the mathematical relationship between the input and the output. The surrogate model is an approximation of this relationship and it is used to guide the search for an optimal solution. Examples of surrogate models include multivariate linear and quadratic polynomials, radial basis function (RBF) models, kriging, and artificial neural networks. Kriging is an interpolation method where the function values are assumed to be outcomes of a random process. An RBF is a mathematical function for interpolating scattered data points in multidimensional space and is much more flexible than traditional splines. I have been developing various optimization algorithms that use RBF models, including those that can be mathematically proved to converge to an optimal solution either deterministically or in a probabilistic sense.

Fitting Probability Models to Water Quality Data

Kimberly Kanakos, '15

Faculty Mentor: Rommel Regis
Department of Mathematics

Supported by the SJU Summer Scholars Program



Environmental sustainability is a rising research area for mathematical and statistical scientists. Learning the best way for the human population to live with the environment requires a precise understanding of how specific variables react to different conditions caused by nature and human activity. Our research goal was to create a procedure for quantifying uncertainty in water quality variables by finding suitable probability models that describe the data. These models can then be used to better predict the future conditions of a body of water and assess the likelihood of the water being able to sustain life for years to come.

The Delaware River is a perfect example of a body of water that is constantly changing because of natural development and human interference with the environment. By creating a specific process to analyze the uncertainty in water quality data sets, all of the sites tested using this process will have a consistent set of results so they may be accurately compared to access the river as a whole. For each specific site and each water quality variable, the process described below will allow researchers to determine probability models that describe the data well and to answer questions about the current and future conditions of the Delaware River and its suitability to sustain life.

The first step in the process is to gather all of the required data into an easily accessible spread sheet. Depending on the goal of the researchers the variables being looked at may vary according to each project. In this study, dissolved oxygen, conductance and pH variables are used. Then, exploratory data analyses are performed by creating histograms of the data sets to determine the shape of the distributions and decide what probability models are suitable. Next, for each candidate probability model, the parameters of the model are determined by maximum likelihood estimation. The probability models used in this study are the Normal, Lognormal, Gamma, Weibull and Gaussian mixture distributions. In addition, nonparametric methods such as Kernel Density Estimation are also used to fit the data. After the model is fit to the data, a goodness-of-fit test such as the chi-square or the Kolmogorov-Smirnov test must be done to see which models are inconsistent with the data and which ones are not. The models with a good fit can then be used to quantify uncertainty in the associated water quality variable.

In this study, the calculations in the above procedure are carried out using IBM SPSS and the Matlab Statistics Toolbox. The results suggest that there may be multiple probability models that describe a particular water quality variable well. These results are consistent with what other researchers have found. For example, for the Benjamin Franklin Bridge, the Normal and Weibull distributions can be used to model the distribution of dissolved oxygen while the Lognormal and Gamma are both inconsistent with the data.



Mark Reynolds
Department of Chemistry
Saint Joseph's University

Ph.D. University of Wisconsin

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 team (EuTchen Ang Chemistry '13, Michael Desciak Chemical Biology '14; Nicholas Murry, Chemistry '13 and Avery Vilbert, Chemical Biology '13) looked at the role of conserved proximal residues in the oxygen sensing domain of FixL using site-directed variant proteins, where individual amino acids are replaced to probe their function. In particular, we looked at the role of two conserved amino acid in the heme sensor region of the protein that binds oxygen, arginine 200 and tyrosine 197. 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 five of these variant FixL proteins (R200A, R200E, R200H, R200Q and Y197A) and the native WT protein and purified them using column chromatography in our large cold closet. They characterized their proteins with a wide variety of techniques including SDS-PAGE, gas binding studies with UV-vis spectroscopy in our lab and CD spectroscopy studies at Haverford College.

My students discovered that all of these variant protein were purified to a high degree by SDS-PAGE (purified so that they are the only protein in the sample and determined their concentration using the pyridine hemochromagen assay. CD spectroscopy revealed that these variant proteins all had similar secondary structures compared to wild-type meaning that they are folded properly. We looked at the binding of cyanide to our variant proteins as an analog to oxygen binding that can be done aerobically and discovered that several of the variants proteins, particularly R200A, R200E and Y197A had a much lower affinity for cyanide than the native WT protein. This suggests that altering the interactions of the heme periphery affect the electronic properties of the heme iron and its ability to bind molecules. Based on these and other studies we propose that R200A and Y197A will have impaired kinase activity because they are important for oxygen sensing. This fall we will test out this hypothesis using a new kinase assay and our purified variant proteins.

The Biochemical Mechanism of the Heme-based Oxygen Sensor FixL from *Sinorhizobium meliloti*

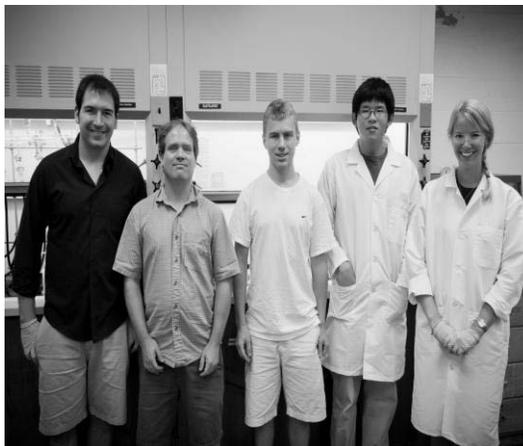
Avery Vilbert, '13

Michael Desciak, '14

EuTchen Ang, '13

Nicholas Murry, '13

Faculty Mentor: Mark Reynolds
Department of Chemistry



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

This summer's research focused on the purification and the study of the biochemical mechanism of the heme-based oxygen sensing protein, FixL, from *Sinorhizobium meliloti*, which is a nitrogen-fixing bacterium in the root nodules of alfalfa plants. FixL is a member of the heme-PAS family. This means that the protein has a heme component and the same conserved amino acids as the PAS domain. FixL is also a part of the histidine kinase family, meaning that the protein has both a heme domain and a protein kinase domain. When the heme component is oxygen bound, FixL's kinase is in the "off" state. Conversely when the heme is not bound to oxygen, the kinase domain is in the "on" state. In the active "on" state, FixL autophosphorylates and then phosphorylates the protein FixJ. FixJ controls the expression of regulatory genes that regulate the transcription and activation of nitrogen fixation genes.

In order to better understand the mechanism of oxygen sensing, five variants were made using site directed mutagenesis on conserved amino acids within the heme-domain that are believed to be crucial in oxygen sensing. The mutants were R200A, R200E, R200H, R200Q, and Y197A. The first letter of the variant signifies the original amino acid, the number designates the location of the residue, and the final letter signifies the new amino acid. These variants were expressed through *Escherichia coli* cells, which were grown up and plated out on Luria-Broth with ampicillin. These cells were then treated with lysozyme and sonicated in order to lyse the cells. The cellular waste was removed and the protein was collected through centrifugation. The protein was then purified through a diethylaminoethyl anion exchange column and an S-200 gel filtration column.

Using UV-visible spectroscopy, the variants were scanned to determine whether they were in the oxy, deoxy, or oxidized state. The variants were also introduced to various gases such as CN and NO, which served as oxygen analogs. This summer, the cyanide dissociation constant was determined for each of the mutants in order to understand the linkage between the mutants and the affinity the mutant heme domain has for cyanide. Also, circular dichroism spectroscopy was used to determine any secondary structural changes that occurred with the mutants with the addition of cyanide. This was done to determine if the mutations would have any effect on the kinase domain activity. A change in the immediate secondary structure was believed to induce kinase activity. However, it was found that cyanide does not cause any major secondary structural changes, and therefore, there was no change in kinase activity. Further studies must be done in order to find any tertiary or quaternary structural changes with the addition of oxygen analogs and determine the kinase activity of these variants.



Eileen Dugan Sabbatino
Department of Special Education
Saint Joseph's University

Ed.D. Wilmington University

Research Interests: Transition from high school to work or postsecondary school for students with disabilities

My recent studies combine two of the areas in which I have spent much of my research in higher education: the study of transition from high school to work or school for students with disabilities and the study of autism spectrum disorders.

The trend has been for students with disabilities to be placed in the least restrictive environments appropriate throughout their K to 12 schooling. Consequently, students with Asperger's Syndrome (AS) are looking to attend colleges and universities upon high school graduation. Currently, most post-secondary institutions are not prepared to support the 'tsunami' of students with AS who are heading their way. Disability service providers at colleges typically offer learning supports such as extra time on tasks, distraction-free test-taking environments, etc.

Those supports are appropriate for students with learning differences, but may not meet the unique needs of students with AS. Their difficulties are more social in nature. Students with AS may exhibit deficits in communication, socialization, peer interaction, and flexibility. Additionally, at adolescence, students with AS tend to develop social anxiety, which can lead to behavior issues.

My research is focused on the best practices for supporting students with AS as they transition to college from high school through transitioning from college into the world of work. To that end, I am investigating ways in which high school personnel can best prepare their students with AS for the transition to college, the supports that are being offered to students with AS at college, the challenges that have been encountered, the ways in which those challenges have been met, and the process by which colleges and universities are preparing their students to transition to life after college.

Examining the Effects of Various Models of Summer Programs on the Socialization and Self-management Skills of Children with Autism

Kelly Lawton, '13

Faculty Mentor: Eileen Sabbatino
Department of Special Education

Supported by the SJU Summer Scholars Program



For a child with Autism, one of the greatest challenges faced each day is engaging in the social world. Elements such as communication and social interaction are difficult skills for a person with Autism to maintain and generalize in different environments. In order for children to improve upon these skills, social learning time must be maximized as much as possible. This includes the months during the summer which can cause students to lose the skills that they have worked on during the year if not used properly. There are many opportunities during the summer that allow children on the spectrum to build upon their social skills, to learn ways to self-regulate their daily behaviors, and many times to interact with their peers without disabilities. This summer, I have looked into both the Extended School Year and Inclusive Camp Program to examine their effects on the development of these children. In addition, I was especially interested to see the difference between the programs as one takes place in the same self-contained classroom environment that children are in throughout the school year and the other presents them with a new environment to interact with their neuro-typical peers.

