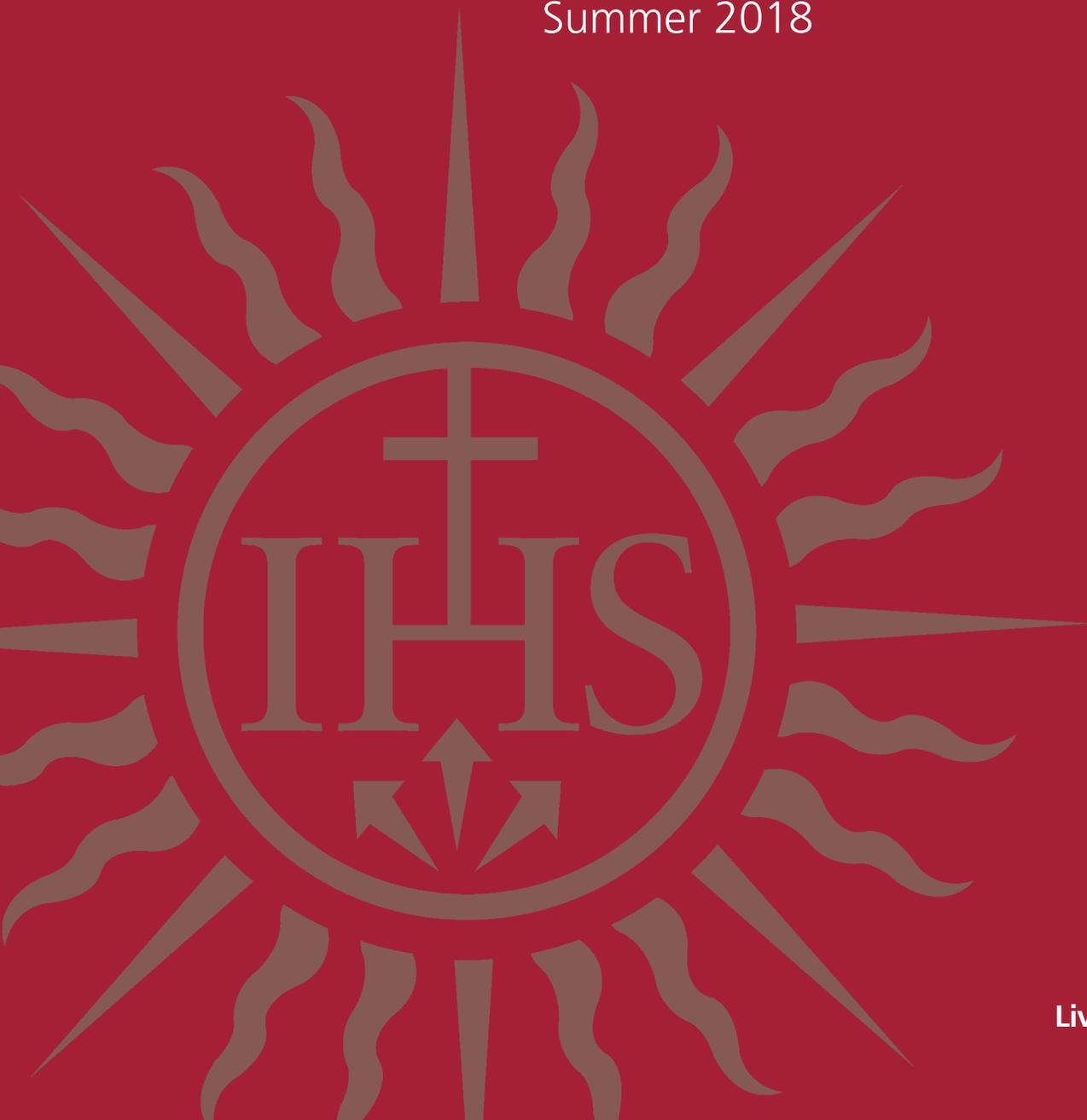




**Summer Scholars Program**

Summer 2018



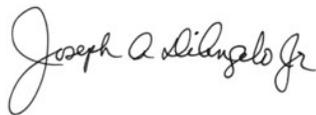
Live greater.

Welcome to the 19<sup>th</sup> Annual Summer Scholars Dinner at Saint Joseph's University. This year, 87 students and 51 faculty mentors, representing 23 departments and programs participated in the Summer Scholars Program. We are excited to have families, donors, administrators and staff join us in tonight's celebration. This signature program would not be as extremely successful without your support.

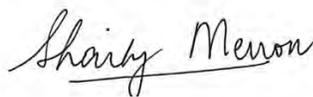
We especially like to thank the Faculty Mentors who give of their time and energy to work closely with students engaged in creative scholarly work and independent research across the University. Our Summer Scholars are grateful for the opportunity you have provided and recognize the difference it makes in their Saint Joseph's experience.

Thank you for taking the time to join us tonight as we celebrate the accomplishments of our impressive student scholars. We would also like to thank everyone whose support continues to make scholarly activity at Saint Joseph's University a priority.

Sincerely,



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



Shaily Menon, Ph.D.  
Dean, College of Arts & Sciences



Jeanne F. Brady, Ph.D.  
Provost/VP for Academic Affairs



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## **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

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**The Office of the Dean, CA&S**  
**The Office of the Dean, HSB**  
**The Office of the Provost**  
**Sigma Xi**



**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. Specifically, this summer my group is investigating the binding of a transcriptional regulator, called AgpT, on the DNA region that controls expression of the *melA-agp* genes. We hope that by learning more about how catabolite repression affects these genes, we can gain understanding of how it controls other genes.

This summer I started a new project in collaboration with Drs. Scott McRobert and Jonathan Fingerut. We are looking at what type of bacteria are carried by vinegar flies (*Drosophila melanogaster*) and by true fruit flies (*D. suzukii*), to investigate if there are any bacteria that are important in their life cycle.

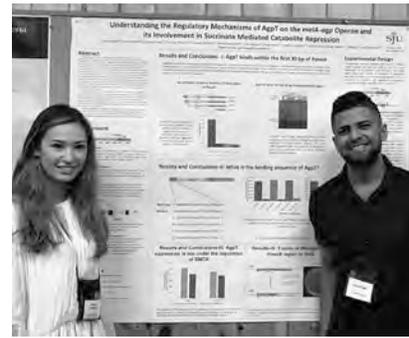
# Understanding the Regulatory Mechanisms of AgpT on the *mela-agp* Operon and its Involvement in Succinate Mediated Catabolite Repression

Isabella Carpenter, '19

Vinay Patel, '20

Faculty Mentor: Catalina Arango

Department of Biology



Supported by the Peter & Dorothy Kowey Research Fellowship and the SJU Summer Scholars Program

*Sinorhizobium meliloti* is a bacterium that engages in mutual relationship with legume plants where both parties benefit. The bacterium provides the plant with nitrogen, an essential nutrient for plant growth, and in return the plant would provide the bacteria with its favorite food, succinate. While the bacteria feeds on its favorite food, or primary carbon source, it does not consume any of its least favorite foods, or its secondary carbon sources, an example of which are  $\alpha$ -galactosides such as the sugar raffinose. The presence of succinate will result in the stopping of the production of proteins that transport and break down the secondary carbon source by either repressing or blocking the expression of the genes that code for those proteins. This process is called succinate-mediated catabolite repression (SMCR). The genes responsible for breaking down  $\alpha$ -galactosides can be found in the *mela-agp* operon, which is under SMCR control because it can only be induced, or turned on, when succinate is absent. A region of DNA located right before the *mela* genes, called the *Pmela*, possesses all the DNA sites necessary for the regulation of the *mela-agp* operon. A protein known as AgpT has been found to turn on the operon; this type of protein is called an activator. The focus of the research is to identify the binding sequence of this protein on the DNA and identify any other possible regulatory sites that control expression from the *Pmela* region.

Since the regulatory sequences that control the expression pattern of the *mela-agp* operon have not been determined, we want to find out where these regulatory sites are within *Pmela*. Previous research has indicated that when the first four nucleotides were removed from *Pmela*, there was a major decrease in the expression of the *mela* genes, thus indicating that there is an activator bound here. We know that the activator that binds to the first 30 bp of *Pmela* is AgpT because when a gel shift assay of the first 30 bp was run, it showed that with AgpT added, the bands of DNA were shifted which meant that AgpT was binding to the piece of DNA. Since we know approximately where AgpT binds, we want to determine its binding sequence. The deletion of the first four nucleotides of AgpT exhibits a dramatic decrease in the expression of the *mela* genes, which indicates that some or all of these nucleotides are important in the binding sequence. Site directed point mutations of the first four nucleotides were constructed as well as random mutations within that 30 bp region. Mutations of the second, fourth, and sixteenth nucleotides resulted in decreased levels of expression of the *mela* genes, indicating that these are necessary for binding of AgpT, thus part of the binding sequence.

One of the approaches that is being done to locate another, if any, regulatory site within the *Pmela* was a 3' truncation which implies that a fragment of the *Pmela* located on the 3' end will be deleted resulting in a shortened promoter region. The shortened promoter will be fused or connected to *gfp*, a gene that codes for green fluorescent protein. We can monitor the intensity of fluorescence by doing a growth curve where optical density (OD) readings are done periodically to measure the growth *S. meliloti* and compare the fluorescence of the mutated promoter to the normal, or wild type, promoter and see if there are any changes in expression of the *mela-agp* operon when induced. A growth curve can also signal if a mutation inhibited the growth of the cell culture which would signal that the gene or nucleotide that was mutated was crucial for the cell to sustain a viable life. In addition to this project, our current plasmids use *gfp* as a way to measure the expression of the operon of interest; however, it is very inefficient because it requires the screening of individual cell colonies and that is very time consuming. A past student replaced *gfp* with the *lacZ* gene that codes for  $\beta$ -galactosidase, an enzyme that breaks down lactose. Xgal, a compound similar to lactose, can be broken down by  $\beta$ -galactosidase and it will leave behind a blue precipitate that will stain the cell colony if the operon is being expressed normally. This new plasmid was screened to make sure the orientation of the gene is correct and follows the *Pmela* so *lacZ* is also expressed when the operon is induced by secondary carbon sources in *S. meliloti*. The summer was spent confirming that this new construct had the correct sequence, was oriented properly and that the full *Pmela* and *lacZ* were present.

In the future, more point mutations will be made in the remaining of the first 30 bp region of *Pmela* in order to figure out the rest of the binding sequence of AgpT on the 5' end. Also, a mutated promoter region with random point mutations will be attached to *lacZ* to more efficiently evaluate the difference of expression of the *mela* genes and identify the location of other regulatory sequences.

The results of this research bring light to the mechanism of SMCR in *Sinorhizobium meliloti* and related bacteria.

# Isolating and Identifying Bacteria Carried by *Drosophila suzukii* and *Drosophila melanogaster*

Chad McMahon, '19

Iswarya Vel, '21

Faculty Mentors: Catalina Arango and

Scott P. McRobert

Department of Biology



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

The purpose for this summer scholar's project was to identify bacteria that were found on the surface of two species Drosophilid flies; *D.suzukii* and *D.melanogaster*. The *D.suzukii* strain was a wild-strain whereas the *D.melanogaster* was a lab strain. *D.suzukii* is an interesting organism to look at because it is an agricultural pest that costs the agriculture industry millions of dollars each year. *D. melanogaster* is one of the most studied and common model organisms.

To obtain the various bacterial strains from the surface of the flies, three pairs of flies of each strain were placed on medium rich TSA plates. Prior to being placed on the plates, the flies were introduced to cycloheximide, an antifungal, which inhibits eukaryotic growth on the TSA plates so that only bacteria would culture. The flies walked on the plates for a three-minute period. After the three-minute period, the plates were left to incubate at 21°C for, approximately, four days. After a sufficient amount of bacterial growth had taken place, colonies that had grown upon the surface of the plate were picked, utilizing sterile technique, and re-streaked onto a new TSA plate and left to grow in the incubator for a similar amount time to grow.

Once pure cultures were obtained, (plates where there were only one type of bacterial colony), a PCR was run to amplify the 16SrRNA of the bacteria. The 16SrRNA is important because all bacteria have it and allows bacteria to be compared by comparing its sequence. Following the PCR, the products were purified and quantified by a Nanodrop spectrophotometer. Washing the tubes is important because it gets rid of all proteins and other molecules that are not the 16S rRNA gene.

After quantifying the PCR products, the specimens were prepared to be sent out for Sanger sequencing. The company that sequenced the bacteria would send back the results and we would utilize the program BLAST (Basic Local Alignment Search Tool) to identify the strain each isolated bacteria colony. In the beginning six plates were prepared, and by the end of the process they yielded 134 isolates; 18 of the 134 isolates were completely sequenced and identified.

There were no overlapping bacteria from in those 18 identified isolates, some overlap is expected once all isolates are identified. However, most bacteria cannot be cultured in a lab, so we cannot confidently state we have identified all bacteria on the surface of these two particular drosophilids. In the future would be to investigate if the bacteria carried by these flies, particularly by *D. suzukii*, there are important in egg hatching and larva developmnet. For this, we will attempt to surgically remove the ovipositor from female *suzukii* and culture/identify the bacteria with hope to better understand what causes fruit to prematurely rot once the eggs have been deposited into the fruit.



**Lisa A. Baglione**  
Department of Political Science  
Saint Joseph's University

Ph.D. Cornell University

**Research Interests:** Global Security and Peace; Democracy, Democratization, and Democratic Breakdown; and Gender and Women's Studies as They Apply to Achieving Peace and Democracy

One of the best aspects of being on the faculty of SJU is that professors have a chance to teach in a broad range of areas, interact with scholars from around the university who have different disciplinary specialties, and develop new research interests.

I came to SJU as a scholar of global security and in particular, arms control negotiations between the United States and the USSR/Russia. While remaining committed to these studies, I have had a chance to develop expertise in gender studies. While that addition might seem strange for a traditional global security researcher, I have found that, in fact, a significant community of scholars emphasize the importance of gender in understanding the bellicosity or peacefulness of states and societies. Moreover, research shows that countries which accept gender equity and the idea of the sexual revolution are far more peaceful, both externally and internally. Thus, the study of gender sheds new light not only on conflict, but also on democracy and democratization. This scholarly work affects how I teach my courses in Global Politics and Global Security, as well as how I perform my research.

Currently, I am pursuing these interests in gender studies, global security, democratization, and pedagogy. I am in the process of writing an article on the importance of teaching about peace (and not simply about conflict) and provide insights from peace researchers and gender scholars on how and why to design such courses. In addition, I am also in the process of writing a textbook for the Introduction to Comparative Politics (one of the sub-fields in political science) that will integrate a gender perspective and show how commitments to equality (of the races, genders, ethnicities, religions, etc.) affect states' abilities to create and consolidate democracies and how some systems use inequalities to promote and maintain authoritarianism. Of course, the textbook also seeks to teach a good deal more, applying pedagogical insights from high impact practices and from the best of the current scholarly work on democracy, authoritarianism, revolution, and "stateness" - the capacity of states to implement policies and control their territory.