As a part of my project, I was given the opportunity to volunteer in the Extended School Year Program in Boonton, NJ for two weeks to better understand what types of social learning time is involved. This allowed me to see the daily routine for myself and to work with the children one on one. Afterwards, I conducted interviews with some of the faculty and directors of the program and learned that a major benefit in this program is that teachers are aware of each child's IEP goals and can focus on their specific needs. In order to include parents as research participants, I posted an anonymous survey in various Autism groups online to gather further data. As for my research on Inclusive Camps, I was able to interview Katie Croce and Lauren Swanson, directors of Camp Kinney here on campus. They gave me a better understanding of the activities and grouping in the camp as well as discussed the benefits of how an inclusive environment adds so much to the social interaction of children on the spectrum.

By using the information I have gathered throughout the summer, I was able to create an informational article entitled: *Making the Most of the Summer Months: The Effects of Various Models of Summer Programs on the Socialization and Self-management Skills of Children with Autism*. This article goes into detail about each program and also has a final piece which is directed towards parents about the importance of continuing to practice these skills at home. In addition, I have created a brochure with free online resources that include social stories, print-outs, and i-Pad activities which I have posted online and sent out to groups for parents with children on the spectrum. Lastly, to apply what I have learned, I have designed the "ideal" summer program for a child with Autism which gives them an experience specific to their needs while still placing them in an inclusive environment. Overall, I have learned the importance of these programs for our young community of children on the spectrum and believe that keeping them involved during the summer is one of the best ways to improve their socialization and self-management skills for the future.



Josephine Shih
Department of Psychology
Saint Joseph's University

Ph.D. University of California,
Los Angeles

Dr. Josephine Shih is a clinical psychologist with research interests in the area of mood disorders. Her research examines the interpersonal aspects of depression and the interplay between psychological risk factors and stressful life events. It is a well-replicated statistic that women are two times more likely to become depressed than men. Dr. Shih is interested in finding out why that is. What is it about women's life experiences that predispose them to depression more so than men? What her research has demonstrated is that there are multiple mechanisms at work. Specifically, compared to men, women are exposed to more stressful life events, are more reactive to the stressful life events that happen to them, and are more likely to personally contribute to some of the stressors they experience.

A second aspect of Dr. Shih's research concerns the context of people's lives and the roles people play in constructing their own interpersonal environments. We all know that stress is bad for our health and emotional adjustment. Do stressful life events just happen to us or do we play an active role in creating the stressful environment and circumstances we experience? Current research suggests that stressful life events often do not occur randomly. In fact, women with a history of depression experiences more non-random events than healthy women as well as women with other illnesses Dr. Shih's research program extends this "stress generation" hypothesis by trying to understand both the "who" and the "how" of stress generation. Who is more likely to generate stress? What do people who generate stress do that increases stressful life events? How can we steer them away from these behaviors? This line of research has significant implications for depression prevention and intervention programs.

In sum, Dr. Shih's focuses more on the causes of depression. For students more interested in understanding the treatments for depression, Dr. Shih has teamed up with Dr. Neill Epperson at the University of Pennsylvania's Center for Women's Behavioral Wellness. Students working with Dr. Shih also have the opportunity to work on research projects in Dr. Epperson's lab, examining new biological treatments of depression.

The Effect of Adverse Childhood Experiences (ACE) on Late-life Cognitive Functioning in Menopausal and Post-Menopausal Women.

Stephanie Scalice, '13



Faculty Mentor: Josephine Shih
Department of Psychology

Supported by the SJU Summer Scholars Program

The RHORS study began approximately 16 years ago by a team of researchers from the Department of Obstetrics and Gynecology at the University of Pennsylvania. It was designed to not only track the natural hormonal changes women experience as they transition into menopause but also to identify the link between hormonal changes and menopausal symptoms. Study participants were recruited through random digit-dialing to households in Philadelphia, Pennsylvania. During each visit, researchers obtained a blood sample, body measurements and a multitude of questionnaires from each participant. More specifically, researchers examined estradiol hormone levels, body mass index as well as psychosocial and demographic variables. Currently, we are in the 16th year of the study and the Adverse Childhood Events Questionnaire (ACE) was added to the protocol. The ACE assesses the number of adverse experiences that a person had during the first 18 years of her life. For the purposes of my project, I have edited the questionnaire by adding the age at which the event occurred and the age when the participant began menstruating. The Adverse Childhood Events Questionnaire stems from the ACE Study which is a prominent study conducted by the Center for Disease Control (CDC). The study examines the link between childhood adversity and later-life health. The results of the ACE study have shown that as a person's ACE score increases so does her risk for other illnesses or maladaptive behaviors. The goal of my project was to determine if adverse life events that occurred before the age of 18 played a role in later-life cognition.

Out of the original 436 participants, 292 have completed all fifteen assessment periods. In the past two years, an in-office visit was not required. Instead, researchers called each of the participants and conducted a 15-20 minute phone interview, which asked questions about the participant's menstrual history over the past year, menopausal symptoms and general health. Approximately, 106 of the 292 participants have been interviewed before I took over the project. For this project, we hypothesized that participants with higher ACE scores will have a more significant decline in cognition than participants with a lower ACE score. It is already known that there is a decline in cognition that occurs during the menopause transition and I am interested to see if adverse childhood events will enhance that decline. We are also interested to see if an adverse event that occurred during or around the time of puberty play a role in the decline in cognition that occurs later in life.

As of August 1st, I have completed 70 interviews and there is not enough interview data to examine the study questions. However, preliminary examination of the data suggests that the incidence of adverse childhood experiences we found in the sample appear to be in line with what the CDC found in their study. In the study to date, 35.7% of the sample indicated no adverse childhood events (34.5% in the CDC study). Similarly, the CDC found that 24.5% of women had an ACE score of 1 and we found that 20% of our sample had an ACE score of 1. Furthermore, the CDC found 15.5% of their sample had a ACE of 2, 10.3% had an ACE of 3 and 15.2% had an ACE of 4 or more. I found that 15.7% of my sample had an ACE of 2, 8.6% had an ACE of 3 and 20% had an ACE of 4 or more. I plan to continue with this project in order to gather enough data to examine the study hypotheses.

Aside from working on this study at the Penn Center for Women's Behavioral Wellness, I obtained a great deal of first-hand research experience. I was able to shadow a research coordinator and sit in on admission visits, structured clinical interviews and fMRI scans. I also learned how to screen potential participants and administer different questionnaires and surveys.



George P. Sillup

Department of Pharmaceutical
& Healthcare Marketing
Fellow, Pedro Arrupe Center
for Business Ethics Education
Saint Joseph's University

Ph.D. The Fielding Institute

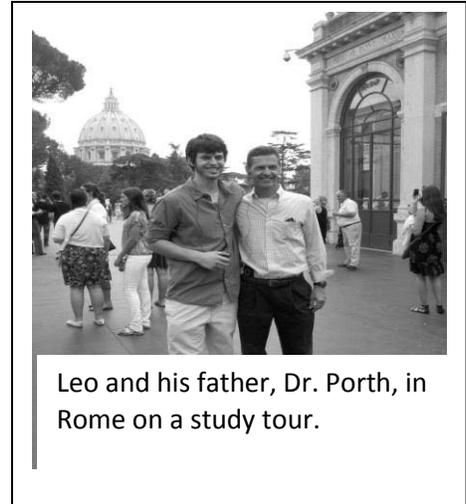
Prior to joining the full-time faculty at Saint Joseph's University in 2004, Dr. Sillup worked in the diagnostic, pharmaceutical and medical device industry for 28 years and held positions from salesman to COO. He worked in major corporations, such as Johnson & Johnson, as well as in start-up businesses, 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 for the eighth consecutive year, *Pharmaceutical Executive*, with his colleague, Stephen J. Porth, "Pharma and the Press; Less News Is Good News".

Media Portrayal of Pharmaceutical Industry

Leo Porth, '13

Mentor: George Sillup
Department of Pharmaceutical &
Healthcare Marketing

Supported by the SJU Summer Scholars
Program

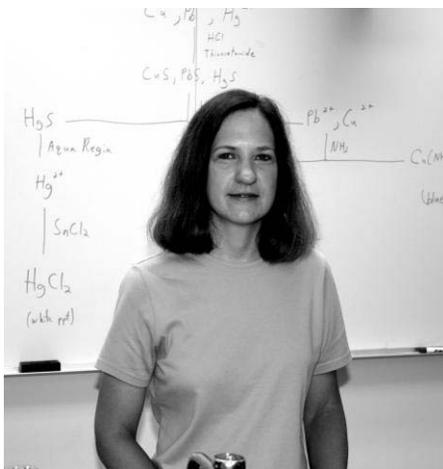


This is my third and final year participating in Summer Scholars with Dr. Sillup as my mentor. The goal of our project is to view and record, through formatted excel sheets, how the media portrays the Pharmaceutical Industry whether it be in a positive light, negative light, or they are neutral in their reporting.

We start by searching the top five newspapers in the U.S. Based on circulation, the *USA Today*, *New York Times*, *Los Angeles Times*, the *Wall Street Journal* and the *Washington Post*, for keywords to establish articles that may have to do with the pharmaceutical industry. From these articles we first establish which articles are relevant to our research and place the irrelevant articles in a separate folder.

First, when we get an article we look at the title and establish whether the title itself is positive, negative or neutral towards the pharmaceutical Industry. Next we read the actual article and establish what light the article portrays Big Pharma (often newspapers have articles neutral but negative headlines or positive and neutral, vice versa etc.) Next we look to see which issues are being brought up and we record a letter of the corresponding issue from our Ethical Issues Legend, which includes such recurring topics as high drug prices, drug safety, Interactions with the FDA, Healthcare Reform etc. Then we record whether someone from the Pharmaceutical Industry expressed their stance. Then we record if there was a specific company or specific drug that was mentioned and we record whether the company and/or drug was written about in a positive, negative or neutral light. Lastly, we write a brief summary of the article itself.

At the end of the year our research is used for an article that is written by Dr. Sillup and Dr. Porth in the pharmaceutical industry's editorially reviewed publication, *Pharmaceutical Executive*.



Jean M. Smolen
Department of Chemistry
Saint Joseph's University

Ph.D. Johns Hopkins University

Research Interests: 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-cyanonitrobenzene) are added to aqueous suspensions of clean metal oxides (FeOOH) and organic reductants (ascorbic acid and cysteine). 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.

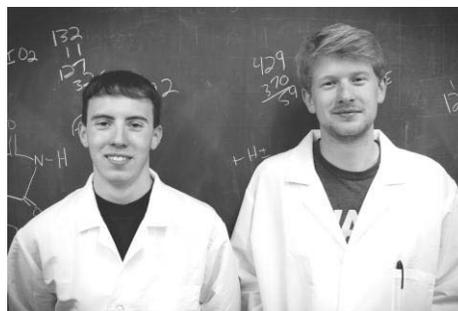
Ultimately, the results of these experiments will be compared to results from experiments conducted with groundwater, lake or marine sediments. After identifying some of the important chemical constituents of these sediments, the rates of degradation will be compared with those in clean systems with 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

Drew Kaneps, '13

Andrew Kusterbeck, '14



Faculty Mentor: Jean M. Smolen

Department of Chemistry

Supported by the SJU Summer Scholars Program, the William J. Gross, '38 Memorial Research Fellowship and the Chemistry Alumni Scholarship Fund

Industrial pollutants are introduced into the environment daily, and some of them are harmful nitroaromatic compounds. Iron oxides are prevalent in the environment, and they can often facilitate the transformation of such 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 used differently sized particles of goethite to examine how this variable affected the overall reaction.

Ferric oxides predominately contain Fe(III) in their natural state. Previous research in the field of environmental chemistry demonstrated 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 allow for the production of larger amounts of Fe(II), as well as facilitating the re-adsorption of more Fe(II) onto the oxide surface. Because of this, our experiments were all performed at neutral pH in order to have a combination of these effects.

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. We also tested aluminum goethite in order to study a compound with a different chemical makeup. The goethite used in our research was synthesized by the 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 larger rate constants and faster transformations of 4-cyanonitrobenzene. We also concluded that smaller goethite sized particles increase the surface area and allow for faster kinetics.

Determination of Ionic and Inorganic Concentrations in the Belmont Water Supply and Saint Joseph's University Campus

Jessica Kesler, '12

Luke Serensits, '14



Faculty Mentor: Jean M. Smolen
Department of Chemistry

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

The Belmont water supply is the water source for West Philadelphia, including parts of the Saint Joseph's University Campus. In order to determine the water quality of the Belmont water supply, water samples from Saint Joseph's Campus: Science Center, Mandeville, Post Hall and Campion, Merion Hall, O'Pake Gym and Connelly Hall were taken. Samples from these sites were treated through a Brita® and Zerowater® filtering system. Water from the reverse osmosis filtering system of the Science Center was also used for comparison. Samples are also taken from creeks within West Philadelphia for a comparison of treated and untreated water. Using Standard Methods, the collected samples are tested for phosphorous, iron, lead, copper, and calcium carbonate. These substances were chosen based on the Philadelphia Water Department's Annual Water Quality Report.

After a complete analysis, it was observed that the phosphorous concentrations of the tap water samples gathered from Saint Joseph's University were above the EPA maximum contaminant level (MCL) of 0.1 mg/L. Results indicated phosphorous concentrations for tap water samples increased after being treated through the Brita filtering system. Alternatively, phosphorus concentrations were decreased to below the detectable range of 0.15 mg/L by the Zerowater filter. We propose that the increase in the detection of phosphorus, after being treated through the Brita filter, is due to a reaction that is allowing for zinc orthophosphate to dissociate. Zinc orthophosphate is a corrosive inhibitor added to tap water to reduce rust in piping by the city. This type of reaction would allow for the zinc to be adsorbed by the activated carbon within the filter, leaving the phosphate more detectable.

Tap water samples resulted in copper concentrations below the EPA MCL of 1.3 mg/L. Significant decreases in copper concentrations after being treated through the Brita and Zerowater filters were observed. For the testing of lead, all samples resulted in readings below the detection limit of 5 parts per billion. All tap samples, unfiltered, Brita filtered and Zerowater filtered resulted in iron concentrations below the detection limit of 5 ppb with the exception of Upstream Indian Creek (92.8ppb) and Post Hall Brita Filtered (2.24ppb). The detection of calcium carbonate classified campus tap water samples as slightly hard water ranging between 17.1-60 mg/L. The Brita water filter significantly decreased the amount of calcium carbonate to below 17.1 mg/L, classifying the filtered samples as soft water. The Zerowater filter completely removed all amounts of calcium carbonate. The reverse osmosis system gave results at or below detection level for all analyses. One creek (Indian Creek) was sampled for analysis. Indian Creek samples were classified as moderately hard water. These samples resulted in concentrations below the EPA MCL for all other analysis as follows: 23.4 ppb of iron, while copper, lead and phosphorus results were below the detection limits.

We hope to continue and expand on this research in the future by further investigating the usefulness of water filters on tap water quality and performing a comparative analysis of creek and tap waters. We wish to continue to investigate the increased detection of phosphorus in conjunction with the use of the Brita water filter by investigating other forms of phosphorus.



Karen Snetselaar
Biology Department
Saint Joseph's University

Ph.D. University of Georgia

Research Interests: Fungi,
plant diseases

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.

Nuclear Conditions in *Ustilago maydis* tumors

Adeline Fagan, '14

Faculty Mentor: Karen Snetselaar
Department of Biology

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



Ustilago maydis is a pathogenic fungus that causes corn smut, a disease commonly found in *Zea mays*, the corn plant. The fungus belongs to the basidiomycete group, which has a long haploid cell cycle including a dikaryon stage where two different nuclei are found within one cell. Infected corn plants develop tumor-like galls that contain diploid teliospores, which when germinating undergo meiosis and form haploid sporidia. These haploid sporidia are non-pathogenic and grow as a budding yeast. Two haploid sporidia mate to form a dikaryotic filament that is pathogenic and can infect its host.

My summer research dealt with investigating mitotic division of *Ustilago maydis* in the tumors. Unlike most basidiomycetes, in *U. maydis* nuclear fusion of the dikaryon cell seems to occur as tumors grow and prior to spore formation. As evidence for this view, we found single nuclei in each tumor cell rather than two nuclei. We also found dividing nuclei, suggesting the cells are going through mitosis. It would be quite unusual for diploid nuclei to be dividing in a basidiomycete fungus.

To further study this, the tumor cells were stained with a fluorescent molecule that binds quantitatively to DNA. A confocal microscope was used to compile images of the stained nuclei, which were then analyzed through the program Slidebook, which summed the pixel intensities of the stained nuclei. Data collected indicates that some nuclei are in both G1 and G2 stages of the cell cycle, supporting the idea that mitosis is occurring. Further work comparing the brightness of these nuclei to nuclei from haploid sporidia will determine if the nuclei are indeed diploid.

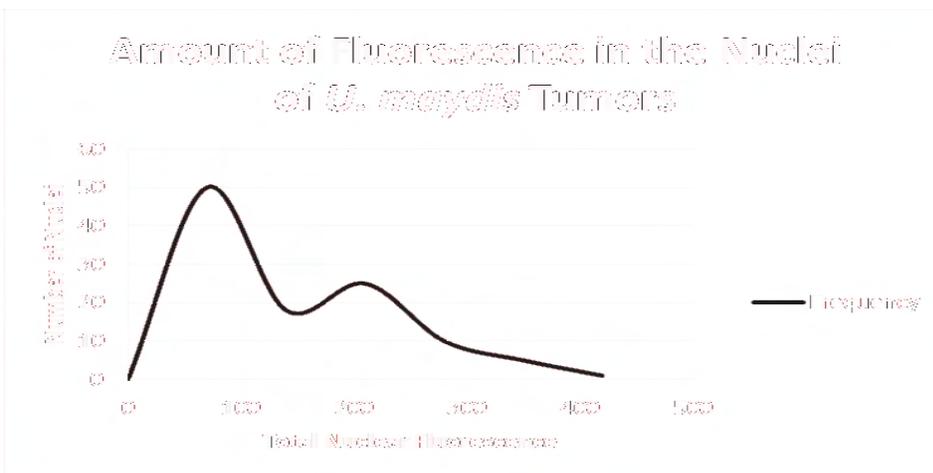


Figure 1: The graph shows the total brightness of the nuclei. The two peaks indicate that the tumor cells are in different stages of the nuclear cycle. The first peak has a total brightness of around 90 and the second peak is double at a brightness of 200. This suggests that the cells are dividing mitotically.