In addition to having great colleagues who promote creative thinking, I have had great students who give me reasons to move forward with new ideas. I was lucky enough to have Erin Davison in my War and Peace class in the Spring of 2017, when I first applied these insights about peace, gender, and democracy as the core of the course. She wanted to pursue some of these ideas further, and you can see the fruits of her hard work in this study. Erin will continue her efforts over the course of the next year, as she spent an enormous amount of time this summer digging deeper into the feminist literature in International Relations and honing her methodological skills.

# **Framing the Woman: Rhetorical Strategies, Foreign Policy, and the Attack on Women's Rights**

Erin Davison, '19



Faculty Sponsor: Lisa A. Baglione  
Department of Political Science

Sponsored by the SJU Summer Scholars Program

When we think about politics, we primarily envision actors struggling to secure power to promote their specific interests. Political actors promote interests by manifesting political will and transforming it into concrete social action. In this process, language plays an integral role. All political action is, to some extent, controlled or influenced by language. As a result, the study language in use, also known as discourse, has gained an increasingly important role in the study of politics. Discourse is both the process and the product of meaning-formation. In politics, it is common for actors to use discursive practices to affirm, create, or destroy social norms that have the power to influence the views and perceptions of others

Norms are a standard or pattern of social behavior. In the political arena, norms that accompany identity - such as gender, race, nationality, and religion- shape discourse and have a significant influence in mediating how people understand reality. For example, references to identity in the rhetoric of policymakers reflect how they conceive the world. To the same degree that identity shapes discourse, discourse also influences identity.

The purpose of my research is to examine how, and in what ways, rhetoric surrounding gender and race entered into the foreign policy discourse of the Trump Administration and to what extent, if any, this rhetoric impacted family planning policies and women's rights. To do this, I utilize discourse analysis, a method common to both constructivists and feminists, that concerns itself with the production of meaning through talk and texts. Through a close reading of speeches, tweets, interviews, and foreign policy statements, I identified dialogical frames which highlight the political and rhetorical maneuverings of the Trump Administration. These frames- coined Us vs. Them, Masculine Militarism, and Calculated Misogyny - showcase the ways that gender, identity, and ideology have come to intersect with political realities.

My research asserts that hegemonic masculinity -- the notion that the values of white men from the upper class define which priorities and policies are "natural" -- characterize American foreign policy. These exclusive norms manifest behaviors and policies that ignore the needs and values of minorities. Over time, these norms have permeated the administrative structure of the government and has created what some scholars call a hegemonic masculine state. When threatened, the state responds in an exaggerated and stereotypically masculine manner, for instance, with an emphasis on aggression, strength, or other traditionally "male" characteristics.

President Trump, his administration, and his base all view the diversification of the United States as a threat that would undermine their privileged status, and therefore these parties have become hypermasculinized. By relying on metaphors and symbolic meanings rooted in long-standing gender stereotypes, ethnocentrism, and racism that promote the interests of white (mainly male) Americans and disparage women and minorities, the Trump Administration constitutes a reality that serves the following goals: maintain the privileged position of a dominant elite, promote American military power, and control the agency of women.

I conclude that the while there exists no specific references to family planning in the discourse of the Trump Administration, the expansion of the Global Gag rule and defunding of the United Nations Population Fund display the extent to which hypermasculine rhetoric influences the creation of policy. The administration's consistent use of racist and sexist imagery has created a reality where women, religious minorities, and people of color are constructed as an "other" or "outside group" and served as a proxy measure to further their political agenda.

Thus, the Trump Administration discourse has created a reality in which ignoring the health, safety, and agency of women at home and abroad is possible.



**Lisa A. Baglione**  
Department of Political Science  
Saint Joseph's University

Ph.D. Cornell University

## **Research Interests:** Negotiation Among Adversaries, Russian Domestic and Foreign Policy, Authoritarianism, Democracy/ Democratization, and Conflict Transformation

My list of stated interests might seem unrelated and too broad-ranging at first glance, but there is a common thread that unites them. As I came to the study of Political Science and International Relations, the world was experiencing the last extremely icy winds of the Cold War, and I was fascinated with why, how, and when the US and the USSR would agree to reduce and eliminate what was seen then as the most essential elements of their security, their nuclear arsenals. My study of superpower nuclear arms negotiations brought me to think theoretically about the conditions under which adversaries cooperate as well as to consider what these bargains between enemies were really about. Did they signify compromises? Were they related enhancements in the relationship? Well, sometimes yes, and sometimes no, and that conditionality of the meaning of these agreements often led to greater problems in the superpower relationship, as one party might feel underappreciated for its sacrifices or another might believe its good faith had been abused.

As I was studying superpower arms control, the USSR was undergoing an enormous transformation and, ultimately, it collapsed. Russia emerged out of the ashes of the Soviet empire, and its nature as well as its relationship with the US and the rest of the world transformed in many ways. I had much to learn (and earned great enjoyment) from trying to puzzle out the course of post-communist change and the conditions under which former communist states might successfully transform their economies, societies, and politics into successful market and democratic systems. Russia is one of these states that has struggled with leaving behind the old and creating economic dynamism and opportunity for a large proportion of its citizens as well as political freedom, civil rights, and effective arrangements for holding elites accountable and subjecting them to the laws of the land.

To this day, I continue my interest in Russia affairs and seek to explain its politics and foreign policy to my students and others who will listen. In addition, I investigate post-conflict transformation, particularly in war-torn and post-communist states. My general approach to world politics is that domestic and foreign policies tend to be closely intertwined and that leaders respond to constituent pressures and their assessments of national identity in pursuing their policy options. Thus, working with Chelsea Smith this past summer (2018) was a pleasure, as she was investigating contemporary Russian foreign policy. Her emphasis on identity is very important, as part of the transformation that Russia has undergone in the last twenty-five years is one of identity, and Putin's understanding of and emphasis on what it means to be "Russian" has changed and is central to that country's domestic and foreign affairs.

# **Identity Crisis: Understanding Russia's Actions Through an Examination of its National Identity**

Chelsea Smith, '20



Faculty Mentor: Lisa A. Baglione  
Department of Political Science

## **Supported by the SJU Summer Scholars Program**

Following the collapse of the Soviet Union, observers waited with baited breath to see what place its successor state, the Russian Federation, would assume in the world. In the early years of the twenty-first century it appeared as though Russia might settle into a place with the West as a partner to the United States and its European allies. Instead, as various American administrations came and went, each attempting its own ultimately ill-fated reset with Russia, this relationship deteriorated. Some scholars began to whisper about the onset of a new Cold War (Legvold, 2016), yet Russia- West relations continued to stumble on. That is, until events in Ukraine pushed them beyond the point of no return (Legvold, 2016). The Euromaidan, a movement of Ukrainian citizens demanding closer ties to the West, provoked Russia to respond with outright aggression. Since then, Russia has not shied away from declaring its decidedly anti-Western stance by taking a far more active role in global politics (often in direct opposition to the United States and its allies), and seeking to undermine democratic institutions throughout the world.

This research was designed to investigate the development of Russia's antagonistic identity in relation to the West and the role that the Euromaidan played in this process. Thus, this project was two-fold. First, it required a careful mapping of Russia's identity transformation throughout the 21st century. The process of identity formation consists of a relationship between a Self and Other (Neumann, 1996; Hopf, 2002). For the purpose of this project, the Russian Self was compared to the Western Other (selected because of its historical relationship with Russia and its role as the global hegemon). Through careful consideration of various primary and secondary sources Russia's relationship with the West was divided into three periods: one of cooperation (2000-2006), one of growing hostility (2007-2012), and one of outright animosity (2013-present). Second, in order to understand why the Euromaidan proved to be the breaking point of Russia-West relations the relationship between the Russian Self and the Ukrainian Other had to be understood. By analyzing personal statements, opinion data, and scholarly analysis it became apparent that Russia understood Ukraine as an extension of its Self, not a distinct Other (Stent, 2014; Feklyunina, 2016; Kissinger, 2015). Thus, the perceived encroachment of the Western identity into Russia's own Self proved the breaking point for Russia-West relations.

Russia will remain a significant world power for the foreseeable future. As such, it is imperative for the leaders of the Western world to find a path for peaceful interaction with this great state. It is only by coming to understand Russia on its own terms that this will be conceivable, and that is a feat made uniquely possibly through identity-based analysis.



**Elizabeth Ann Becker**  
Department of Psychology  
Kinney Center Faculty Affiliate  
Saint Joseph's University

Ph.D. University of Wisconsin

## **Research Interests: Social Behavior, Epigenetics, Autism Spectrum Disorders**

My primary interests as a behavioral neuroendocrinologist are two-fold; first, to understand the neural mechanisms that underlie the transmission of species typical behavior from parent to offspring. In particular, I focus on non-genetic, parental contributions to the development of offspring brain and behavior (e.g. how parental care influences offspring biology). Second, I am interested in the ways in which maternal prescription drug use may negatively impact neurodevelopment.

In the Becker Lab, we use the monogamous and territorial California mouse (*Peromyscus californicus*) to examine parental contributions to the neurodevelopment of typical and disordered social behavior. We focus on understanding the impact that parental behavior has on the roles that neuropeptides (vasopressin and oxytocin) and hormones (testosterone and corticosterone) play in regulating social behavior.



We have a new area of research in the lab examining the neurodevelopmental consequences of early-life antidepressant exposure (via maternal drug use throughout lactation). Our findings suggest a causal link between SSRI (a class of antidepressant) use by nursing mothers and dysregulation of the oxytocin system which is implicated in the development of autism spectrum disorders.

This summer was particularly stimulating and productive with six summer scholars working in the Becker Lab. Julia Forbes, Gabe Sallard, Brandon Creisher, Amelia Bielefeld, Molly DuPuis, and Rob Roy worked tirelessly on many aspects of several studies in the lab including: study design, behavioral testing, and immunohistochemistry. In addition they learned lab management skills. These tremendous young scientists have been the backbone of the lab this summer, and to them I am eternally grateful.

Our research is supported by the National Science Foundation, the Tom and Mary Gallagher Foundation and Saint Joseph's University.

## **Developmental Consequences of SSRI Exposure on Aggression and Anxiety In *Peromyscus californicus***

Amelia Bielefeld, '20

Brandon Creisher, '20



Faculty Mentor: Elizabeth Ann Becker  
Department of Psychology

Supported by the John P. McNulty Scholars Program, the National Science Foundation, the Tom and Mary Gallagher Foundation and the SJU Summer Scholars Program

Depression is a prominent issue in the United States and calls for treatment under certain circumstances. Depression is more common in women than in men, and depression rates during pregnancy can be as high as 18%. This has shown to have negative impacts on the behavior of the offspring who were exposed to this depressive environment. Therefore, it is vital to treat the depression. SSRIs, or selective serotonin reuptake inhibitors, are one method of treatment. However, antidepressants can cause deficits in offspring, one being autism spectrum disorder, if administered during pregnancy or while nursing. The specific cause of ASD is not known, but maternal depression and SSRI use could be factors.

The aim of the present study is to clarify the behavioral consequences on offspring of prenatal maternal depression followed by postnatal SSRI use. To accomplish this, we used an animal model, *Peromyscus californicus*. These mice are a great model because they are both monogamous and biparental. They pair bond for life and both mothers and fathers take part in all acts of parenthood except for nursing. Pregnant mouse mothers were injected with corticosterone, a stress hormone, to mimic a depressive environment for the pups in utero. They received injections of corticosterone or a control, vehicle, on gestational days 15-20. Following birth, an osmotic mini pump was implanted into the mid-scapular region and delivered fluoxetine (SSRI) or vehicle. The pump was used to model the daily dosage of SSRI use in humans. Fluoxetine is able to cross the ductal-epithelial barrier into the pups via nursing. This potentially causes hyperserotonemia, or an excess of serotonin in the plasma. Hyperserotonemia is a well-documented symptom of ASD in adults and children.

Once the offspring were 120 days, behavioral testing took place. The mice underwent a social interaction test and a resident intruder to assess their social and aggressive behavioral changes. These tests allow us to observe ASD like behaviors in the animals. Neurotypical behaviors would include a high level of social exploration and aggressive territorial defense. We expect mice with ASD like symptoms to have decreased social interaction and heightened aggression.

# **Oxytocin Cell Activation in Response to Social and Non-Social Stimuli Following Developmental Fluoxetine Exposure**

Molly Dupuis, '20

Gabrielle Sallard, '19



Faculty Mentor: Elizabeth Ann Becker  
Department of Psychology

Supported by the National Science Foundation, the Tom and Mary Gallagher Foundation, the Nicholas and Susan Nicolaides Research Fellowship and the SJU Summer Scholars Program

High rates of maternal depression during the perinatal period have led to frequent use of antidepressants during pregnancy, particularly selective serotonin reuptake inhibitors (SSRIs) such as Fluoxetine. While these medications have led to an amelioration of depressive symptoms, research has found that they cross the placental barrier and are excreted through breast milk. This can alter the brain chemistry of the fetus. One possible consequence for the infant is a condition known as hyperserotonemia: an excess of serotonin, a mood-regulating neurotransmitter, in the blood and an accompanying decrease in the brain tissue. This imbalance may cause dysregulation of oxytocin (OT), a neurotransmitter key in social interaction and recognition. Martin, Liu, and Wang (2012) observed decreased levels of OT and social behavior deficits in prairie voles with elevated levels of serum serotonin during development, many of which are characteristic of autism spectrum disorders (ASD) along with changes in stimulus recognition. In fact, hyperserotonemia affects approximately 30% of individuals diagnosed with ASD (Hollander, Kolevzon, & Coyle, 2011). In a study by Schultz et al. (2000), children diagnosed with ASD viewing a social stimulus (a human face) had increased activation of brain areas involved in nonsocial stimulus recognition, and decreased activation of the brain regions implicated in social stimulus recognition. Animal models such as the California mouse (*Peromyscus californicus*) can be utilized to further study this phenomenon because the biparental rodent species demonstrates several social behaviors including novel stimulus preference and monogamous pair bonding. The purpose of this study was to observe the effects of developmental exposure to SSRIs on California mouse pups' behavioral and brain activity when interacting with a social or nonsocial stimulus.

During the summer of 2018, we injected multiparous California mouse mothers with the stress hormone corticosterone, mimicking maternal depression, or vehicle solution during gestational days 15-20. After birth, on postnatal day (PND) 2 mothers were implanted with a mini-osmotic pump dispensing fluoxetine or vehicle solution. This created three developmental conditions for their pups: corticosterone exposure only (mimicking untreated maternal depression), SSRI and corticosterone exposure (mimicking treated maternal depression), or vehicle only (the control group). On PND 28, pups were weaned from their mothers. On PND 65, experimental pups will be evaluated by a social or nonsocial interaction test to observe behavior, then transcardially perfused to fixate their brains for further study. Retro-orbital eye bleeds will also be performed for verification of hyperserotonemia in the pups. In preparation for these procedures, we practiced pump surgeries, RO eye bleeds, intraperitoneal injections, transcardial perfusions, and behavioral tests throughout the summer.