Suzanne Sorkin

Department of Music, Theatre
and Film

Saint Joseph's University

Ph.D. University of Chicago

Research Interests: Music
Composition

One significant aspect of my approach to music composition is the use of timbre as a variation procedure and as a structural device. I am interested in applying the traditional understanding of harmonic progression (forward motion, tension and release) to timbre, in order to create an overall sensation of timbre progression in my works. Central to my methodology is the use of orchestration, instrumentation, and changes in coloration of a constant musical object (a single chord, short harmonic progression, melodic motive, or collection of pitches) to provide timbre progression as well as an overall cohesive form. Although this fixed musical object remains a constant throughout the composition, the sound world into which the object is placed is continually changing. In addition to providing my work with a sense of unity, timbre variations of a constant musical object also help to create formal structure. Each fresh re-orchestration of the musical object becomes a signpost to the listener for a new formal section.

I have received awards, commissions, and grants for my compositions from national and international organizations including the Fromm Music Foundation at Harvard University, Meet the Composer, American Composers Forum, Earplay, and American Society of Composers, Authors, and Publishers (ASCAP). My compositions have been performed throughout the United States and abroad by such ensembles and soloists as counter)induction, Mannes Trio, Chamber Music Now, Third Angle, Third Millennium Ensemble, Washington Square Chamber Players, and Amy Briggs Dissanayake.

Exploring Musical Composition and Applications to Musical Theatre

Nicole Benzing, '14



Faculty Mentor: Suzanne Sorkin
Department of Music, Theatre and Film

Supported by the SJU Summer Scholars Program

After becoming a member in the pit orchestra for the SJU Theatre Company, I decided to truly immerse myself in the process of musical composition for vocal performance and accompaniment. My creative work within the realm of music composition involves two main techniques: text setting and formal structure.

The first area of vocal composition, text setting, involves the exploration of word and vowel usage, in addition to selecting specific words to be emphasized musically. Vocal writing involves a more stream-lined use of text in comparison to poetic writing, which can encompass a more loquacious and verbose use of text. Vocal melodies are to be simple, coherent, and express certain words that have a higher importance, as opposed to narrative words. In order to express singular words or vowels, they must be set with longer rhythmic durations and contain larger interval leaps or melismas. Text setting serves as a very critical process of vocal composition when constructing the vocal melody, but in order to fulfill the melody, harmonic elements must be composed for accompaniment.

The first part of the harmonic process was where I determined the formal structure of a given song. For example, my first song has the form verse, verse, chorus, bridge, and chorus. The next part of this process involved the possibility of modulation, changing the tonal center of the piece, determining use for dominant seventh chords and secondary dominants, and ultimately the Roman numeral for triads in the given key. Modulation and the use of secondary dominants also relate to emphasizing specific words and help keep the song moving in a teleological way to portray a certain emotion or overall goal. Therefore, considering harmonic functions within the formal structure for songs proved to be a very challenging part of this vocal composition process.

In the near future, I plan to finish composing music for the musical I have been working on, and present a showcase as my senior project as a music major.



Cathleen G. Spinelli
Department of Special Education
Saint Joseph's University

Ph.D., Special Education, Temple
University
Ed.S. & M.Ed. Learning
Disabilities, College of New Jersey

Research Interests: Special education topics, including diagnosis and remediation, autism spectrum disorders, learning disabilities, family and school communication and collaboration, and medical and health related disabilities.

I have a number of research interests that are all related to the field of special education. As a former school administrator, school psychologist and educational consultant, I have been very aware of the need for pre-service and practicing teachers to have the knowledge and skills that enable them to create and use authentic, curriculum-based progress monitoring assessment. My interest resulted in a textbook, *Classroom Assessment for Student with Special Needs in Inclusive Settings*, which is currently in its third edition and published by Pearson Publications. While presenting at national professional education conferences, it was clear that a professional development text written specifically for practitioners was needed. This resulted in my next textbook, *Linking Assessment to Instructional Strategies: A Guide for Teachers*, which is also published by Pearson Publications. My other interests in special education have been the topics of a number of journal articles and presentations at national and international professional education conferences. My work on the editorial boards of educational journals and with national special education organizations has also been based on the latest research in the field of special education.

My recent focus and the topic of my current research deals with theory and application of best practices for teachers of students with Autism Spectrum Disorders (ASD) and collaboration with families dealing with ASD. Fortunately, the summer scholar that I mentored this summer has been a special education major and a Kinney Scholar, so we share this research interest and have enjoyed a productive collaboration.

Autism Spectrum Disorders (ASD)

Jennifer Wilson, '13

Faculty Mentor: Cathleen Spinelli

Department of Special Education

Supported by the SJU Summer Scholars Program



Society is becoming increasingly aware of the characteristics of Autism Spectrum Disorders (ASD) and the needs of the individuals and families affected by this disorder. However, there are upcoming changes in the diagnosis of this disorder that will impact educational, diagnostic, classification, and supportive services for individuals with ASD. Throughout the summer, I have done research to understand these changes and which strategies would be most beneficial for teachers and service professionals to prepare them to best serve students with ASD.

In May 2013, the fifth and latest edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) will be released. This revision, specifically, the updated diagnostic criteria for Autism Spectrum Disorder (ASD), is anticipated to be very controversial. This anticipated revision will greatly affect the ASD community. The proposed DSM-V will redefine diagnostic criteria for ASD, resulting in the elimination of the diagnosis of Aspergers Disorder. All individuals receiving an ASD diagnosis will be labeled as having Autism with a severity level of 1, 2, or 3 (1 requiring support and 3 requiring very substantial support). There are a number of pros and cons to this revision. A positive change is that more individuals will qualify for support services but a negative aspect is that some individuals may avoid receiving a diagnosis due to fear of the “Autism” stigma which will prevent the individual from receiving needed support. Other concerns include issues with insurance coverage, Medicaid, and SSI due to this change in diagnostic criteria

Teachers who are new to the field or teachers who simply do not have the experience or educational training with children on the spectrum are at a complete disadvantage for classroom management. Students on the spectrum are at a disservice if they are not receiving the highest quality instruction. As the number of those diagnosed with Autism Spectrum Disorders continues to rise at an astonishing rate, it is no surprise that teachers around the country want to have the knowledge and skills in behavioral and instructional strategies. I have researched evidence-based practices, such as Applied Behavior Analysis, Social Stories, and Self-Management that have proven to produce positive change in behaviors with students with ASD.

As a future teacher, I believe it is important that college courses and school districts provide adequate trainings for perspective and current educators on how to effectively use strategies such as extinction, hierarchy of prompting, and generalization to improve students' behaviors. Educators need to be aware of community, state and federal resources and services to provide to families in need of support. When teachers consistently use best practices and evidence-based strategies and become a resource for reliable and validated support, this will help to ensure that students are making progress in the classroom as well as performing daily functional life skills.



Clint J. Springer
Department of Biology
Saint Joseph's University

Ph.D. West Virginia University

Research Interests: Plant
Physiological Ecology

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*.

Foliar Sugar Concentration of *Arabidopsis thaliana* Grown at Elevated Atmospheric Carbon Dioxide concentrations

Jessica Jean, '13 Lincoln University

Faculty Mentor: Clint Springer
Department of Biology

Supported by the Howard Hughes Medical
Institute



Arabidopsis thaliana is a flowering plant that is native to Europe, Asia, and northwestern Africa. The plant has a short life cycle, is easy to grow, has the first genome to be sequenced and is used for understanding the molecular biology of many plant traits including flower development and light sensing. In the present study *Arabidopsis thaliana* was used to elucidate the role of sugar signaling in elevated CO₂ -induced altered flowering time. Elevated CO₂ can act as an environmental cue that can alter flowering time. Sugar signaling may also play a role in regulating plant gene expression. It was proposed in this study that sugar signaling is involved in altered flowering time of *Arabidopsis* under elevated CO₂. Seven sugar signaling or metabolism mutant lines of *Arabidopsis thaliana* (*etr1-1*, *ctr1-1*, *sis1-1*, *gin1-3*, *prll*, *gin1-1*, and *abi5-1*) were utilized in the analysis. Each line was grown under ambient (400 ppm) and elevated (1000 ppm) CO₂ conditions until a 1 cm flowering stalk was observed. When flowering was observed,

days to flowering, leaf number and aboveground dry biomass were all measured. Any mutations that showed a significant interaction for genotype X treatment for the growth parameters were indicated as possibly functioning in the mechanism for altered flowering time in response to CO₂. *Abi5-1* and *prll* both showed a significant interaction for days to flowering and biomass respectively. To further examine the role of sugars in these interactions, foliar sugar content was analyzed for *abi5-1* and *prll*.

My role in this experiment was to perform a sugar extraction and analysis. Sugars were extracted in 80 % (v/v) ethanol and centrifuged at 3000 x g three times to a final supernatant volume of 6 ml. This process allowed us to remove all the soluble sugars from our leaf samples. Activated charcoal was used to remove green pigments to obtain a clear extract. One hundred microliters of each sample solution was used to analyze for glucose, fructose, and sucrose. The analysis was performed using a sucrose, D-fructose, and D-glucose assay kit (Megazyme International Ireland, K-SUFRG 03/11, Wicklow, Ireland). In a stepwise calorimetric reaction, sucrose content was determined by spectrophotometry (absorbance) after reagents were added. Sucrose was then broken down into glucose and fructose and again the reactions were read by spectrophotometry. Absorbance values were used to extrapolate sugar concentration (mol/L) and content (mg/g)

Unfortunately the results for the *prll* were inconclusive for sugar analysis, but those for *abi5-1* showed a significant interaction of genotype X treatment for total sugars and sucrose content. This shows that *abi5-1* responded differently from the wild type and in response to the CO₂ treatments. These results indicate that *abi5-1* possibly lies within the mechanism of CO₂ induced alteration of flowering time by way of sugar and/or ABA signaling networks that may have altered gene expression when CO₂ levels were high.