## **Aggressive Encounters Alter Corticosterone But Not Paternal Behavior in the California Mouse**

Julia Forbes, '19

Faculty Mentor: Elizabeth Ann Becker  
Department of Psychology



Supported by the National Science Foundation, the Tom and Mary Gallagher Foundation, the Nicholas and Susan Nicolaides Research Fellowship and the SJU Summer Scholars Program

This summer I finished analyzing the blood samples for former graduate student, Linda Muller's master thesis project. I was fortunate enough to present our research at the 2018 Parental Brain Conference in Toronto, Canada in July.

The aim of our project was to study the effects of environment on parenting behavior. Our subjects were *Peromyscus Californicus* or the California Mouse which is a monogamous and biparental species where mothers and fathers mate for life and both play a role in rearing their offspring. While previous research has been conducted on the effect of the environment on maternal care and subsequent offspring development, relatively little is known about how the environment effects paternal care. To investigate this possible relationship, we studied the theory of Anticipatory Parental Effects which states parents change their behavior in response to cues from their environment. Through changes in parental behavior, information is transmitted to offspring to increase offspring fitness (Burgess and Marshall 2014). We wanted to investigate the effects of an aggressive environment on paternal behavior. We created an aggressive environment by exposing the fathers to the Resident-Intruder Paradigm and looked at their resultant paternal retrieval behavior. Increased retrievals, or when a father picks up a displaced pup and carries them back to the nest, indicates increased paternal care and offspring aggression. We hypothesized that fathers exposed to increased aggressive encounters would have a greater retrieval frequency. Previous research has shown that aggression is not stressful for fathers and we wanted to test this by comparing plasma corticosterone levels before and after the resident intruder test for virgin fathers. We analyzed our plasma samples this summer using the corticosterone ELISA assay and hypothesized that father's exposed to the aggressive encounters would have the same corticosterone levels as control fathers.

Our behavioral results show that aggressive encounters do not affect paternal attentiveness towards offspring. However, we saw a significant difference between the corticosterone plasma levels after the resident intruder test between control fathers and fathers that were exposed to the test. We have concluded that increased aggressive encounters elevate plasma corticosterone levels in fathers. Therefore, aggressive encounters may increase stress in fathers but not males without offspring.

# **Pair Bond Formation in the California Mouse**

Robert J. Roy, '19



Faculty Mentor: Elizabeth Ann Becker  
Department of Psychology

Supported by the National Science Foundation, the Tom and Mary Gallagher Foundation and the SJU Summer Scholars Program

The California mouse (*Peromyscus californicus*) offers researchers the rare opportunity to work with a mammal that is both biparental and socially monogamous. Such behavior in mammals is extremely rare as only 5% of mammals are biparental, and only 3% are monogamous. Human beings are also among this limited number of mammals who display such behavior. Due to the rarity of such mannerisms, animal models such as California mice become immeasurably valuable in reaching an understanding of some of the most basic human behaviors by enabling us to observe their behavioral and biological mechanisms.

Monogamous relationships in mammals are typically referred to as pair bonds. Pair bonds between two animals is shown after the animals have spent enough time together that, when given the choice, they choose the familiar animal over a novel one. In non-monogamous species this is reversed. Pair-bond formation has been studied in the monogamous prairie vole which forms lasting pair bonds within 24 hours of cohabitation. However, the duration of cohabitation needed for a monogamous relationship to form is species-dependent, and is currently unknown in the California mouse. What is known is that the California mouse requires a longer period of cohabitation which makes it closer to humans in its behavioral mannerisms. Additionally, lack of knowledge to this crucial detail presents issue in future research with the California mouse that want to look into its monogamous behavior. The purpose of this study was then to uncover this crucial detail by observing behaviors in the species related to pair bond formation to determine how long it takes California mice to become monogamous.

In order to determine how long it takes California mice to form a monogamous pair we observed pairs at specific points from their initial first meeting to having spent a week living as a pair by intervals of 24 hours. To observe whether there was a pair bond we placed the mice in a three chambered cage and allowed either the male or the female (called the focal) to freely choose between the familiar mouse or a stranger mouse of the same sex tethered to opposite chambers in the cage in a behavioral assay known as a partner preference test. We recorded these tests and scored for behavior to see which mouse the focal mouse spent more time huddling with or fighting with.

The tests we ran this summer were just a test run for what is to be my master's project for the next two years. However, what we were able to find from the tests we ran this summer promise solid results for the future. We found that California mice will show more huddling behavior toward familiar mice, and more aggressive behavior toward unfamiliar mice which is exactly what we hypothesized. With this we can begin to progress on this project and hopefully come to gain a better understanding of one of the core behaviors in humans; monogamy.



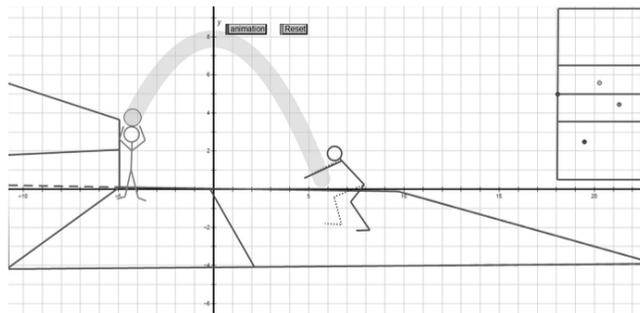
**Tetyana Berezovski**  
Department of Mathematics  
Saint Joseph's University

Ph.D. Simon Fraser University

**Research Interests:** Understanding of  
Mathematics, Sporthematics

*Sporthematics* is the study of the relationship between mathematics and sports. It refers to a broader cluster of ideas ranging from the mathematics of scheduling tournaments to the application of sports to mathematics education. The goal of *sporthematics* is to contribute to both the understanding of sports and the understanding of mathematics, along with underlining the importance of the connections between the two.

In the past decade, Mathematics of Sports began to be recognized as an attractive platform for innovative teaching methods of mathematics. For seven years I research the nature of the relationship between sports-related activities and mathematics learning and teaching. I have been working in the domain of the cross-disciplinary tasks design for the most part of my career as a researcher and as an instructor. During this period, my students and I have developed mathematical models as well as the sports-related tasks appropriate for teaching mathematics ranging from the middle school to the graduate level. The contexts for the design included ice-skating, lacrosse, karate, soccer, basketball, car racing, and rhythmic gymnastics.



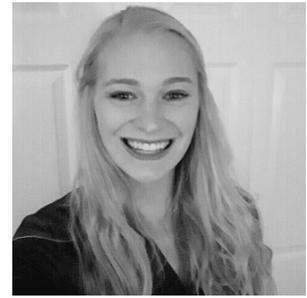
During this summer, Lauren Hall and I engaged in design of the cross-disciplinary content activity for mathematics and physical education classes at the secondary level. The mathematical modeling of volleyball passing evolved into animation, designed using the dynamic geometry software. Related activity-based experimental curriculum will be tested next. We anticipate that physical movement along with animated activity will complement students learning of mathematics, and deepen their conceptual understanding. The bodily-movement learning theory supports our conjecture, and positive outcomes.

Students who love mathematics, physics, technology, and sports, find such cross-disciplinary studies particularly fascinating and enjoyable since they learn to intergrade various subjects' knowledge to experience *Cura Personalis* with respect to themselves and to those they plan to teach.

# Sports-Based Learning in the Classroom: Volleyball

Lauren Hall, '19

Faculty Mentor: Tetyana Berezovski  
Department of Mathematics



Supported by the Robert & Carla Conaty Research Fellowship and the  
SJU Summer Scholars Program

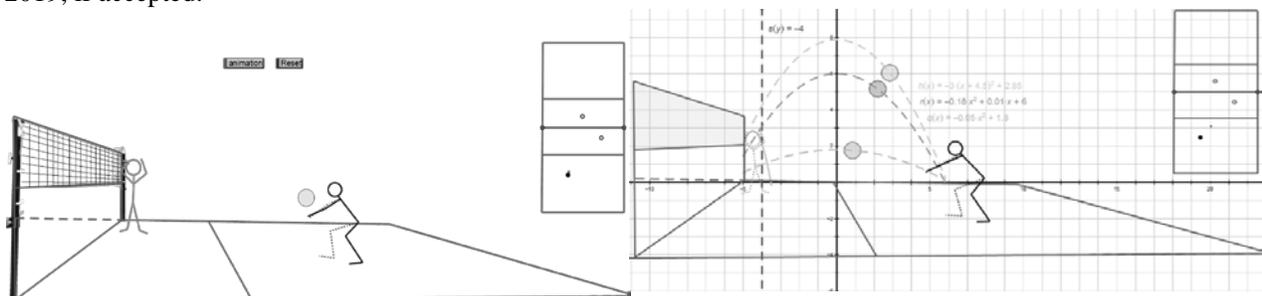
“Sporthematics is the study of the relationship between mathematics and sports” (Berezovski, 2018).

Coming into the summer scholars program, I wanted to establish the connection between volleyball, mathematics education and sports education. Sports are an engaging topic for high school students. Students learn best when they are interested, and can connect prior experiences to new knowledge. The goal of this study was to develop innovative cross-disciplinary tasks as alternative instructional tools.

To begin the research process, we started with a literature review of the three dimensions we wanted to incorporate in our research project; Mathematics Education, Education, and Physical Education One article in particular, *Mathematical Tasks as a framework for Reflection* by Stein and Smith discussed the importance of not only creating a high level task for students but the importance of how the task is implemented. This implantation can lead to a maintenance or decline of a task (Stein & Smith, p. 273). The maintenance of a task is when students can work through a task and persevere until they uncover the mathematical solution path, thus maximizing learning. The decline of a task is when the task becomes simply procedural or students are too overwhelmed to continue. As a teacher, this is why it is important to focus not only on what students should know, but allow them the opportunity to discover how to learn. According to Margaret Wilson’s *Six Views of Embodied Cognition* defines the theory of embodied cognition as the belief that “cognitive processes are deeply rooted in the body’s interactions with the world” (p.1). The alignment of mathematics with physical education is a way of combining the bodily movements performed in PE class with mathematical application and principles to create a well immersed learner. As the Common Core Standards for Mathematics states “instructional shifts in mathematics cannot occur without the integrated emphasis on content and practice” (p.4).

We created a rubric of aligned mathematical and physical education standards from grades 7 to 12 with desired outcomes under the topics of Numbers and Operations, Geometry, Statistics and Probability, and Algebra. Using Geometer’s Sketchpad we took a video clip of a person passing a volleyball and constructed an animated model which performed this task. From this, we created calculus and algebra activities to be completed using mathematics of the dynamic animation of passing a volleyball.

I hope to continue this project further and collect data for proper analysis of the activities and further feedback towards sports-based learning. I also plan to present our findings at the Joint Mathematics Meeting 2019, if accepted.





**Shantanu Bhatt**  
Department of Biology  
Saint Joseph's University

Ph.D. Emory University

**Research Interests:** Regulation of Gene  
Expression in Bacterial Pathogens

My lab focuses on the roles of regulatory small RNAs (sRNAs) in the virulence of the bacterial pathogens enteropathogenic *Escherichia coli* (EPEC) and *Escherichia albertii*. EPEC and *E. albertii* belong to the class of pathogens called attaching and effacing (A/E) pathogens, because they adhere to intestinal cells and destroy microvilli. These structural changes, in turn, reduce the ability of intestinal cells to absorb water and nutrients, leading to diarrhea. Under extreme conditions, severe dehydration can lead to death. The ability of A/E pathogens to cause diarrheal disease is housed within the cluster of genes termed locus of enterocyte effacement (LEE). Therefore, understanding the regulatory controls that impinge on the LEE is critical for developing effective interventional strategies.

**EPEC** - To date, over 40 protein-based systems are known to regulate gene expression from the LEE of EPEC. In contrast, the roles of regulatory small RNAs (sRNAs) remain cryptic. My lab identified the first three small RNAs – MgrR, RyhB, and McaS – that synchronize gene expression from the LEE of EPEC. Moreover, during our study we discovered a novel mechanism by which MgrR exerts its effect. Since then, we have discovered 4 additional sRNAs – Spot42, OmrA, OmrB, and DsrA – all of which further refine gene expression from the LEE. To the best of our knowledge these 7 sRNAs are the ONLY identified RNA-based regulators of the LEE in EPEC.

***E. albertii*** – The bacterium was first isolated in 1991. However, it has been routinely mischaracterized. Moreover, until 2016, not a single gene had been mutated in the bacterium, because of the absence of a reliable method for genetic engineering. My lab developed the very first protocol for engineering mutations in the genome of this bacterium. We demonstrated the reliability and reproducibility of this technique by mutating multiple genes that are known to be involved in the virulence of other A/E bacteria such as EPEC and EHEC. Since then we have begun to address the functionality of these genes. We have identified four regulators – Ler, GrlR, GrlA, and Hfq – that affect gene expression from the LEE of *E. albertii*. These four factors represent the ONLY experimentally validated regulators of the LEE of *E. albertii*. One of these regulators, Hfq, exerts its effect by facilitating base-pairing between sRNAs and their target mRNAs, thereby implicating sRNAs in bacterial virulence. Current ongoing research on *E. albertii* seeks to identify the specific sRNAs that regulate the LEE in this bacterium.

# Investigation of the Role of the Small RNA RydC on Regulating the Locus of Enterocyte Effacement (LEE) in Enteropathogenic *Escherichia coli*

Emily Costello, '21

Faculty Mentor: Shantanu Bhatt  
Department of Biology



Supported by the SJU Summer Scholars Program

Enteropathogenic *E. coli* (EPEC) primarily infects infants in developing countries and is transmitted through contaminated food and water. EPEC is an attaching and effacing (A/E) pathogen that forms characteristic A/E lesions on the surface of infected intestinal cells. A/E pathogens are so called because they attach to intestinal host cells and destroy the microvilli associated with them to form A/E lesions. A/E lesions decrease the ability of intestinal cells to absorb nutrients and water, which leads to diarrhea. The locus of enterocyte effacement (LEE), a major pathogenicity island in EPEC, allows for the formation of A/E lesions. The LEE encodes the proteins for a type 3-secretion system (T3SS) including structural and effector proteins. The master transcriptional factor Ler, encoded by the *LEE1* operon, activates transcription from the other LEE operons, which, in turn, leads to LEE-encoded protein expression. The structural proteins EspA, EspB, and EspD make up the needle-like appendage that extends from the bacterial cell and punctures the host cell membrane to connect the cytoplasm of the host cell to that of the bacterial cell. This connection enables the bacterial cell to secrete effector proteins, such as the translocated intimin receptor (Tir), into the host cell's cytoplasm. Tir is then integrated into the host cell membrane where it associates with intimin located on the outside of the bacterial cell. Tir-intimin interactions ultimately signal host cell proteins to reorganize the host's cytoskeleton beneath the attached bacteria to form A/E lesions, resulting in increased bacterial colonization and diarrheal disease.