***Panicum virgatum* L. variance in stomata width and density among populations and in response to water treatments**

Amanda Laznicka, '14

Faculty Mentor: Clint Springer
Department of Biology

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



Panicum virgatum L. (switchgrass) is a warm-season, perennial native of the Central Great Plains of North America that has recently been recognized for use as a biofuel source. As a promising source of renewable energy, scientists like myself are testing *Panicum virgatum* L. to study how it responds to the predicted climate change in the next one hundred years. This summer, my team and I examined the physiological and morphological changes in three genotypes of switchgrass that are commonly used for biofuel production in response to changes in watering frequency.

My part in this extensive study was to determine the variance of stomata width and density between the three genotypes and the two water treatments (ambient and drought). Stomata are pores that regulate the gas exchange of CO₂, oxygen and water vapor between plants and their environment. Stomata are present along the full length of *P. virgatum* leaves, as well as on both sides of the leaf.

The *P. virgatum* leaf samples were collected during its late growing season from three different locations (Kansas, Texas, and Oklahoma) with samples grown in both ambient and drought conditions from all locations. I prepared five 1-cm² samples from each leaf for stomata observation. Samples were viewed via fluorescence microscope under 20 x magnifications until I framed and captured the areas with the clearest and most numerous stomata on each side of the sample. I measured the widths of three stomata in every picture via *Image J*. I determined stomata density by regulating placement of a 26-mm² square in the center of each picture and counting the number of stomata that fell within the box. Stomata halfway in the box or further were counted.

Data analysis was conducted via computer program *SPSS*. There was no significant difference in stomata width or density by population or treatment. Stomata density varied significantly ($p = .026$) by population, but not by treatment.

Further testing for stomata variance will continue in the upcoming school year. New samples will be observed and analyzed to determine stomata variance across the *P. virgatum* growing season. Variance among ploidy level, between the top and bottom side of the leaf, and along the length of leaf (apical, mid, basal) will be tested using current and future data.

Quantification of the level of *Heterodera glycines* infection in *Glycine max* (L.)

Megan Smith, '14

Faculty Mentor: Clint Springer
Department of Biology

Supported by the SJU Summer Scholars Program,
and the Department of Biology



The soybean *Glycine max* (L.) is a very important oil seed crop all over the world. A parasite known as the soybean cyst nematode, *Heterodera glycines*, severely reduces soybean crop yield globally. The nematode implants itself into the roots of soybeans as a young worm, and when it reaches the vascular cylinder of the plant it swells and becomes sedentary. The female worms feed off of the plant's cells and store their eggs until they die, and their body becomes a brown, hardened cyst that houses the eggs for years at a time. The technique currently used to quantify the extent of *H. glycines* infection of *G. max* plants involves tedious staining and careful counting of the worms present inside the plant root.

As a member of the Global Change Eco-physiology Lab this summer, I set out to develop an infection quantification protocol that is more efficient using PCR techniques. Polymerase chain reaction (PCR) is a technology that allows DNA sequences to be copied to high numbers using a reaction of primers, DNA template, nucleotides, and a polymerase enzyme. My first step was to research primers that had been previously used to amplify *H. glycines* DNA and then design my own primers using NCBI Primer-BLAST and *Primer3* on Geneious Pro software. Then, I began the process of extracting DNA from the nematode cysts using phenol/chloroform DNA extraction, but analysis with gel electrophoresis showed this was not successful. I proceeded to run the PCR reaction using hatched worms as the source of the DNA template and my designed primers, which successfully amplified the expected DNA segment. DNA extraction was then attempted directly from the worms using phenol/chloroform, Qiagen DNeasy Kit, and QIAquick PCR purification kit. PCR results using DNA from each of these extractions were compared. I plan to continue this project with the hopes of using quantitative PCR to successfully create a standard curve of DNA amount versus number of worms to better quantify the level of infection in soybean roots.



Dr. A. J. Stagliano
Department of Accounting
Saint Joseph's University

Ph.D. University of Illinois

Research Interests: social accounting and accountability, sustainability accounting, disclosures of environmental costs and liabilities

Climate change, mainly engendered by human activities, may be more than an “inconvenience,” it might have as significant a financial impact on the *next* generation as the extraordinary run-up in energy and healthcare costs has had for the current one. This, along with other corporate social responsibility and environmental disclosure issues, has been the focus for much of my empirical research effort during the past 30 years.

Although most of the work of professional accountants and auditors appears to the public to be rather mundane (even dull!), adjusting to the changing needs of financial and economic data users is a vibrant and dynamic activity. Today, holders of scarce financial resources want to be informed as decision makers with respect to the actual and expected outcomes of their investment choices. Whether it's in a private company, like McDonald's, a non-profit entity, like Saint Joseph's University, or a government unit, like the Commonwealth of Pennsylvania, financial statement users want full, fair, transparent disclosures regarding all the effects of operations. The future of financial reckoning may well be accountability, not mere accounting, not just counting! Members of society at all levels want to know the social and environmental impacts of delivering goods and services. Consumers want to know more about products than availability and price; they want to know the lasting impact of choosing to buy and consume. Investors demand more than just profit measurements; they want and need to understand the societal effects of the production activities sponsored by their commitment of capital to the business firm. Contributors to non-profits and taxpayers supporting government units likewise require more than just numbers; they want information about impact.

Accounting for the risk of climate change, the cost of alternative energy generation, the impact on society of pollution and environmental despoliation is the wave of the future. Research we do today on measuring and reporting in these areas will help us design better decision-making models and assist us in making future financial decisions that take into account people and the planet along with profit. What will it cost if the sea's level increases by a foot or two? Measuring that might help us decide what to pay to prevent such an occurrence.



Climate Change and Sustainability Disclosures Engendered by the New SEC Guidance

Brandon Talisesky, '14

Faculty Mentor: A.J. Stagliano
Department of Accounting

Supported by the SJU Summer Scholars
Program



In recent years, climate change has become an issue of debate. New laws and regulations have been enacted to address the effects of greenhouse gas emissions on the environment. On January 27, 2010, the SEC approved an interpretive guidance regarding disclosure requirements related to climate change risk. The document has four main components: The impact of existing regulation and legislation, the impact of international climate change accord, the indirect consequences of the new disclosures, and the actual consequences and physical impacts of climate change on business. All disclosures from the above components will create many questions and uncertainties concerning the materiality of climate change risks as they apply to a particular business.



My role in this project was to extend a previously developed database of company annual financial reports (Form 10-K) from 2008-2010 periods into year 2011 filings. From that, I identified text disclosures regarding climate change in the newly downloaded Form 10-K documents. I then extracted paragraphs of relevant text disclosures so that content analysis can be performed by the principal researchers.

Preliminary results have shown that the new SEC guidance has had little impact on the company's financial statements. Item 7 in the Form 10-K, known as Management's Discussion and Analysis, discusses the operations of the business by comparing the current period to the previous one. In the research done for 2010, only 43 out of the 178 companies we looked at reported anything regarding climate change. In 2008, this number was 31 companies. However in Item 1A, known as Risk Factors, describes the potential risk a company has for the future. In 2010, 110 companies reported information or about 62% of the companies we researched compared to 65 companies in 2008. These numbers show that companies are beginning to disclose information in the 10-K.

The end goal of this project, which will cover a five year time span, is to use the data developed in the project to help determine the impact the SEC guidance has had on the company disclosures of risks of exposure to climate change.



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.

Lipid Utilization in *Heterodera glycines*

Alyse Ameer, '14

Samantha Atchison, '14

Faculty Mentor: Paul Tefft

Department of Biology

Supported by the SJU Summer Scholars

Program, the Howard Hughes Medical Institute, and the Department of Biology



Heterodera glycines, the Soybean Cyst Nematode (SCN), is an obligate parasite of the soybeans. Female *Heterodera glycines* are lemon shaped and form a hardened cuticle that forms a cyst which contains the eggs. The SCN is cryptobiotic and remain dormant in the soil for long periods of time, making control difficult. The second stage juvenile invades the roots of the plant where it establishes a feeding site in the phloem, which is the vascular tissue that transports sugars in the plant. Visible symptoms of infection in the plant are stunted growth and chlorosis due to a deficiency of sugars in the leaves. The SCN causes approximately one billion dollars of damage to soybean plants in the United States annually.

Our research was focused on the lipid utilization in the SCN. The female cysts vary in color depending on their age. The cysts were divided in to three categories based on color; white, light brown, and dark brown. The eggs from these cysts were hatched in either water or zinc chloride. Zinc is an artificial stimulant that increases the hatching response of the eggs. After waiting 10-12 days for the eggs to hatch, each sample was divided in half to be studied for either lipid content or hatching response. To study the lipid content, oil red was used to stain the neutral lipids in the hatched nematodes. The nematodes were transferred to slides and were photographed at random to have an objective sampling. Using "Image J" NIH software the area of the neutral lipids was measured and the average area per worm was calculated. To study hatching response the eggs and worms from each category was counted.

The results depicted in Fig. 1 show that in all three of the categories of cysts, the eggs that were hatched in water had the highest area of neutral lipids. Also, the eggs found in light brown cysts had the highest amount of neutral lipids in worms hatched in both water and zinc. The hatching response in Fig. 2 shows the rate of eggs hatched in zinc compared to those hatched in water. The light brown cysts had the highest hatching response. The white and dark colored cysts were very similar in their hatching.

Our research suggests a relationship between the lipid content of cyst and the hatching response. A further study will investigate the relationship between lipid content and infectivity.

Figure 1
Lipid Content

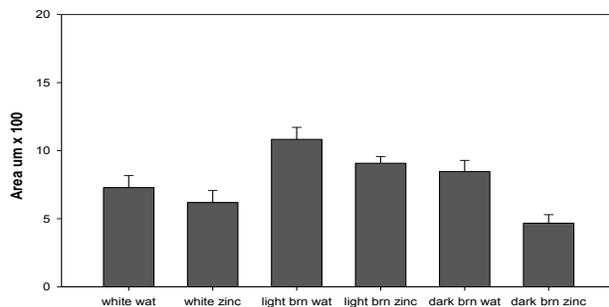
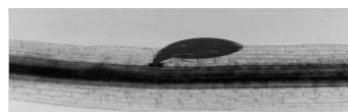
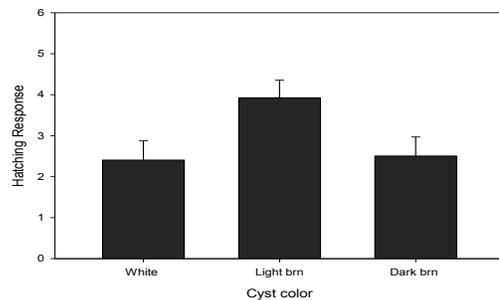


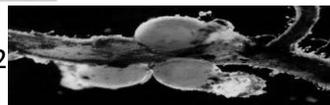
Figure 2
Hatching



(left): developing female SCN

(right): female SCN loaded with eggs:

12





John Vacca

Department of Teacher Education
Saint Joseph's University

Ph.D. The Pennsylvania State
University

Research Interests: Parent-child relationships among infants and toddlers with severe neurological disabilities; School-readiness and teacher preparation in early childhood/elementary education.

My educational and professional backgrounds encompass the two fields of early childhood education and school psychology. Following my doctoral program, I advanced my training by participating in a two-year post-doctoral fellowship in neurodevelopmental disabilities and clinical psychology in the Department of Pediatrics at The Johns Hopkins University School of Medicine. I later completed my professional training by participating in an intensive course at the University of Oxford in England which focused on the influences of parent-child relationships on the development of emergent literacy skills. With my unique blended background, I have been able to focus my research on questions that address how early childhood educators and related professionals can work collaboratively with parents and families of young children to foster not only the child's learning but strengthen the child's sense of self and identity. Much of my work is based on resiliency theory and dynamic motor systems theory that speak to the variables both biological and environmental that predispose a child to lifelong learning and success.

While contributing to the field of research in early childhood, I am also in the unique position to contribute to the personnel preparation of future early childhood teachers. My primary teaching responsibilities in the Department of Teacher Education is to provide pre-service teachers a strong foundation in pedagogy that reflects developmentally and exceptionality appropriate practices and key learning principles from Constructivist Learning theory and Motivation theory. As a whole, I strive to help my students make informed decisions about their teaching and their development of lesson plans and activities through ongoing reflection. We know that high quality early childhood education is steeped in practices that emerge from the reflective teacher/practitioner. Therefore, I was thrilled when Ellen Taylor approached me to support her in her Summer Scholar's research which focused on the relationship between reflective practice and the establishment of a highly engaging environment on the motivation of young learners.

Throughout the summer, Ellen has been able to carry out her research and her passion for the teaching profession, by engaging in ongoing self-reflection as a camp counselor and future teacher. Ellen demonstrated positive growth not only as a future teacher but as an emerging scholar in the field. I know she will use this experience ongoing as she continues her studies in education and as she develops herself as a highly qualified teacher and researcher.

The Student and the Camper: A Look at the Differences in Student Motivation in the Classroom and in the Summer Camp

Ellen Taylor, '13

Faculty Mentor: John Vacca
Department of Teacher Education



Supported by the SJU Summer Scholars Program and the Department of Teacher Education

For the majority of the calendar year, children fulfill the primary role of student, where they spend countless of hours each day learning their mathematics, history, and grammar. From June to August, kids shed this role, and they embark on whatever adventures the summer months hold for them. If asked, many kids prefer the summer season over any other, because it is the time of year without school. Additionally, if asked, they much prefer their summer activities over that experienced in the fall, winter, and spring. Why is this? *Motivation*.

Wendy Pan (date?) states that motivation is “to give reason, incentive, enthusiasm, or interest that causes a specific action or a certain behavior (page number). This definition worked best as it fit the scope of what the present investigation. Motivation has continues to be a topic of interest and discussion within the education. A key requirement for any teacher is to use their knowledge of motivation to support student learning and engagement. To do this, teachers use different modes of instruction that address diversity, backgrounds, and learning styles. What might motivate one student may distract another.

During the summer months, where the expectations of conduct and grades are reduced, activities are available for kids to participate in – usually of their choosing. The general conclusion, easily observed in every individual’s life, is that choice is a strong motivator because people tend to choose what they like or what benefits them. My proposed project was to take a look at children who have chosen a specific summer activity and provide a comparison between their motivation in school and in camp. The specific summer activity I chose was a three week summer theatre program. This is convenient because I have been a part of the program, both as a participant and now as a staff member, for seven years. I have a familiarity with many of the campers, their parents, and my fellow staff members. As my research preparation continued, the project was transformed. Originally I had intended to develop the assessment myself, but this proved too ambitious. I also quickly realized that I had not allowed for a valid or reliable way to assess the student aspect of these children, only the camper side. So, instead, I created an informal assessment for the one person that I knew I could easily analyze: myself. In anticipation for student teaching in the fall, I was taking a summer course at Saint Joseph’s University in June, while simultaneously working at a camp in July. I kept a journal of my motivation and interests throughout my time as a student and as a camp counselor. The key aspects I focused on were my motivation in preparation, during class and camp, and my social interactions.

Based on a review and analysis of my journal, I concluded that self-reflection as an educator is crucial in many ways. Mentally reviewing and considering everything in hindsight increased my awareness of how cause-and-effect balances work, as well as a provided a calming process for events that involved emotions. I also have a much clearer view of the daunting task set before a teacher: teach, learn, motivate, assess, and manage. Motivation cannot always be structured and planned, which requires knowledge of the individual’s likes, dislikes, strengths, weaknesses – and knowledge of your own. Most importantly, the kids are not just campers, not just students, but individuals.



Richard Warren
History Department
Saint Joseph's University

Ph.D. University of Chicago

Research Interests: State Formation
and Political Culture

My research is grounded in the study of nineteenth-century political culture in Latin America. Many of my early publications focused on Mexico City in the late colonial and early republican periods (ca. 1780s-1840s), in which I explored the repercussions of the rise of popular sovereignty as both discourse and practice. In recent years, I have built upon this foundation in three ways. The first has been a series of publications that reflects upon and assesses changes in the way history is written, including considerations of the methodological challenges and opportunities inherent in the study of political culture. The second has been a number of essays that broaden the temporal, geographical and conceptual frameworks of my work. The most recent is related to my investment in bringing contemporary historical scholarship into the undergraduate classroom at Saint Joseph's University, as an architect of the university's new required general education course in history, *Forging the Modern World*. As a result of our work designing and implementing this course over the last five years, Dr. James Carter and I decided to research and write a book, accessible to a broad audience, that expands to an analysis of the global context the political and social transformations that have so fascinated us in our individual research programs on East Asia and Latin America respectively.

Cognition and Historical Understanding: Improving Retention of Historical Material Through Visual Renderings of the Past

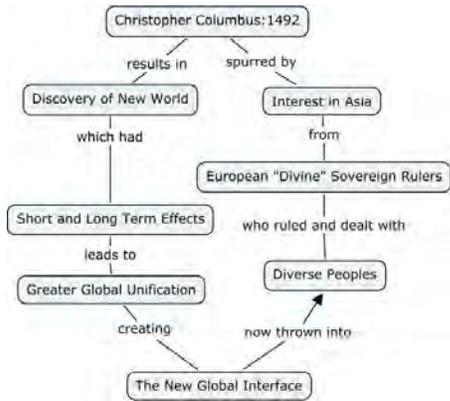
Kelsey Kostelnik, '14

Faculty Mentor: Richard Warren
Department of History

Supported by the SJU Summer Scholars Program
and the International Relations Program



Success in any discipline requires mastery of information. In history, understanding events and chronologies precedes higher order analysis. For example, to engage in serious reflection on the nature of revolutions in the modern world generally, one needs to understand the causes and consequences of the French Revolution. The question, then, is how does one best learn and retain this information? Recent research on cognition suggests that visual cues in the

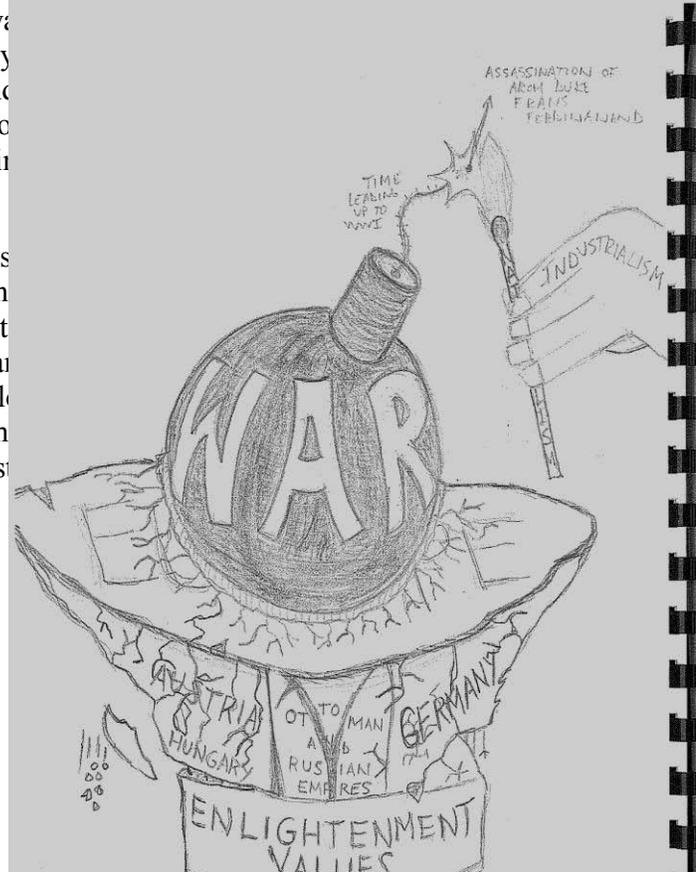


presentation of information (images, graphs, models, even altered typefaces) can improve retention. For my summer scholar project, I focused on the use of concept maps to improve learning outcomes in history. Concept maps or information graphs organize and represent knowledge in a simple and clear manner for the reader. These tools also create visual links between different concepts, which are very important for the student/reader as they denote how major ideas are related.