My research is focused on addressing the roles of small regulatory RNAs (sRNAs) in the regulation of the LEE. sRNAs base pair to their target mRNAs to affect transcriptional elongation, mRNA stability, and/or translation. Specifically, the goal of this research project is to determine if the sRNA RydC affects expression of the LEE, and if so, to determine its operational mechanism. RydC is 64 nucleotides in length and requires the chaperone protein Hfq to base-pair to its target mRNAs. This summer, using western blotting, I determined that overexpression of RydC decreases the expression of the LEE-encoded proteins Tir and EspA.

In the future I plan to clone the *rydC* allele from EPEC into a plasmid and transform it into EPEC because, thus far, we have been using *rydC* from *E. coli*, which differs from the *rydC* of EPEC by a single nucleotide substitution. Then, I plan to repeat the western blot experiments to probe for Tir and EspA as well as other LEE-encoded proteins, to verify that the observed phenotype is maintained with the EPEC-specific allele. Finally, I would like to figure out the precise molecular mechanism by which RydC is affecting the expression of these LEE-encoded proteins.

# The Small Regulatory RNA DsrA is a Negative Regulator of the Locus of Enterocyte Effacement in Enteropathogenic *Escherichia coli*

Brian Critelli, '19



Faculty Mentor: Shantanu Bhatt  
Department of Biology

Supported by the SJU Summer Scholars Program

Enteropathogenic *Escherichia coli* (EPEC) is a gastrointestinal pathogen that causes disease by intimately attaching to host cells, destroying intestinal microvilli, and forming attaching and effacing (A/E) lesions, thus leading to chronic diarrhea. Such virulence derives from the bacterium's major pathogenicity island, the locus of enterocyte effacement (LEE), which encodes key virulence factors that allow the bacterium to connect its cytosol to that of the infected host cell and inject toxic effector molecules that facilitate bacterial colonization and impact its ability to induce disease. This 35 kilobase genomic island encodes key virulence factors such as the type three secretion system (T3SS), which allows the bacterium direct access to the cytoplasm of the infected host cell. Thereafter, the pathogen injects toxic effector molecules into the host to manipulate signal transduction pathways that facilitate bacterial colonization and impact its ability to induce disease.

Whereas much is known about protein-based regulators of the LEE, the role of regulatory small RNAs (sRNAs) remains cryptic. sRNAs are a heterogeneous group of molecules that typically range from 50 to 500 nucleotides in length and largely exert their effects by base-pairing to target messenger RNAs (mRNAs) to ultimately affect transcriptional elongation, mRNA stability, and/or translation.

The purpose of my research has been to understand the post-transcriptional regulation of the LEE by the sRNA DsrA in EPEC. On the basis of western blotting, our results suggest that the regulated overexpression of DsrA downregulates the steady-state levels of several LEE-encoded proteins, including translocated intimin receptor (Tir), GrlA, EspA, and EspB. Reciprocally, deletion of *dsrA* leads to an observed increase in the abundance of the same virulence factors. Each of the LEE-encoded gene products for which we assayed is activated by the master transcription regulator Ler, suggesting that DsrA might be targeting Ler. However, DsrA did not affect  $\beta$ -galactosidase activity from a *ler'*-*lacZ* translational fusion that was transcriptionally driven from the heterologous *araBAD* promoter. Interestingly, when the *araBAD* promoter was replaced by the native *ler* promoter, overexpression of *dsrA* dramatically reduced  $\beta$ -galactosidase activity from *ler'*-*lacZ*<sup>+</sup> transcriptional fusion. Thus, collectively, our results suggest that DsrA globally silences the LEE of EPEC by indirectly affecting transcription of the LEE1-encoded master regulator *ler*. Our current efforts are dedicated at elucidating the identity of the indirect regulator(s).

# Two Hfq-Dependent sRNAs, OmrA and OmrB Repress the Locus of Enterocyte Effacement in Enteropathogenic *Escherichia coli*

Sarah Muche, '18

Faculty Mentor: Shantanu Bhatt  
Department of Biology



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

The gastrointestinal pathogen enteropathogenic *Escherichia coli* (EPEC) falls under the family of attaching and effacing (A/E) pathogens. During the infectious process, A/E pathogens can form intimate connections, called pedestals, on the surface of infected intestinal cells. Pedestals are protrusions that extend out from the infected cell and are primarily composed of the cytoskeletal protein actin, which is recruited from disintegrated microvilli. Disintegration of microvilli causes the symptomology of diarrhea. The ability of the bacterium to form pedestals, colonize, and cause disease is dependent on a functional type III secretion system (T3SS), which functions as a molecular syringe that enables the infecting bacterium to inject toxic proteins into host cells.

The genetic element that encodes the type III secretion system (TS3S) is known as the locus of enterocyte effacement (LEE). The LEE is a cluster of operons that includes regulatory factors such as Ler, the master regulator of the LEE (encoded within the *LEE1* operon), structural components of TS3S such as EspA and EspB (encoded within the *LEE4* operon), and effector proteins such as Tir (encoded within the *LEE5* operon). The transcriptional regulation of the LEE has been well-studied; however, not much attention has been given to its posttranscriptional regulation. Investigations by our lab, as well as by others, reveal that small regulatory RNAs (sRNAs) are prominent posttranscriptional regulators that fine-tune gene expression from the LEE. These sRNAs require the RNA chaperone protein, Hfq, that facilitates their base-pairing to their target mRNAs to impact gene expression.

Upon initial screening via western blotting, two homologous Hfq-dependent sRNAs, OmrA and OmrB were observed to repress the LEE. More specifically, the two sRNAs negatively regulated the levels of GrlA (encoded within the *grlRA* operon) and the GrlA-activated targets, Tir, EspA, and EspB. However, OmrA and OmrB do not directly base-pair with the *grlRA* mRNA, suggesting their effect on *grlRA* is likely indirect. Further investigation revealed that OmrA and OmrB also did not base pair to the *ler* mRNA, which specifies the major transcriptional activator of *grlRA*. Rather, the two sRNAs repressed transcription from the *ler* promoter. We hypothesize that OmrA/B regulate a transcriptional factor that is conserved in EPEC and *E. coli*, which, in turn, affects transcription of the *LEE1*-encoded master regulator Ler to globally affect gene expression from the LEE. Our current efforts are focused on identifying the intermediate regulator(s) through which the sRNAs are affecting the *LEE1* transcription.

# Investigating the Role of the Small Regulatory RNA FnrS in the Regulation of the Locus of Enterocyte Effacement in Enteropathogenic *Escherichia coli*

Thi Nguyen, '21



Faculty Mentor: Shantanu Bhatt  
Department of Biology

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

Infections caused by Enteropathogenic *Escherichia coli* (EPEC) are a health concern in developing nations. Symptoms from EPEC bacterial infections include dehydration, vomiting, and diarrhea. EPEC forms attaching and effacing (A/E) lesions, resembling pedestal-like structures, on the surface of infected intestinal cells which are responsible for such symptoms. The creation of A/E lesions leads to destruction of the microvilli and impairs their function to absorb nutrients and retain water, leading to the observed diarrheal symptoms. Moreover, A/E lesions also allow EPEC to stay tightly attached to the infected cell and persist in the intestinal tract during the diarrheal episode.

The ability of EPEC to form A/E lesions and induce disease in the host is due to the Locus of Enterocyte Effacement (LEE) pathogenicity island (PAI), which encodes a type III secretion system (T3SS) that allows EPEC to inject virulence factors into the infected host cell. One such factor is the translocated intimin receptor (Tir). Tir is inserted into the host cell membrane where it binds to the protein intimin, which is on the outer membrane of the bacterium, and leads to intimate association between EPEC and the host cell. The LEE exhibits a complex mode of regulation in which most environmental signals affect the transcription of the master regulator of the LEE, *ler*. *Ler*, in turn, activates transcription from the other genes of the LEE whose proteins assemble to form the T3SS.

While research has been performed with regard to the transcriptional regulation of the LEE, not much is known concerning post-transcriptional regulation. Our goal is to identify small regulatory RNAs (sRNAs) dependent on the protein chaperone Hfq that regulate the LEE in EPEC. Hfq is responsible for facilitating the base pairing of sRNAs to its target messenger RNAs, thereby altering the stability, transcription, or translation of the mRNA. Previous work completed in the lab has identified several Hfq-dependent sRNAs that have indirect and direct effects on the LEE. My project pertains to the sRNA FnrS, which is responsible for reprogramming *E. coli* metabolism in response to anaerobic conditions. This sRNA is activated by the transcription factor, Fumarate Nitrate Reductase (FNR), an oxygen availability sensor. We used the Western blotting Assay to quantitatively determine the levels of the LEE-encoded proteins upon overexpression of FnrS. It was determined that FnrS negatively regulates Tir and EspA. Since FnrS affects several virulence proteins of the LEE, it is likely that this sRNA exerts its effect through a regulator of such proteins. This is one of the questions that will be explored in our future research.



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

Ph.D. Michigan State University

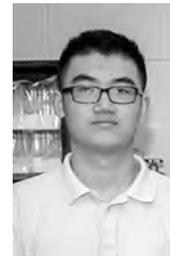
**Research Interests:** Spectroscopic and  
Electrochemical Studies of Redox Proteins and  
Heme Model Compounds

Heme proteins are a family of proteins that contain the heme cofactor and are involved in many types of biological functions. For example, heme *b*, a type of heme cofactor found in myoglobin (Mb), hemoglobin (Hb), and heme peroxidases, is used by heme proteins for oxygen storage and transport, electron transfer, oxygenase, catalase, peroxidase, and gas sensing. Although all these protein structures may be different, the heme cofactor is the active site in all of them and my research goal is to understand how heme-protein interactions uniquely defines the biological role of a heme protein. For many years, we have used UV-vis spectroscopy and electrochemical techniques to study heme proteins because of the physical-chemical properties of the heme cofactor: hemes absorb strongly in the UV-visible region and can also be subjected to oxidation reduction reactions. In our studies, we have used fluoride binding as a probe of the heme pocket structures of Hb, Mb, horseradish peroxidase (HRP), and clam hemoglobins. Fluoride ion is an interesting choice since it is not a physiological ligand. However, many heme proteins have the ability to bind fluoride ion and differences in the fluoride binding properties suggest differences in the heme pocket structure. Our past studies using this method have shown that the heme pocket structure affects the electronic properties of the heme in the presence of fluoride. But because there are many type of heme-protein interactions, it is very hard to pinpoint a particular protein-heme interaction as the sole definer of the biological role of a heme protein. To achieve a greater scope in understanding the role of the protein structure, during the last few years, my SSP research students have used temperature-controlled experiments to study the thermodynamic properties of fluoride binding. In doing this, we have been able to measure the enthalpies and entropies of fluoride binding in Hb, Mb, and horseradish peroxidase (HRP). We have observed that all these three heme proteins show a strong correlation between the entropy and enthalpy of fluoride binding. Additionally, with a few exceptions, the studied heme proteins are more resistance to denaturing in the presence of fluoride binding. We are in the process of understanding the molecular mechanism that explain fluoride binding and heme stabilization in the studied heme proteins.

# Midpoint Potential Measurements of Hemoglobin in the Presence of Fluoride

Elizabeth Del Rio, '19

Michael Feng, '20



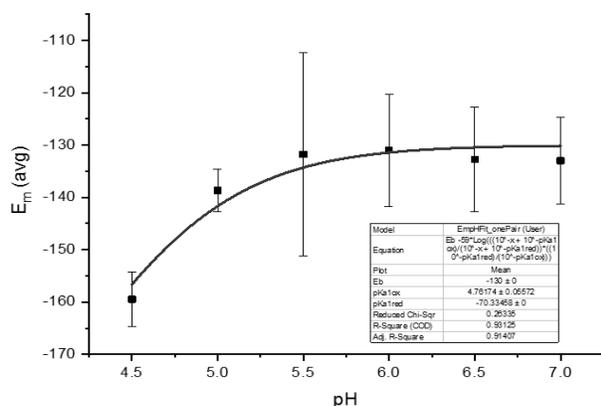
Faculty Mentor: Jose F. Cerda

Department of Chemistry

Supported by the SJU Summer Scholars Program

Heme protein is the general term for a group of proteins that contain a heme cofactor and the function of a particular heme protein is dictated by the chemical properties of the iron ion in the heme cofactor. The main goal of this research project is to understand how the biological role of a particular heme protein is determined by its unique heme-protein interactions using spectroscopic and electrochemical techniques. The heme protein that was studied was the fluoride complex of hemoglobin (Hb). Fluoride binding in heme proteins is used as a probe of the heme pocket structure. Using a UV/Vis spectroelectrochemical equipment to study Hb without  $F^-$  and in the presence of  $F^-$ , specific heme-amino acid interaction can be measured by using the midpoint reduction potential ( $E_m$ ).

For this experiment, UV/Vis Spectroelectrochemistry was used to determine the midpoint reduction potential of the heme protein. The protein, designated mediators, and buffer with the targeted pH combined with  $F^-$ , were deoxygenated three times for fifteen minutes to make sure that no oxygen would bind to the heme pocket, and then was placed into an optical cell.



**Figure 1:** Results of average  $E_m$  for Hb with  $F^-$ ; the  $pK_a$  oxd. = 4.76

Once this was done, the sample was fully reduced before any data could be collected to avoid any oxygen intermediate(s) that may form. The sample was oxidized and then reduced in increments of 30 mV and the absorption was recorded. Upon reduction or oxidation, the main peak absorption shifts from around 430 nm to around 403 nm or vice versa. The data shown below in Figure 1, is a plot of the average measured midpoint reduction potential,  $E_m$  vs. pH. The plot is similar to that obtained for the fluoride complex of myoglobin (Mb). However, the measured  $pK_a$  was 4.76 and not 5.30, as was for Mb. Two possible explanations for this is that the lower  $pK_a$  in Hb indicates a weaker  $F^-$  to histidine interaction, compared to Mb, or more data needs to be collected between pH 4.5 and 5.5 to see if there is a sigmoidal curve similar to the Mb- $F^-$  data.

In the future, additional thermodynamic properties, such as entropy and enthalpy will be measured to further understand the role of the overall protein structure in ligand binding.

# **Molecular Mechanisms in Heme Protein Function: A Thermodynamic Perspective From Fluoride-Binding Studies**

Ashley Frankenfield, '19

Emily Hunter, '20



Faculty Mentor: Jose F. Cerda  
Department of Chemistry

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

Heme proteins are a family of proteins that contain the heme cofactor and are involved in many types of biological functions. Hemes are found in many type of enzymes and are used for oxygen transport and storage, catalase, peroxidase, oxidase, oxygenase and electron transfer. The heme cofactor has an iron ion in the center, which is the active site. The protein function is regulated by the chemistry of the heme, specifically by the chemical properties of the iron ion. Given the variety in heme protein function, our overall research goal in our lab is to understand how heme-protein interactions uniquely defines the biological role of a heme protein.

For many years, three well-known heme proteins have been studied in Dr. Cerda's lab. These are horseradish peroxidase (HRP), hemoglobin (Hb) and myoglobin (Mb). Horseradish peroxidase catalyzes the oxidation of organic substrates by using hydrogen peroxide or organic peroxides, hemoglobin is used for oxygen-transport and myoglobin is used for long-term storage of oxygen in muscle tissues. In our study, we used fluoride binding as a probe of the heme pocket structures. Many heme proteins have the ability to bind fluoride ion and differences in the fluoride binding properties suggest difference in the heme pocket structure. Based on previous studies, it is known that fluoride can only bind within the heme pocket if it is in the ferric state. In our experiments during this summer, we focused on understanding how fluoride stabilizes the heme during the process of denaturing (heme loss). For this study, we used UV-vis spectroscopy to determine the midpoint temperature,  $T_m$ , for heme loss in HRP, Hb, and Mb.

Based on our results, with a few exceptions, it can generally be concluded that fluoride makes the protein more resistant to heme loss. We believe that this is due to the stabilization of the ferric state of the heme protein, upon fluoride binding. The heme-bound fluoride ion in Hb and Mb is stabilized by hydrogen bonding from the distal histidine. In HRP, fluoride stabilization is observed at low pH (pH = 5), but not above pH 7. This result is in agreement with previous studies from Dr. Cerda's lab, which show that fluoride binding in HRP is not thermodynamically stable above pH 7. We are in the process of understanding how the structural differences in HRP and Hb/Mb explain our results.



**Susan E. Clampet-Lundquist**

Department of Sociology  
Saint Joseph's University

Ph.D. University of Pennsylvania

**Research Interests:** Urban Neighborhoods, Families, Adolescent Risk Behavior and Social Policy

Susan Clampet-Lundquist came to the field of sociology through an interdisciplinary route which informs her research and teaching. While at the University of Pennsylvania, she earned a Master's degree in Demography and a Ph.D. in Sociology. This training provided her with methodological skills that are both quantitative and qualitative.

This summer, she worked with Sophie Werner in collaboration with POWER, a community-organizing group in the Philadelphia metropolitan area. Among other issues, POWER has advocated for fair funding for public schools in Pennsylvania. Currently, public schools in PA receive one of the lowest shares of state funding in the U.S., and this results in severe inequalities across school districts. As a Communications major, Sophie had the skills and knowledge to create videos that POWER will use in raising awareness across Pennsylvania. She worked with their media staff person to interview a range of people, traveled to Harrisburg for an education advocacy event, and created three videos that document research behind the unequal funding in Pennsylvania and advocacy for changing this situation.

# **Public School Funding in Pennsylvania: Inequitable, Inadequate, Racially- Discriminatory and Morally Unjust**

Sophie Werner, '19

Faculty Mentor: Susan E. Clampet-Lundquist  
Department of Sociology



Supported by the SJU Summer Scholars Program

Public school funding in the Commonwealth of Pennsylvania relies heavily on local taxes. This means that one school district can receive a wealth of resources due to the property value of a given district, while another district receives inadequate funds to meet the needs of their students. The Fair Funding Formula was proposed and passed in 2016 by the Pennsylvania General Assembly, but currently only 7% of public school funding dollars are put through this formula. The Fair Funding Formula addresses inherently racist funding practices, and attempts to provide a quality education all children in Pennsylvania.

In partnership with POWER (Philadelphians Organized to Witness, Empower, and Rebuild) and their Education Justice campaign, I conducted interviews with community members, activists, educators, students, and tax payers to learn about this injustice from varying perspectives. On June 20, POWER held an Action Day in Harrisburg to support House Bill 2501, which was recently proposed by Rep. Chris Rabb. The bill seeks to put all of the funding through the Fair Funding Formula, and to eliminate funding practices that perpetuate a cycle of poverty and inequality.

POWER is rooted in a network of churches throughout Philadelphia and its surrounding counties, as well as Harrisburg and its surrounding counties. The structure of POWER Interfaith is complex, but it is rooted in a variety of faiths that call one to the cause of social justice. In order to maintain the momentum achieved on the Action Day in Harrisburg, I produced a video to highlight the passion and persistence of those in attendance. This video was shared internally and externally, and served as a critical follow-up message to those who are members of POWER Interfaith.

Education Justice is one of the six campaigns that POWER is currently lifting up. As the organization begins to focus on voter engagement, it is critical that the issue of inequitable public school funding remains topical internally and externally. Through the compilation of interviews done through the summer, pre-existing research on funding shortages, and the stories of those impacted by funding inequity, I produced a second video. This video explains public school funding, the status of PA's inequitable funding, the Fair Funding Formula, HB2501, POWER's Education Justice team in partnership with Our City Our Schools and Pay Up PPA. This video will be used as a tool to educate those who are not aware of PA's inequitable funding practices, and to invigorate those already in the movement to continue to fight for justice.



**Peter A. Clark, S.J.**

Departments of Theology & Religious  
Studies & Health Administration  
Director-Institute for Clinical Bioethics  
Saint Joseph's University

Ph.D. Loyola University of Chicago

**Research Interests:** My research this summer focused on the formulation of a paradigm for a “Comprehensive User Engagement Site.” Last year 64,000 individuals died from opioid overdoses in the United States. There were 1200 overdose deaths in Philadelphia alone. The research fellows in the Institute of Clinical Bioethics collaborated with 4 Mercy Catholic Medical Center (MCMC) medical residents and 4 Philadelphia College of Osteopathic Medicine (PCOM) medical students to create a paradigm for a Comprehensive Unser Engagement Site (CUES) also known as a safe injection site program for the city of Philadelphia. CUES are places designed to prevent people from dying of drug overdose. At CUES people with substance use disorders will be able to safely use drugs, like heroin, under medical supervision while they are encouraged to enter treatment programs. The MCMC medical residents examined the medical issues related to heroin and fentanyl drug abuse. The PCOM medical students evaluated the CUES in Vancouver, Canada called Insite, which has been extremely effective in decreasing drug overdoses. The Institute research fellows created a paradigm for the Philadelphia CUES that would include safe injection booths, a needle exchange program, HIV/Hep C testing, Narcan (Naloxone) distribution, wound care, and detoxification and rehabilitation counseling. An evaluation of the program shows that such a site would save lives, decrease the number of drug overdoses, decrease blood borne infections and save money by decreasing Emergency Room visits. The rationale for CUES is based on the principles of Catholic Social Teaching, which include sanctity of life, quality of life, care for the vulnerable, human dignity and solidarity. It is also ethically based on the Harm Reduction Theory. The proposal will be distributed to the Mayor of Philadelphia and the Philadelphia Health Commissioner and will be submitted for publication. The hope is that this paradigm can become a model for other major cities in the United States.

The remainder of the summer consisted in helping to formulate ethical policies for Caritas Baby Hospital in Bethlehem, Palestine. The Institute of Clinical Bioethics at Saint Joseph's University is now representing Caritas Baby Hospital as their Bioethics consultants. We are in the process of assisting the medical staff at Caritas in forming an Institutional Ethics Committee and helping them design and implement ethical policies on issues such as: brain death, Do Not Resuscitate Orders, medical futility, patient's rights, etc. The staff of the Institute of Clinical Bioethics has initiated and implemented a procedure to do ethical consults via Skype to assist patients, their parents and the medical staff in Palestine. In addition, the 2 bioethicists in the Institute consulted at the 17 hospitals we represent in Pennsylvania, Maryland and Delaware and taught ethics to over 450 medical interns, residents and fellows in these hospitals.

# **Modification of Pennsylvania State Supreme Court Ruling on Informed Consent**

Toliver Freeman, '20



Faculty Mentor: Peter A. Clark, S.J.

Departments of Theology & Religious Studies and Health Administration and the  
Institute of Clinical Bioethics

**Supported by the Institute of Clinical Bioethics and the SJU Summer Scholars  
Program**

Recently, the Commonwealth of Pennsylvania Supreme Court came to a verdict that affects the informed consent process that could be detrimental to the medical field. This is due to a dramatic postponement in the access to critical services that gravely ill patients need from the attending physician. This case came about due to a patient, by the name of Mrs. Shinal, claiming that she was given inaccurate information regarding her surgery when speaking to the attending physician's physician assistant. Even though the surgery involving the removal of a nonmalignant tumor in her brain resulted in Mrs. Shinal's carotid artery being perforated, leading to hemorrhage, stroke, partial blindness, and brain injury, there was no assertion claiming that the harm was due to medical negligence.

The ensuing Supreme Court case, *Shinal vs. Toms*, was begun by the patient, Mrs. Shinal, on Dec. 17, 2009. A jury found in favor of Dr. Toms. Mrs. Shinal appealed and the Pennsylvania Superior Court upheld the decision. Then case was heard before the Pennsylvania Supreme Court in November 2016. The case was decided June 20, 2017 with a 4-3 vote favoring Mrs. Shinal and ultimately affecting the process of informed consent in Pennsylvania.

Informed consent is the process of the medical professional providing a patient with the risks, benefits, and alternatives options of a medical procedure in a comprehensible fashion to the patient. The Supreme Court ruling displays that not only are the attending physicians responsible to relay the risk, benefits and alternatives procedures regarding an invasive procedure, but the attending physicians are solely responsible for obtaining informed consent themselves. This abolishes the validity of nurse practitioners, physician assistants, and medical residents to obtain informed consent from the patient; thus delaying the medical actions needed for extremely ill patients.

The purpose of this project was to form a strong proposal for the Supreme Court to amend the current Pennsylvania Informed consent statute. Specifically allowing medical resident, nurse practitioners, and physician assistants to obtain informed consent from the patient along with the already permitted attending physician. I shadowed Nurse Practitioners, medical residents, and physician assistants to determine if they are qualified to relay a surgical plan to a patient in a comprehensible manner. In order to objectify the term "qualified" interviews were held for those holding positions in the American Health Association, the Pennsylvania Nurse Practitioner Association, and the Pennsylvania Physician Assistant Association. After all of the qualitative data was obtained, a formal proposal was written to urge for a change in the statute.

# **Vaping: A New Epidemic**

## **Medical, Legal, and Ethical Implications**

Olivia Nguyen, '19



Faculty Mentor: Peter A. Clark, S.J.  
Departments of Theology & Religious Studies and Health  
Administration and the Institute of Clinical Bioethics

Supported by the Institute of Clinical Bioethics and the SJU Summer  
Scholars Program

Vaping is the act of inhaling and exhaling vapor produced by an e-cigarette or similar device. E-cigarettes are long tubes resembling that of a tobacco item such as a cigarette, cigar, pipe or pen. Vaporizers were created as an initiative to help individuals quit smoking by substituting harmful tobacco smoke with aerosol. Portable, interchangeable, and battery-powered, vapes have become the preferred method of tobacco use. They work by heating a liquid consisting of nicotine to form an aerosol that mimics a sensation to inhaling. Thus, in the early 2000s, vapes were marketed to smokers hoping to serve as a bridge between tobacco smoking and eventual abstinence. However, the "e-liquid" that contains nicotine is also mixed with formaldehyde, propylene glycol, vegetable glycerin, chromium, nickel, zinc, magnesium, lead and more. These toxic chemicals and metals are also linked to cancer, respiratory and heart disease.

Coming in different shapes, sizes, and flavors, e-cigarettes have skyrocketed in U.S. sales with estimates of about 2.35 billion dollars in 2016. JUUL Labs Incorporated, in particular, has dominated the e-cigarette industry capturing 71% of sales. However, it is not the established adult smoker population who are using these vapes; it is the younger generation. According to the Surgeon General's report in 2016, there has been a 900% increase in e-cigarette use among high school students from 2011 to 2015. The 2016 National Youth Tobacco Survey noted that 1.7 million high school students in addition to 500,000 middle school students claimed to have used e-cigarettes. The popular uptake of e-cigarettes among young adults can be attributed to the fact that the JUUL Labs Inc. had fashioned an e-cigarette with a look that resembled a flash drive. As a result, students can bring them to schools and conveniently stow them away before and after use. Furthermore, the myriad of flavors compounded with the addictive nature of the vape draws more and more young adults into its usage. Nevertheless, vaping has become an epidemic among the younger generations, whom are unaware of the risks and addictive behaviors involved with its use.

In an attempt to raise more awareness, I collaborated with a medical resident, pharmacist, and bioethicist to develop a multi-pronged approach in addressing the newfound vaping epidemic. The project takes a look at the medical, legal, and ethical implications behind vaping. The various parts of an e-cigarette were researched to ascertain how the e-liquid converts to aerosol. From a medical purview, the biochemical impact of the aerosol chemicals was examined to see how aerosol rewires the brain to become addictive. Also, long term physiological effects on the body and medical conditions that arise were presented. From a legal standpoint, tobacco companies were investigated to see how their marketing lead to the widespread use of vapes in addition to looking at governmental actions revolving around it. From an ethical scope, the principles of nonmaleficence, beneficence and justice were applied to justify that it is our social responsibility to address this epidemic and provided recommendations.



**Laura M. Crispin**  
Department of Economics  
Saint Joseph's University

Ph.D. The Ohio State University

**Research Interests:** Labor Economics,  
Economics of Education, Economics of  
Poverty and Income Inequality, Applied  
Econometrics

My primary research interests are extracurricular participation and the effects on educational and labor market outcomes. Extracurriculars help students to gain both cognitive skills such as math and reading, and non-cognitive skills such as interpersonal, leadership, and teamwork skills, all of which increase human capital and ultimately wages. Furthermore, there is an opportunity cost associated with participation: time spent in extracurriculars must take time away from other activities, which tends to reduce risky behaviors such as smoking and drinking. Thus, it is likely that participants will be more successful than non-participants in terms of educational attainment and wages.

Using econometric techniques and rich, nationally representative data from the Department of Education, I am able to estimate the causal effects of extracurricular participation in high school on students' high school dropout decision and college attendance and completion decisions. As an example of my findings, I find substantial effects of participation on dropout rates, reducing the likelihood of dropping out by 14 to 20 percentage points.

I am particularly interested in "at-risk" students—those from disadvantaged backgrounds—because dropout rates for this group are more than twice as high as the dropout rates of their peers, and without policy intervention, the outcomes for at-risk students will be substantially worse than their peers. I find that for at-risk students, extracurricular participation is especially important for reducing the dropout rate, indicating that policies to provide and promote extracurricular activities in areas with high concentrations of at-risk students will be particularly effective at increasing educational attainment and wages for students.