To fully comprehend the impact of visual aids, I realized that I needed to explore further the learning

process itself. This took the summer research into various fields including psychology, philosophy of history, consumer psychology, and more. From these readings, I have tried to merge my interests in history with a number of distinct topics that will both attract readers' interest and enhance their learning experiences.

The application of my research is manifesting itself on several fronts. I have been working with my mentor to develop a set of concept maps for inclusion in a book that I and another member of the Saint Joseph's History Department have written. My research has also inspired me to develop my own graphic novel that uses a science fiction premise to investigate the past through the lenses of different historical methodologies and theories of history.





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. An example of this bursting behavior is shown in Fig. 2. Bursting 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. In these studies the small-world network model is used. This modeling approach is used in a variety of studies and enables the researcher to control not only the connections between adjacent neurons but also examine the role of long distance connections.

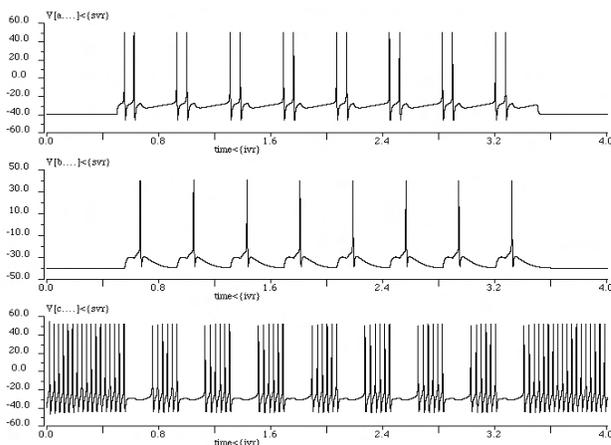


Fig 1. A Simple Three Neuron Network

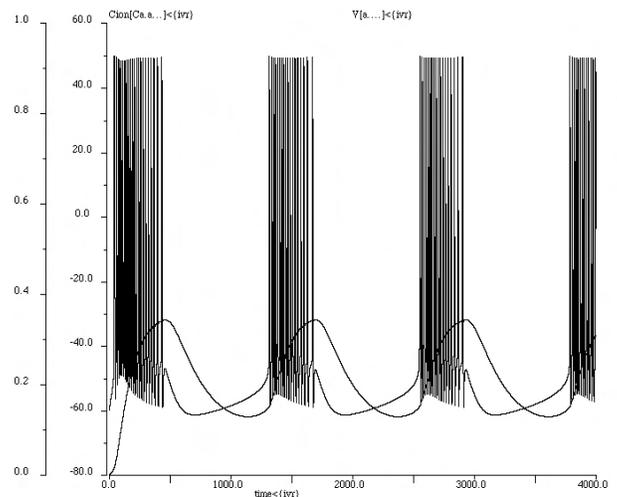


Fig 2. A Multichannel Burstin Neuron

The Suprachiasmatic Nucleus and Circadian Rhythms Depicted in a Small World Network

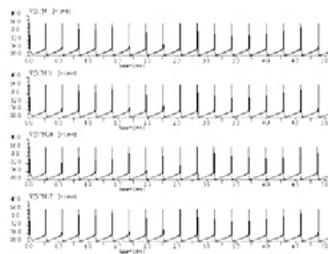
Edith Adjei-Danquah, '15

Faculty Mentor: James Watrous
Department of Biology



Supported by the SJU Summer Scholars Program

Figure 1



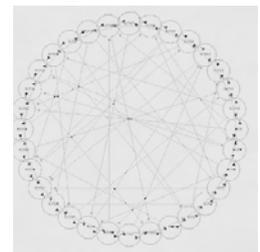
Essential to human daily life is the entrainment of circadian rhythms, or the body's way of maintaining a sense of time throughout a 24 hr. day. The structure responsible for maintaining this clock is known as the suprachiasmatic nucleus (SCN), located in the hypothalamus of the brain. Through the use of internal and external cues, the SCN regulates the body's sleep-wake cycle, digestion, and other body functions. A characteristic unique to SCN neurons is the autonomous firing or generating of action potentials

without stimulus (Fig 1). Research by Sim and Forger (2007) has shown variations in calcium concentration within the cell plays an important role in this autonomous firing.

Table I Parameter Values for HH and SCN Neurons in Small World Networks

	Hodgkin-Huxley (HH)			Suprachiasmatic Nucleus (SCN)				
	K ⁺	Na ⁺	L	K ⁺	Na ⁺	L	K(Ca)	Ca ²⁺
Conductance (μS)	36.0	120.0	0.3	32.0	7.0	0.1	2.0	5.0
Equilibrium Potential (mV)	-72.0	55.0	-49.4	-80.0	50.0	-40.0	-84.0	60.0

Figure 2



A SCN neuron with a calcium ion channel, ion pool, as well as a calcium-dependent potassium ion channel was constructed using the Java-based software *Simulator for Neural Networks and Action Potentials (SNNAP)* and the conductance and equilibrium potential values shown in Table I. Once this neuron generated action potentials typical of an SCN neuron, a small world network in ring formation (Fig 2) consisting of 32 SCN neurons; short-distance excitatory and inhibitory connections; excitatory long-distance connections; and “n+1” connections was constructed. With the network producing action potentials identical to the model neuron, a light stimulus and glutamate receptors were added to a new network consisting of thirty-two neurons (Fig 2). The kinetics of the Gingrich-Burke model were used in working with the glutamate receptors and the variable for light in this network. Modeling the effect of light and adding in glutamate receptors is of particular interest because light can directly trigger the release of glutamate in the retinohypothalamic tract (RHT), which in turn increases the calcium influx within SCN neurons. It is this variation in calcium influx that plays a significant role in the autonomous firing of SCN nerve cells.

The Use of Small World Networks to Model Epilepsy Within the CA3 and CA1 Regions of the Hippocampus

Victoria Atchison, '14

Faculty Mentor: James Watrous
Department of Biology

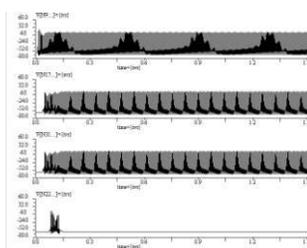


Supported by the SJU Summer Scholars Program

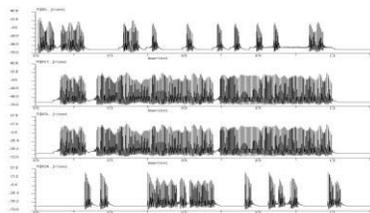
Epilepsy is one of the most commonly diagnosed neurological disorders, characterized by seizures that are generated due to a temporary overload of synchronous excitatory activity in neural networks. Epileptic seizures in the region of the brain known as the hippocampus are of particular interest due to this region's disposition toward excitability. Within the hippocampus are the CA1 and CA3 regions, and epileptiform activity in these regions have been characterized by the following behaviors: prolonged seizures that can last seconds or minutes, and short bursting activity that lasts approximately 100 ms. Previous research by Netoff et al. (2004) on epilepsy in the CA1 and CA3 regions of the hippocampus have displayed that network architecture in small world networks have an effect on epileptic behavior.

Using the small-world theory approach and the Java-based software *Simulator for Neural Networks and Action Potentials* (SNNAP), models of the CA3 and CA1 regions were constructed, using a network consisting of thirty two Hodgkin-Huxley neurons. The CA3 and CA1 networks differed based on their synaptic connections. The CA3 and CA1 models make use of the high computational power and synchronous behavior of small-world networks, and successfully simulated the predicted epileptiform behavior by Netoff. The voltage versus time output screens for selected neurons in the 3, 6, 9, and 12 clock positions of the ring shaped network displayed sustained, prolonged seizing in CA1 (Fig. 1A) and interictal bursts of activity followed by network shutdown in CA3 (Fig. 1B). Since small-world network models are characterized as being simple, flexible, and multidirectional, the CA1 and CA3 regions can be randomly rewired with long distance connections to observe the effects on epileptiform activity. The CA1 region displayed a transition from prolonged seizing to ictal bursting and the CA3 displayed transition from ictal bursting to network shutdown, and both these results concur with the previous research of Netoff.

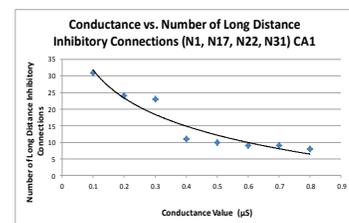
Additionally, long distance inhibitory connections were placed in the network, displaying a distinct trend: as the synaptic conductance increased, the number of inhibitory connections needed decreased in order to reach network shutdown for CA1 (Fig. 1C). For the CA3 region, as the conductance increased, there was no effect on the number of long distance connections, with a set number of 16 connections needed to produce network shutdown. For the CA1 region, as conductance was increased, the number of action potentials generated displayed sporadic activity, eventually leading to network shutdown at the highest conductance of $0.8 \mu\text{S}$. For the CA3 region, despite the increase in conductance from $0.1 \mu\text{S}$ to $0.8 \mu\text{S}$, the number of action potentials for N1 remained constant with 7 action potentials generated, and N27, N31, and N16 displayed no output. Further research continued using electrical synapses and changing K^+ conductance.