A related project that I've recently begun is to estimate the effect of sports participation in high school on the likelihood of being bullied. A priori, it is not clear the direction of the effect: students engaged in sports may develop strength and self-esteem that may deter bullies, but may also become victims due to bullying by team mates. Therefore, it remains an empirical question as to whether the net effect of sports participation reduces instances of bullying. My co-author and I use data from three different nationally representative datasets to explore this topic, and find that participation in sports reduces the likelihood of being bullied by as much as 10 percentage points. These findings have clear policy implications: increasing opportunities for students to engage in activities such as sports may be a low-cost intervention to reduce bullying in high schools.

# **The Effects of Student Loan Debt on Early Labor Market Outcomes**

Charlie Gallagher, '19

Faculty Mentor: Laura M. Crispin  
Department of Economics



Supported by the SJU Summer Scholars Program

There is a narrative going around: Students are being crushed under a mountain of debt, and while loan bills are soaring they are finding themselves under-prepared and over-educated for the modern labor market in America. However, evidence suggests that large loan bills are not the trend, and students are not under-prepared for work when they get out of school. Further, as the income divide between college and high-school graduates widens, higher education continues to be a good investment for many types of students. Despite their lifetime benefits, student loans come with a price. For my Summer Scholars project, I am investigating indebted students' employment decisions during their early, formative years in the labor market.

The existing evidence is not clear. Several articles find a positive relationship between loans and income, concluding that students in debt try to ease their debt burden by taking jobs that pay more (Rothstein and Rouse, 2011; Minicozzi, 2005; Field, 2009). Other researchers have found contradictory results. Anxious to start paying back their loans, students were less choosy in the job market, taking lower income, less relevant jobs (Weidner, 2016; Gervais and Ziebarth, 2017; Abraham, et al., 2018). The fault line appeared to be this: studies that took their data from elite universities show a positive relationship between debt and income, while nationally representative studies tended to show a negative relationship.

My research attempts to answer four questions. First, what are the effects of student loans on job choice two and three years after students graduate with a bachelor's degree? Second, were students from elite universities more likely to seek high paying jobs as a reaction to student loans than their average and low-quality university peers? Third, how did debt affect other labor market decisions such as job turnover and weekly hours? And fourth, how can the disparity between these studies be reconciled?

Using a multi-variate regression analysis with a wide range of controls, I found no relationship between student loans and income, turnover, or hours. This was true for both a student loan dummy variable as well as a categorical variable that broke down loan amounts into four categories. Also, I did not find a significant positive relationship among the high-income-potential students.

I attribute the conflict in the literature and my own non-result to two factors. First, students experience opposite pressures when they first get out of college. They are trying to both minimize their financial burden with a high-paying job and urgently trying to find a job to pay their bills. Second, it's possible that students face restricted options in the labor market. In that case, they cannot react to the psychological burden that loans place on them because they don't have enough options. The psychological burden exists: on average, students with loans were 12.5 percentage points more likely to say they were "extremely stressed" financially. Further, respondents were asked to report whether they made various career decisions because of their student loans, and at least a quarter of indebted students reported that they had. So, my answer is not conclusive, but I believe my paper expands the current research on loans.



**Neil T. Desnoyers**  
Department of Decision and System Sciences  
Saint Joseph's University

M.S., M.B.A. Drexel University

**Research Interests:** Analytical Approaches to  
Scheduling

Scheduling is not something to which many people who find themselves performing the work give much thought. But as the scheduling requirements become more complex and the number of resources (people, machines, facilities, etc.) beings scheduled increases, the effort needed to produce a workable schedule increases exponentially. Analytical approaches to scheduling can both improve the efficiency of the process and increase the robustness of the resulting schedule. As with many tasks in today's world, tools have been developed that can make our lives easier. The tools or software used to create schedules use mathematical optimization, including binary integer programming. In this context, binary refers to the fact that a resource can either be scheduled (1) or not scheduled (0) for a particular task or unit of time.

Scheduling classes, teachers and students is an important task in K-12 education. The rooms, teachers, students, and other requirements need to be matched with educational requirements and qualifications and well as existing facilities, etc. Although software exists that can perform some parts of the scheduling process, much of the work must be done manually. Why haven't analytical scheduling methods been fully incorporated into the process of building the Master Schedule? Perhaps because the K-12 market is a government market so firms that supply software to this market lack the significant impetus to incorporate the methods into their products.

The process of scheduling starts with identifying requirements. Tasks, roles/responsibilities, locations, required skills, and number of resources required must be identified. The resource availability and the requirements are then entered into the appropriate software (i.e., MS Excel) and an optimization engine (or "solver") then produces a schedule. If everything is done properly and there are enough resources, the resulting schedule satisfies both all the requirements of the event or project and the student availabilities. One of the biggest benefits of using analytical approaches when scheduling is that any necessary changes (i.e., if one resource becomes unavailable and is replaced by another resource with different availability) can be addressed with the push of a button which creates a modified schedule.

The tools, or solvers, used in scheduling are software. Software, as with most other things, is being continually improved. My research has helped identify problems with one of the solvers available in Google Sheets spreadsheets. Other researchers are working on improving the mathematical optimization techniques that are used by solvers to solve these problems.

# **Improve Master Scheduling at Beverly Hills Middle School**

Rabia Ansari, '20



Faculty Mentor: Neil T. Desnoyers  
Department of Decision & System Sciences

Supported by the SJU Summer Scholars Program

The focus of this project was to work with the Beverly Hills Middle School administration to help improve their process of creating a master schedule. A master schedule is defined as “a schedule that is made up of all classes created for the school, with all of their associated terms, meeting patterns, teachers, and rooms. With a master schedule in place, the administrator can schedule teachers, analyze student course requests, and assign teachers and rooms to classes.” The responsibility to create a master schedule for any school isn't an easy task, it takes commitment, time and a lot of trial and error. To make this process less time-consuming and more efficient, throughout the summer we had been working on the approval process for IRB, read papers to get a better understanding of the subject, had several interviews with the school's administration, and began learning Python.

The IRB (Institutional Review Board) is an administration who has the responsibility of protecting the rights and welfare of human research subjects recruited to participate in any research activities. Getting approval from the IRB is necessary in our project because we are working with the information of students and staff which requires us to complete human-subjects research training.

Also, we started a literature review by reading research papers to get a better sense of the approaches that are being used today in the field of scheduling. In addition to better understand the scheduling process at BHMS, we held interviews with the administrators. We learned that the current process begins in February and isn't completed until August and it requires constant changes that need to be made according to teacher availability and student needs.

The end goal of this project is to create algorithms (a step by step list of instructions that if followed exactly will solve the problem under consideration) to improve the scheduling process and create new software to implement these algorithms, using Python. It is a high-level programming language where it had the ability to formulate problems, think creatively about solutions, and express a solution clearly and accurately. This process will save administrators time, so they can work on more productive tasks.



**Erin E. Downey**  
Department of Art  
Saint Joseph's University

Ph.D. Temple University

**Research Interests:** Exploration of Cultural Convergences Between the Low Countries and Italy During the Early Modern Period; Impact of Migration on Perceptions of Local and Foreign Artistic Identity

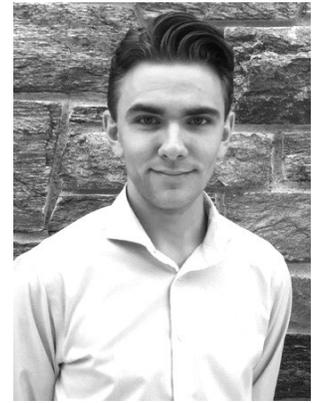
Erin Downey's dissertation, completed in the summer of 2015 and entitled "The Bentvueghels: Networking and Agency in the Seicento Roman Art Market," laid the groundwork for this avenue of inquiry. Her current research further examines the challenges of early modern migration, and seeks to highlight specific strategies undertaken by foreign artists when navigating an increasingly global system of trade and travel. She is currently in the process of developing the dissertation into a book manuscript that analyzes the full impact (stylistic, social, and economical) of migration on the broader northern European artistic community in Rome, and the consequences of such an extended stay abroad for several key artists upon their return to the Low Countries.

Her research also considers the role of Netherlandish artists in the flourishing international print and book industry established by the Jesuit community. More recently, she has focused on writing articles that address constructions of foreign identity as well as significant examples of collaboration and exchange between Netherlandish artists and local patrons and practitioners in Italy. The first of these, an article on the Galleria Giustiniana, the catalogue of the antiquities collection of Vincenzo Giustiniani, was published last May.

# Gender and the Jesuits: A Study of the Portrayal of Female Figures Within Italian Baroque Art

Joseph G. Quinlan, Jr., '19

Faculty Mentor: Erin E. Downey  
Department of Art



Supported by the SJU Summer Scholars Program

Many of the Baroque Period's artistic pieces, especially those produced in Italy, were profoundly shaped by the socio-religious aspirations of the Counter-Reformation Church and its new religious orders, in particular the Society of Jesus. These aims were often directed at inspiring the masses of the age to rejoin or stay faithful to the Catholic Church in spite of the recent efforts of the Protestant Reformation. In particular, the Baroque Era is distinctive for its increased emphasis on the artistic portrayal of female figures in comparison to previous eras. However, a large part of the visual legacy of this artistic shift has yet to be studied by art historians, many of whom have focused instead on the more famous works from this period. Furthermore, digital and secondary resources addressing this shift in visual culture are lacking. Thus, the goal of this project was to analyze the role that the political and religious aspirations of the Jesuits and their patrons played in the depiction of female figures in Italian Baroque art during the Counter-Reformation. In addition to this, these portrayals were further examined in the context of discovering what gender roles were promoted and perpetuated by the Catholic Church during this era.

The project was carried out primarily through firsthand fieldwork within Rome, Italy. This research consisted of examining religious pieces that depicted women within the following three categories: Biblical heroines, Early Christian martyrs, and contemporary figures. These artworks were examined in the context of both their intended surroundings and related writings.

Iconographic research from this fieldwork has seemed to indicate multiple artistic, religious, and social trends regarding the portrayal and role of women within the Counter-Reformation church. Aside from a higher presence and elevated importance within the Catholic Church's commissioned works, the forms and popularity of feminine depictions indicated that many religious patrons, including the Jesuits, wanted pieces that illustrated that *both* men and women were essential to the survival of the Church and that there were many models in both historical and contemporary times for them to follow. These trends and specific findings will be later discussed in a thesis which is to be written within the following semester.



*Jael Slays Sisera*. Andrea Pozzo (c. 1680)  
Chiesa di Sant'Ignazio, Rome - This occupies one of the four bases of the Jesuit church's main dome, a space that would have normally been reserved solely for depictions of the Evangelists or Church Fathers in earlier times.



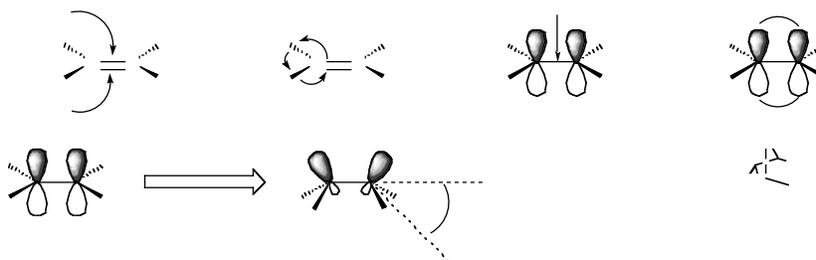
**Mark A. Forman**  
Department of Chemistry  
Saint Joseph's University

Ph.D. University of Pennsylvania

**Research Interests:** Strained and  
Theoretically Interesting 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 ( $\sigma$ ) bond and a pi ( $\pi$ ) bond as shown in Figures 1a-d. Maximum overlap between the p-orbitals of the  $\pi$  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,  $\theta$ , 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<sup>2,4</sup>.0<sup>3,8</sup>.0<sup>5,7</sup>]non-4-ene (**2**) (Figure 1f).



**Figure 1**

During the summer of 2018, my research group continued the investigation of the synthesis and study of pentacyclo[4.3.0.0<sup>2,4</sup>.0<sup>3,8</sup>.0<sup>5,7</sup>]non-4-ene (**2**) and direct synthetic precursors. As part of this study, we investigated new synthetic routes to diiodide **3** and related polycyclic alkyl iodides using the Barton iododecarboxylation method. This new method for the synthesis of the 4,5-diiodopentacyclo[4.3.0.0<sup>2,4</sup>.0<sup>3,8</sup>.0<sup>5,7</sup>]nonane precursor will allow for additional studies of this strained alkene.

# The Synthesis of Pentacyclo[4.3.0.0<sup>2,4</sup>.0<sup>3,8</sup>.0<sup>5,7</sup>]non-4-ene

Isabella Armento, '19

Elise Brutschea, '19



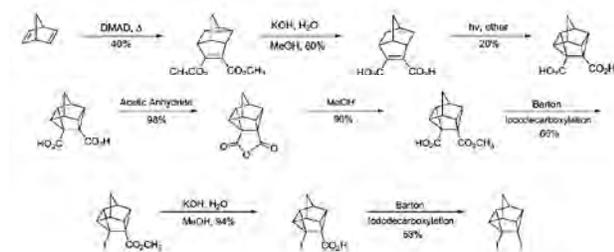
Faculty Mentor: Mark A. Forman

Department of Chemistry

Supported by the Robert & Carla Conaty Research Fellowship, the John P. McNulty Scholars Program, the Division of Organic Chemistry Fellowship, the 2018 Goldwater Award and the SJU Summer Scholars Program

The synthesis of strained organic molecules allows for the study of the limits to the chemical bond and chemical stability. Furthermore, the study of these molecules allows for a better understanding of regularities in structure, stability and reactivity. The Forman research group specifically studies strained alkenes, a class of molecules that contain carbon-carbon double bonds.

This summer, the Forman research group focused on the study and synthesis of pentacyclo[4.3.0.0<sup>2,4</sup>.0<sup>3,8</sup>.0<sup>5,7</sup>]non-4-ene, a pyramidalized alkene. Pyramidalized alkenes are geometric derivatives of alkenes from their ideal structure, through bond angle distortion of the carbon-carbon double bond via syn-folding from the ideal bond angle of 120° to a geometry more similar to tetrahedral. Pentacyclo[4.3.0.0<sup>2,4</sup>.0<sup>3,8</sup>.0<sup>5,7</sup>]non-4-ene, the molecule of interest, has unique bond angle strain on the carbon-carbon double bond, which renders it highly reactive and results in a short life span of only seconds. The high reactivity and short life span of our target molecule contribute to the difficulty in synthesizing pentacyclo[4.3.0.0<sup>2,4</sup>.0<sup>3,8</sup>.0<sup>5,7</sup>]non-4-ene.



Literature precedent suggests that the best route to a pyramidalized alkene is from a vicinal dihalide. Thus, 4,5-diiodopentacyclo[4.3.0.0<sup>2,4</sup>.0<sup>3,8</sup>.0<sup>5,7</sup>]non-4-ene has been identified to be the ideal precursor to our molecule of interest. The focus of this summer's research was to synthesize the direct precursor of pentacyclo[4.3.0.0<sup>2,4</sup>.0<sup>3,8</sup>.0<sup>5,7</sup>]non-4-ene. Building up a stockpile of the direct precursor allows research to continue throughout the academic year as the reactions for each precursor require a large amount of time to carry out, and thus it is important to build up a supply during the summer.