A



127B



C

Modeling of the Suprachiasmatic Nucleus Through SNNAP

Catherine Elorette, '14

Faculty Mentor: James Watrous
Department of Biology



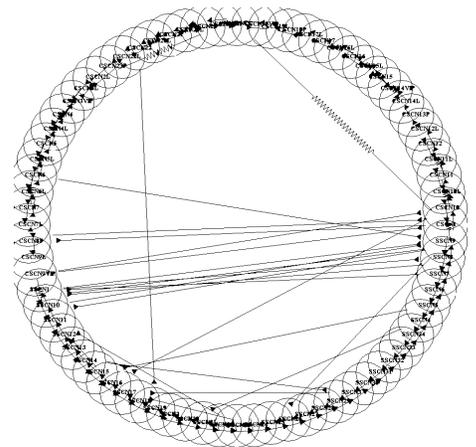
Supported by a Gift from Nick Nicolaides, '87 and the Howard Hughes Medical Institute

The suprachiasmatic nucleus, or SCN, is a small, paired structure found in the hypothalamus of the brain. Light is transduced through the optic nerves and reaches the SCN at its location just behind the optic chiasm, where the inputs from each eye come together. The SCN controls the circadian rhythms of the body; using the light input it receives to reset the body's cycle of sleep and wakefulness. There are two major components to the SCN, a shell and a core. The core is more receptive to light and controls the activation of genes during the daytime, while the shell is responsible for suppressing activity during the night. One of the most interesting characteristics of the SCN is that its neurons are connected in an arrangement known as a 'small world network', in which each neuron is connected to its four nearest neighbors and may be connected to a few neurons farther away in the network.

My research this summer utilized a computer program, SNNAP (Simulator for Neural Networks and Action Potentials), in order to create a model of the suprachiasmatic nucleus. The SNNAP program allows the user to create a network of unique neurons and synaptic connections. This means that not only can each neuron be altered to better model the neurons in the SCN, the connections between those neurons can be modified, as can the properties of the overall network itself.

In order to model the SCN in SNNAP, I worked with Edith Adjei-Danquah to create two separate small world networks, one which modeled the core segment of the SCN and the other which modeled the shell segment. I relied on previous research done in Dr. Watrous's lab to make a working model of the shell that contained 34 neurons in a small world network arrangement.

When both networks were finished they were combined together, providing a working model of the complete SCN network that was used to simulate the functions of the SCN during daytime and nighttime. Using this setup we were able to successfully recreate the activity that has been observed experimentally. In the future we can use this network to test how changing components of the SCN network alters its functioning.



How Pacemaker Neurons Effect Epileptiform Behavior Within the CA3 and CA1 Regions of the Hippocampus

Lauren Kozlowski, '15

Faculty Mentor: James Watrous
 Department of Biology



Supported by a Gift from Nick Nicolaides, '87 and the SJU Summer Scholars Program

Epilepsy is recognized by seizures which are produced from an excess of synchronous positive feedback in neural networks and is one of the most commonly diagnosed neurological disorders worldwide. Research by Netoff et al. (2004) showed that ictal bursting (50-100 ms) is observed in the CA3 region of the hippocampus while prolonged seizures (100+ ms) are observed in the CA1 region. The addition of a pacemaker neuron, neurons that fire independently without the need of an external stimulus, affects these two types of epileptiform activity in small-world networks.

Representational models of the CA3 and CA1 regions were constructed using the Java-based software *Simulator for Neural Network and Action Potentials* (SNNAP) by constructing networks consisting of 32 neurons, each with the corresponding number of synaptic connections and synaptic strengths. These models simulated the predicted epileptiform activities in voltage versus time output screens in the 3, 6, 9, and 12 clock positions of the ring-shaped network; therefore, the CA3 region demonstrated ictal bursting and the CA1 region demonstrated prolonged seizing. Once these networks were successfully assembled, a pacemaker network of Morris-Lecar neurons was electrically connected to the CA3 and CA1 networks and used as a stimulus.

The Morris-Lecar Spiking Neuron Model was the first pacemaker neuron to be modeled computationally and was done so in order to provide a way to observe the behavior of barnacle muscle cells. This study simulates the inclusion of a pacemaker neuron in the CA3 and CA1 neuronal networks and how this inclusion will affect the epileptiform activity. The Morris-Lecar network consisted of 32 neurons electrically connected; however, only the first neuron was given pacemaking ability. After electrically connecting the first neuron of the Morris-Lecar network to the first neuron of the CA3 and CA1 networks, differences in the simulation output were noted.

The prolonged seizing activity of the CA1 region of the hippocampus (Figure 1A) still remained after the addition of the Morris-Lecar Network to the original model (Figure 1B); however, the activity was slightly lessened while also exhibiting continuous bursting behavior. In addition, the ictal bursting activity of the CA3 region network model (Figure 1C) still remained after the addition of the Morris-Lecar Network (Figure 1D) but the activity once again was lessened, meaning that there were fewer action potentials in the same period of time.

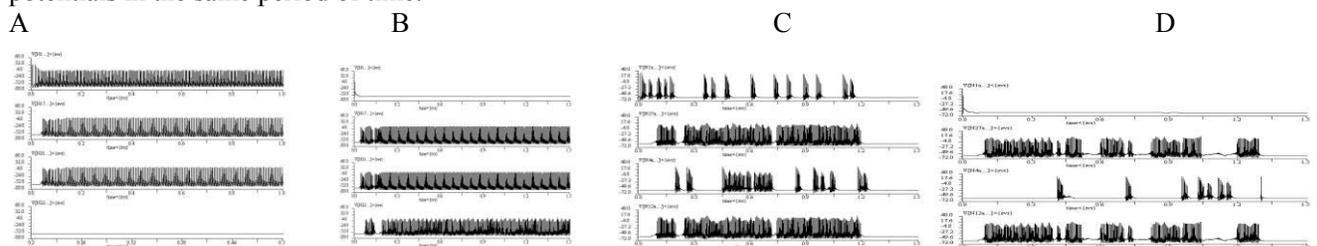


Fig 1. A) CA1 Network; prolonged seizing B) CA1 Network stimulated by a Morris-Lecar Network C) CA3 Network; ictal bursting D) CA3 Network stimulated by a Morris-Lecar Network



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Madelon Crosson's project, A 21st Century Woman's Photographic Interpretations Of the Impressionistic Woman, has asked Madelon to study the work by several late 19th century artists with a degree of intensity and complexity far beyond what might be encountered in a typical undergraduate art history study.

Her study had to support her own re-working of each piece. It was, therefore, necessary to understand each piece from multiple perspectives including: the social narrative of the work; the relationship of the artist to the subject/character of the piece and the formal tools of color and composition employed in the piece.



Madelon's work on this piece by Degas illustrates some of the concerns and some of Madelon's solutions. Her analysis of the piece includes,
"...two aspects of this painting share equal importance. The first thing I notice is the stance of both the man and woman. The woman slightly hunched over and shielding much of her face from the light suggests that she is uncomfortable, maybe even embarrassed or ashamed. The man on the other hand stands confidently, leaning against the side of the door possessing a quality of assumed power over the young woman. This power role is emphasized in their stance and size. The second thing I notice is the way Degas lit the scene. Much of the room is in shadow apart from the bed and the back of the woman, the light coming from a lamp in the middle of the room. The man stands in the shadow, his figure almost perfectly outlined in black on the door behind him. Both the lighting and the tension sensed between the two people in the painting suggest that something sinister has just happened or is about to occur."

Madelon's photographic interpretation emphasizes Degas' social dynamic while providing a greater emphasis on the woman's state of mind. The modern interior toys with that of Degas' piece.

In addition to pieces by Edgar Degas, Madelon has worked on pieces by Mary Cassatt, Renoir and Henri De Toulouse-Lautrec.



21st Century Woman's Photographic Interpretations Of the Impressionistic Woman

Madelon Crosson, '13

Faculty Mentor: Dennis Weeks
Department of Art



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Impressionistic paintings provide the viewer with a fleeting glimpse of an intimate moment while using color and light in a completely different and exciting way. This particular style leaves “impressions” rather than a concrete image, an idea that has come to fascinate me. I find depictions of anonymous women in Impressionistic paintings and how they are portrayed by different artists to be particularly intriguing.

As a photographer, I became interested in developing a portfolio that would introduce a contemporary perspective to several Impressionistic paintings featuring women from the 19th and 20th centuries. My goal was to find a way to re-imagine and recreate each piece in such a way that each photograph would be a direct allusion to the painting it was inspired by while attempting to bring something new and dynamic to the image.

With this goal in mind, the project forced me to alter the way I observe and appreciate paintings. I became more aware of the many elements at work that come together to create the piece as a whole. I came to recognize the significant aspects of a painting, the central focus, the shapes that figures create, the variety of colors used in flesh tones, the narrative behind the piece, and the importance of the composition. I learned to focus on what was essential in the piece and therefore necessary to recreate in the new image. I also learned to ignore elements that were not crucial and used this realization as an opportunity to make the image more contemporary.

Through this methodology of studying paintings, I was able to determine what steps needed to be taken in order to evoke a definite sense of the painting in my photographs while giving myself the creative freedom to add my personal touch to each image. Therefore, each photograph is not only a representation of the original painting but is also a product of my specific interpretation.

Along the way, several pieces that were aesthetically pleasing as paintings did not work well photographically. This discovery made me contemplate what factors those particular pieces have compared to other works that make them more difficult to recreate. This thought process allowed me to gain a deeper understanding of the differences between painting and photography and the strengths and weaknesses each field possesses.