This summer we investigated a different route to the direct precursor from previous summers. Due to the poor yields of our decarboxylative-iodination reactions using the Gandelman method, we turned to the Barton method. The Barton method of decarboxylative-iodination is air and moisture sensitive, requiring us to learn new synthetic techniques. We found that the best method to our precursor is by protecting an acid group as an ester, followed by decarboxylative iodination, deprotection, and then a second decarboxylative iodination.

By the end of the summer, we have been able to synthesize enough precursor to further our research goals for the upcoming school year. Our plans for the upcoming academic year include attempting a double decarboxylative-iodination directly from the diacid instead of protecting one acid group. Additional plans include using electrochemistry to reduce the diiodo precursor to synthesize the pyramidalized alkene, a greener approach than reagent-based approaches.

# The Synthesis of Pentacyclo[4.3.0.0<sup>2,4</sup>.0<sup>3,8</sup>.0<sup>5,7</sup>]non-4-ene

Christina DeAngelo, '20

Emily Schaeffer, '20

Faculty Mentor: Mark A. Forman

Department of Chemistry



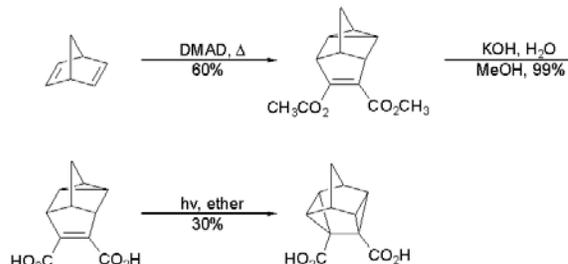
Supported by the Robert & Carla Conaty Research Fellowship and the  
SJU Summer Scholars Program

This summer, the Forman research group focused on the study and synthesis of nonnatural products. By performing and adjusting various synthesis reactions, the Forman research group attempts to create the strained alkene pentacyclo[4.3.0.0<sup>2,4</sup>.0<sup>3,8</sup>.0<sup>5,7</sup>]non-4-ene. Due to its polycyclic structure, the carbon-carbon double bond in this molecule is forced to deviate from its ideal geometry. The carbon-carbon double bonds that make up alkenes, normally form bond angles of 120°. The double bond geometry in pentacyclo[4.3.0.0<sup>2,4</sup>.0<sup>3,8</sup>.0<sup>5,7</sup>]non-4-ene is substantially different from this value.



Pentacyclo[4.3.0.0<sup>2,4</sup>.0<sup>3,8</sup>.0<sup>5,7</sup>]non-4-ene experiences pyramidalization, resulting in a geometry closer to tetrahedral instead of the desired trigonal planar geometry. This pyramidalization is a result of *syn*-folding the R group substituents on an alkene. Our target molecule is highly reactive due to this strain on the carbon-carbon double bond; the molecule's lifespan is only a few seconds. This contributes to the difficulty of synthesizing pentacyclo[4.3.0.0<sup>2,4</sup>.0<sup>3,8</sup>.0<sup>5,7</sup>]non-4-ene.

This summer, the focus of our research was to synthesize the precursors to pentacyclo[4.3.0.0<sup>2,4</sup>.0<sup>3,8</sup>.0<sup>5,7</sup>]non-4-ene. In addition to this, the reactions were adjusted in order to present a higher yield at the end of each step. By performing these reactions for the entire summer, there is an abundance of precursor molecules to allow for continued research throughout the year. The summer is an essential time to carry out these reactions because they require long periods of time. The molecule we targeted was closed diacid. This was made over a series of three reactions.



First, a Diels-Alder was run to produce diester. This product was these utilized in a hydrolysis reaction to create open diacid. Finally, a photochemical reaction was run to expose the open diacid to ultraviolet light to form closed diacid. This reaction took place overnight and resulted in low yields, so two were run almost every night this summer to keep the inventory maximized.

Towards the end of the summer, we synthesized other molecules, such as anhydride and acid ester to further help our team to keep moving forward. The closed diacid we produced will support us in our efforts to potentially synthesize pentacyclo[4.3.0.0<sup>2,4</sup>.0<sup>3,8</sup>.0<sup>5,7</sup>]non-4-ene.



**Brian M. Forster**

Office of the Associate Dean  
College of Arts & Sciences  
Saint Joseph's University

Ph.D. Cornell University

**Research Interests:** Science Pedagogy;  
Microbiology

I am the laboratory coordinator for the general education program natural sciences laboratory-based classes for students who are not majoring in science. Since my arrival in Fall 2011, my colleagues and I have started several research projects on science pedagogy. Pedagogy is the science of teaching. I am specifically interested in defining best practices for teaching science to non-science majors.

Past pedagogical research in my teaching laboratories has examined techniques to demonstrate the collaborative nature of science. One project involved the use of Winogradsky Columns, miniature ecosystems that allow for the enrichment of phototrophic bacteria (bacteria that use sunlight as their energy source). Non-science majors and biology majors team up to identify bacteria enriched in these columns using different techniques. A second project recently completed involves the identification of bacteria from water samples where non-science majors from different lab courses must combine the different techniques they have learned in order to isolate and identify bacteria. The uniqueness of this lab activity is that there are very little directions given in their lab handout. Two years ago, my colleagues and I expanded our work to look at developing inquiry-based labs showing how the kidney filters and the importance of wetlands in filtering pollutants.

This summer, my lab's pedagogical research is continuing with the theme of developing lessons for non-science majors, showing them the ability our environment has on promoting water quality and water quantity. To help mitigate the destructive effects of stormwater runoff, Saint Joseph's University has both green roofs and rain gardens. They are both able to absorb runoff to reduce flooding and retain pollutants so they do not enter into a watershed. It is our goal that this lesson will be implemented into the university's non-majors environmental science lab course by Summer 2019.

# Development of an Inquiry-Based Science Lab Focusing on the Usage and Benefits of Rain Gardens

Jacquelyn Lomino, '20

Faculty Mentor: Brian M. Forster  
Office of the Associate Dean  
College of Arts & Sciences



## Supported by the SJU Summer Scholars Program

This summer I developed an inquiry-based lab activity based on rain gardens. When it rains, water can either be absorbed into the ground or it can generate runoff. Runoff is when the water lands on an impermeable surface such as roofs or pavement and results in flooding in an area. Flooding can cause physical damage (an event known as weathering) and can harm water quality by picking up and carrying pollutants. One way to mitigate the effects of flooding is by installing rain gardens. A rain garden can absorb runoff since they are typically placed in a depression in the ground. They are also made up of a mixture of soil that allows the runoff to permeate easily, along with being filled with native plants to help promote biodiversity and help filter any pollutants the runoff might have collected along the way. Saint Joseph's has rain gardens near Merion Hall and the Science Center.

In the lesson I am preparing, non-science majors will compare the two rain gardens on campus. Students will also compare soil areas outside of the gardens as controls. They will test the key elements of the rain gardens to understand why they are important for the area to have. Our major learning objective is that students will understand the purpose of a rain garden through these activities, and based on their observations, decide which rain garden is the more effective one on campus.

The students will first investigate whether the garden can absorb runoff. They will use Google Earth to determine the slopes of the gardens (figure). They will also determine the class, porosity and permeability of the garden soil to see if water can be absorbed.



Secondly, the biodiversity of the gardens will be analyzed. This summer, I went out into the gardens and set pitfall traps to collect soil invertebrates. I then identified and pinned them. The students will look at the pinned invertebrates and identify them, rather than having to go collect them outside first. The students will also analyze diversity in microorganisms that were present in the areas. I went outside and collected soil samples, that I then used a kit to isolate DNA from. The samples were sent for metagenome sequencing. I am currently preparing the sequencing results in a manner that will allow non-science majors an easy way of seeing the differences in the microbial communities in these gardens.

Our future work involves implementing this lab into a non-majors science lab. Students will be assessed on their comprehension of the importance of rain gardens through pre and post assessments.



**Owen W. Gilman, Jr.**  
Department of English  
Saint Joseph's University

Ph. D. University of North Carolina

## **Research Interests:** American War Literature and Film, Nature Writing, Southern Literature, Contemporary American Literature



Using an American Studies approach, I have explored American war literature and film in some 30 articles and three books, particularly *Vietnam and the Southern Imagination* (University Press of Mississippi, 1992) and *The Hell of War Comes Home: Imaginative Texts From the Conflicts in Afghanistan and Iraq* (University Press Of Mississippi, 2018). *Vietnam and the Southern Imagination* showed that writers from the American South represented the Vietnam War with a unique perspective—that of people whose history had earlier included devastating loss in war, a piece of history that would insert itself inevitably, one way or another, in stories featuring combat experience in Vietnam.

The most recent study uses an American Studies approach to explore why and how Americans become committed to engagements in war. After interrogating the long history of war experience for Americans, beginning with the “acquiesce in the necessity” formulation established in the Declaration of Independence, I examine the most recent war activity—in Afghanistan and Iraq—building on scrutiny of American culture and politics by Rachel Maddow (*Drift*), Jonathan Haidt (*The Righteous Mind: Why Good People Are Divided by Politics and Religion*), and Charles Duhigg (*The Power of Habit*), Nicholas Carr (*The Shallows: What the Internet is Doing to our Brains*), and Sebastian Junger (*Tribe: On Homecoming and Belonging*). The middle section of the book focuses on the imaginative responses to recent war activity, with chapters on journalism/creative nonfiction, film (e.g. *The Hurt Locker*, *Zero Dark Thirty*, *American Sniper*), poetry (collections by Brian Turner, Kevin Powers and others), and fiction (e. g. *Billy Lynn's Long Halftime Walk*, *The Yellow Birds*, *Young Blood*). The final section explores the massive tendency for American to be distracted by superficial “Fantasyland” interests which get in the way of significant understanding of war and its consequences for veterans. This pattern of distractedness adds significantly to the pain, physical and mental, suffered by veterans upon return from war, and it also makes certain the likelihood of future war activity for Americans.

# **The Personality Merger**

Dylan Wolf, '19

Faculty Mentor: Owen W. Gilman, Jr.

Department of English

Supported by the SJU Summer Scholars Program



The Personality Merger is a novel which speaks to the loneliness experienced by many in modern day society. It also focuses on the notion and meaning of artistic struggle in today's world.

In our modern world, people are more aware of their feelings of loneliness than ever before. Many people feel disconnected from others and yet wish to share their experiences. This desire to share and be a part of other people's experiences is prevalent throughout all of modern social media. Every social media status update is an attempt by an individual to share and participate in another person's life, to not feel so alone in the situations in which someone is placed.

This novel centers on a somewhat successful freelance photographer, Roger Chandler, in Philadelphia who mostly works for advertising companies. Roger and his wife Corina are experiencing some difficulties in their marriage, largely from Roger's wish to become a "true" artist, and have begun going to marriage counseling sessions when a new piece of technology is invented. It is a personality merging machine which allows a person to enter another's mind and experience consciousness from their point of view. Roger and his wife are among the first people to experience personality merging in a medical trial made for marriage counseling. In the trial, both Roger and Corina experience a true connection with one another and leave with the feeling that they will never be lonely again. Quickly, this machine becomes a commodity which every person has and eventually needs, but this process soon entails unforeseen and ironic consequences. Roger watches as the machine sparks the dissolution of society in Philadelphia and is determined to find a way to help.

However, this is only one section of the final novel which will be comprised of three other parts. The narrative will introduce Roger and Corina and get them through counseling and into the early stages of the personality merger via technology. The summer project has taken them to the introduction of some unexpected consequences, all of which later will carry the story through to novel length.



**Peter M. Graham**  
Department of Chemistry  
Saint Joseph's University

Ph.D. University of Virginia

**Research Interests: CO<sub>2</sub> 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. The world economy continues to rely 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 of tungsten, molybdenum, and rhenium that can overcome the stability of carbon dioxide. These metals strongly coordinate carbon dioxide and in doing so bend the normally linear molecule. This activates carbon dioxide towards otherwise impossible reactions. Gaining a better understanding of how such metal complexes interact with carbon dioxide and promote chemical reactions is critical to developing new catalysts for carbon dioxide activation. Such catalysts could convert carbon dioxide into carbon monoxide, formates, acrylates or dialkyl carbonates, all traditional chemical building blocks.

# Activation of Carbon Dioxide Using Molybdenum Metal Complexes

Brandon Jiannotti, '19

Faculty Mentor: Peter M. Graham  
Department of Chemistry



Supported by the American Chemical Society Petroleum Research Fund (ACS PRF) and the SJU Summer Scholars Program

From the start of the industrial revolution to today, the climate has experienced a dramatic disturbance. Carbon dioxide, the carbon-containing product produced by the combustion of fossil fuels, has become more concentrated in the atmosphere. This imbalance in carbon dioxide in the atmosphere is linked to global climate change.

One strategy that is used to address this excess amount of carbon dioxide and return the atmosphere to a more balanced state is to use carbon dioxide itself as a chemical feedstock. Carbon dioxide is a tricky molecule to work with since it is not very reactive. However, complexes of transition metals such as molybdenum can promote reactions with carbon dioxide. We have discovered that these carbon dioxide complexes can be synthesized starting from carbon monoxide complexes. The molybdenum carbon monoxide complexes that I have been investigating are  $\text{TpMo}(\text{NO})(\text{PPh}_3)(\text{CO})$ ,  $\text{TpMo}(\text{NO})(\text{PPh}_2\text{Me})(\text{CO})$ , and  $\text{TpMo}(\text{NO})(\text{PPhMe}_2)(\text{CO})$ . My project focused on the synthesis of carbon dioxide complexes featuring a phosphine that can be lost upon heating:  $\text{PPh}_3$ ,  $\text{PPh}_2\text{Me}$ , and  $\text{PPhMe}_2$ . The loss of these ligands is believed to allow further reactivity of the molybdenum complex. However, the synthesis of carbon dioxide complexes for complexes featuring  $\text{PPh}_3$  and  $\text{PPh}_2\text{Me}$  has proven challenging. However we have successfully synthesized a carbon dioxide complex featuring  $\text{PPhMe}_2$ . Infrared spectra have also indicated that there is a carbon dioxide coordinated to the metal center. The dimethylphenylphosphine is important because it is a labile ligand, meaning it can be easily removed while heating. Through phosphorus NMR spectra we have strong evidence that the phosphine group does in fact fall off upon heating. This new carbon dioxide complex featuring a labile phosphine ligand is important since will allow us to explore new reactions of carbon dioxide.

# Reactivity of Molybdenum Carbon Dioxide Complexes

Madelyn MacDonald, '20

Faculty Mentor: Peter M. Graham  
Department of Chemistry



Supported by the Robert & Carla Conaty Research Fellowship and the  
SJU Summer Scholars Program

The conversion of carbon dioxide ( $\text{CO}_2$ ) to useful hydrocarbon compounds has been a plant's mechanism for storing energy for as long as recorded evolution. This process is limited to plants who use photosynthetic energy to overcome the inherent stability of  $\text{CO}_2$ . Other strategies must be used in order to convert  $\text{CO}_2$  into hydrocarbons in the laboratory. One approach is introducing  $\text{CO}_2$  to a heavy metal, in this case molybdenum. Addition of other ligands to the molybdenum atom allows reactive  $\text{CO}_2$  complexes to be formed. The main complexes used for my research are  $\text{TpMo}(\text{NO})(\text{NHC})(\text{CO}_2)$  and  $\text{TpMo}(\text{NO})(\text{DMAP})(\text{CO}_2)$  (Tp= trispyrazolylborate; NHC= 1,3-dimethylimidazol-2-ylidene; DMAP= 4-dimethylaminopyridine).

The main focus of my summer research has been forming a nitrogen methylated derivative of the above  $\text{CO}_2$  complexes. To achieve this, the complex can either be methylated before or after the  $\text{CO}_2$  ligand is added. Methylation of the  $\text{CO}_2$  complexes results in methylation at one of the oxygen atoms instead of the nitrogen. However, methylation before the  $\text{CO}_2$  ligand is formed seems to lead to the methyl group bonding to the nitrogen as desired. Future goals for this part of my research are to optimize the conditions for methylation reaction and then explore the reactivity of this product.

Another focus of my research this summer has been attempting to determine the decomposition product(s) of  $\text{TpMo}(\text{NO})(\text{NHC})(\text{CO}_2)$  by heating it in solution at high temperature. This can cause the  $\text{CO}_2$  to react and give a carbon monoxide (CO) or oxide (O) complex. Recent results seem to indicate that the  $\text{CO}_2$  complex decomposes into a mixture of  $\text{TpMo}(\text{NO})(\text{NHC})(\text{CO})$  and  $\text{TpMo}(\text{NO})(\text{NHC})(\text{O})$  in a reaction known as disproportionation. The oxide product is interesting because oxides are known to catalyze oxidation reactions. Future goals for this reaction are isolation of both decomposition products.

# Reactivity of Molybdenum Alkene Complexes With Carbon Dioxide

Steven Oldenburg, '19

Faculty Mentor: Peter M. Graham  
Department of Chemistry



Supported by the American Chemical Society Petroleum Research Fund (ACS PRF) and the SJU Summer Scholars Program

Even though climate change is a major issue that is affecting the world today, there is debate about whether or not it should be addressed. The main justification used by those who do not want to address climate change is that doing so would have an immediate negative economic impact. If climate change could be addressed in a way that would produce a valuable commodity, people might have fewer reservations in helping to improve the planet's health. The main cause of climate change is excess carbon dioxide in the air. If this gas can be used to make chemical products, the amount of carbon dioxide in the air would decrease and the products produced could be of positive economic impact. It is important to note however, that simply developing carbon-dioxide-utilizing reactions alone will not be sufficient to fully confront climate change.

One trait of carbon dioxide that makes it difficult to work with is that it is very stable. In order to be able to react carbon dioxide, this stability must be overcome. To do this, a catalyst would be required. This project is focused on investigating whether certain transition metal complexes, specifically molybdenum complexes, are able to catalyze a carbon dioxide reaction. The complexes that have been investigated by the Graham group have shown the ability to coordinate the carbon dioxide molecule and change its shape so further reactions can be possible. With that being said, more research needs to be done on these complexes to determine how exactly they interact with carbon dioxide and which reactions can be made possible.

My project has focused on investigating the reactivity of the molybdenum alkene complexes with carbon dioxide. The precursor is first synthesized, and is then reacted with bromine and methyldiphenylphosphine to form  $\text{Tp}(\text{Mo})(\text{NO})(\text{PPh}_2\text{Me})(\text{Br})$ .

(Tp = trispyrazolylborate). Once this product is isolated, it is reacted with sodium metal in an oxygen free environment in the presence of the alkene cyclopentene, as the sodium is very sensitive to air and moisture. This reaction has given consistent results, producing the intended cyclopentene complex. This cyclopentene complex will next be reacted with carbon dioxide with the goal of producing an acrylate product. Acrylates are common monomers used to make plastics such as plexiglass, the superabsorbent polymer in diapers, and super glue.



## **Hongjun Ha**

Department of Mathematics  
Saint Joseph's University

Ph.D. Georgia State University

**Research Interests:** Actuarial Science,  
Financial Risk Management, Machine  
Learning

We are living in the era of big data. Traditionally, we have hoped that we could make a better decision with a big data environment. However, it turns out that we need a breakthrough idea to take advantage of this source for better decision or prediction because the classical statistical method is not enough to capture complex information embedded in data. The Machine Learning is the new area of statistics, data science and computer science where we try to learn something from data systematically. Not like the previous standard method, people are not the subject to learn, but the artificial intelligence is the player who tries to learn from the existing data and predicts the future based on its training. The most famous and successful example is the AlphaGo which won Lee Sedol, the world champion in Go. The AlphaGo is the program which was intensively trained based on many instances by professional Go players. It searches the best strategy based on its experience by predicting the results of its action. The example is not far away from our lives. When we are on the Internet, we are sometimes surprised by advertisements which aim our needs. How do the Internet providers know your interest? There is an embedded program in your, and it runs your attribute of shopping based on your visiting websites. There are numerous examples where the machine learning did fantastic jobs such as cancer prediction and traffic predictions.

The machine learning is not an Oracle. It should be developed and maintained for a particular purpose by human's creativity. In my research, I am interested in applying the machine learning algorithm to economic problems and prediction of policyholder's behavior. If we can invent the specific machine which predicts customers' behaviors appropriately, we can do many things, for instance, profit increase and sound risk management.

During summer, I was pleased to have a brilliant student, Anna-Maria Brezovski. We studied a basic machine learning model and trained it with real data for predicting prices of houses in Alabama. We expect that we invent the complicate machine which incorporates more variables like human brain when buying a house and predict a reasonable price.

# Prediction Based on Machine Learning in the Context of Real Estate

Anna-Maria Berezovski, '21

Faculty Mentor: Hongjun Ha  
Department of Mathematics



Supported by the SJU Summer Scholars Program

As the world population continues to increase, the demand for residential housing does as well. With this constant creation of new real estate, more and more data is being created. This data can be cultivated and used to help international home buyers in finding their dream house for the optimal price. Machine learning can be used to take in this data and formulate patterns to predict house prices to ensure overpricing won't happen to foreigners moving in.

The initial step within the research was to understand the basic statistical concepts that made up all the factors of prediction at an elementary level such as simple linear regression and multi-linear regression. Once this basic understanding was achieved, I was able to apply these concepts to my data which I found. In order to connect these ideas and data, I used the programming language R which is structured to run statistical analysis from data. I learned how to use this language to run the different types of analyses that I needed to do.

The data that was used was information regarding housing sales in the state of Alabama along with the crime rates within the state. This is key information because through the research process, it became obvious that the state which was being analyzed has a significant effect on how the data will look.

The results of my different statistical tests indicated a number of different outcomes. One of the key conclusions was that the population in an area has a heavy effect on house price. In the case of the state of Alabama, the lower the population was the more expensive the home. It can be assumed that these properties are larger since there are less people within the area. This assumption can be further supported by looking at the data which indicates the average square footage that is being sold in the area. The more square footage, the more expensive the overall land. Another result was that the number of houses that are on sale at the time of purchase also has an effect. If more houses are on the market at the same time, the less expensive the housing is. This is most likely due to the competitiveness of the market at popular selling times. While the results I achieved are not definite, they do indicate these patterns within the collected data.

The next step of this research is to develop more complex models for predicting house prices. The multi-linear regression method is decent at predicting but only in the general sense. It does not work well with many factors which can be expected in the real world. Once a more complex model can be created, it can be applied to the other US states. This would be interesting because it would indicate how there are different trends within the US in regards to house prices for buying. The end-goal for this research is to take this prediction ability and apply it on an international scale.



**Piotr Habdas**  
Department of Physics  
Saint Joseph's University

Ph.D. University of Silesia

## **Research Interests:** Glass Transition, Soft Condensed Matter, Rheology of Non-Newtonian Liquids

During summer of 2018 two summer scholar students worked in my laboratory, and two students volunteered for part of the summer. Miranda Mazzio '18 and Rui Zhang '18 worked on extracting properties of complex liquids by tracking motion of magnetic beads suspended in dilute and dense colloidal suspensions. Michael Jenkins'19 studied dynamics of colloidal particles in dense suspensions with various strengths of inter-particle attraction and ways to extract particle trajectories using machine learning. Francis Snyder '21 studied the structure of gels. Moreover, six high school students, Ian Self, Jack Seiberlich, Harrison Sharp (La Salle College High School), Thomas Petz, Carter Hrabrick (Saint Joseph's Preparatory School), and Owen Sherbinko (Marple Newtown High School) worked with my students and me on various projects studying particle dynamics in dilute colloidal suspensions and colloidal gels.

Rui made samples with dilute colloidal suspensions and a small number of magnetic beads. Next, he constructed a motorized system next to a microscope in order to move a magnet near the sample and therefore exert a range of forces on the magnetic beads. From the motion of the magnetic beads one can extract properties of dilute colloidal suspensions. We have obtained preliminary results of how a magnetic bead moves through a dilute colloidal suspension. We plan to conduct systematic studies of magnetic beads moving with various speeds through colloidal suspensions of various concentrations.

Colloidal suspensions have been used successfully as a system that models the behavior of a regular glass. Miranda made samples with various attractive strengths between colloidal particles, thus making them stickier, to see how particle dynamics change as the particle stickiness increases. Using confocal microscopy, we collected 3D data over several hours and then tracked the centers of the colloidal particles. We study how colloidal particles interact with each other. We are continuing analysis of data to extract more information about cooperative particle motion and how it changes with the concentration of colloidal suspensions and with inter-particle attraction.

Typically, data is collected in colloidal suspensions using confocal microscopy over several hours and then centers of colloidal particles are determined. The process of finding the centers of colloidal particles is time intensive. Recently, neural networks have started to be used in order to accelerate this process. Real time particle tracking can allow to determine if the data collection parameters are optimal or if there is something wrong with a sample. Mike has constructed a neural network that determines if the image has a colloidal particle or not. We hope to construct neural networks that will eventually allow for real time particle tracking.

Gels are soft materials used in many branches of industry, cosmetics and food, to name a couple. Francis drags a magnetic particle through colloidal gels with a range of properties. Hence, he probes the gel structure on microscopic level learning about the strength of gel strands. Our goal is to understand how gel structure changes and rejuvenates as the gel structure is locally perturbed.

# **Investigating the Structure of Colloidal Gels Using Microrheology**

Francis Snyder, '21



Faculty Mentor: Piotr Habdas  
Department of Physics

Supported by the SJU Summer Scholars Program

Colloidal suspensions are systems in which small particles are dispersed throughout liquid. Colloidal suspensions are interesting as they have been used since the 1980s to model molecular glasses. The particles in the suspension can be large enough to be observed through optical microscopy, yet still small enough to exhibit visible Brownian motion due to the system's thermal energy. Colloidal gels are a subset of colloidal suspensions. In colloidal gels a depletion attraction is induced between the colloidal particles through the addition of a polymer depletant of a much smaller size than that of the colloidal particle. Because of this attraction colloidal gels form a series of strands of colloidal particles, held together by that depletion attraction.

Research into the structure of gels is ongoing as new techniques of quantification of gel structure are developed. There is little research in regards to the microrheological properties of gels. Microrheology is a technique of applying stress to a medium in order to study the resulting deformation and flow. While conventional rheometers are large, microrheology can be done using a much smaller and simpler setup. The sample is probed with a small magnetic bead which can be manipulated by an electromagnet above it and a permanent magnet parallel to the plane created by the sample. By adjusting the current through the electromagnet the bead's vertical movement can be manipulated and it can be suspended in the sample. The permanent magnet controls the bead's lateral movement through the sample, and its position can be changed either moving it closer or further from the sample, in order to change the lateral speed of the bead. The force the permanent magnet pulls the bead with can be determined by probing a sample of a known viscosity, such as water. Once we know the force the magnet exerts on the bead at different positions, we can begin to investigate the microrheological properties of the sample such as microdiffusivity and microviscosity by analyzing the movement of the probe.

Through the analysis of quantitative descriptors of gel structure such as bond angle distribution, topological cluster classification, and microrheological properties, we should be able to further the understanding of the structure of gels and how that structure reacts to stress induced through the probe. This summer I investigated ways of quantifying gel structure and worked towards producing verifiable results.



**Emily K. Hage**  
Department of Art  
Saint Joseph's University

Ph.D. University of Pennsylvania

**Research Interests:** 20<sup>th</sup> - and 21<sup>st</sup>-Century American and European Art; Magazines, Museum Studies, Art and Social Justice

With a background in philosophy, political science, and economics, I am fascinated by the social, political, cultural, and financial contexts of Western art in the twentieth and twenty-first centuries. My research focuses on artists' manipulations on the magazine medium, from Dadaists' art journals from 1910s and 20s to artists' sustained involvement in *Fortune* magazine through the 1960s and punk zines in the 1970s. Although often overlooked, artists' involvement with print media constitutes some of their most direct and widespread effectiveness. The often subversive relationship between image and text in magazines and collages is especially compelling to me. My research on artists' magazines informs my analyses of 21<sup>st</sup>-c. artists' infiltration of mass media channels and questions about how present-day social media alter the landscape of artistic practice and activism.

Having worked in museums for years, I am committed to making cultural institutions accessible and engaging for a broad range of audiences and raising awareness of the importance of display design. Locally, I am involved in supporting artists in Philadelphia, whose work speaks to issues of social justice and contributes significantly to the increasingly globalized art world of the twenty-first century. I have worked with summer scholars on a variety of topics related to my research, including yarn bombing, representations of African Americans, and present-day Philadelphia artists' efforts to promote social justice.

# **Art for Women Empowerment: An Art Show Representing Female Artists and Their Work**

Samantha O'Connell, '20

Faculty Mentor: Emily K. Hage  
Department of Art

Supported by the SJU Summer Scholars Program



After learning about some of the major artists from the past, I realized there was a lack of female representation in the art world. With a passion for art history and feminism, I set out to do Summer Scholar's research to create an art show featuring only female artists. The show, which will run from late September to early October 2018, will take place in Boland Hall Gallery on Saint Joseph's University Campus. I wanted to find artists who were passionate about proving their artistic abilities in a world dominated by men, and I wanted to find artists who showed a passion to empower other women through their art.

The show, entitled "Art for Female Empowerment," is a non-profit exhibition and fundraiser, one aimed at celebrating female artists and feminism through art. I proposed to the artists that any sales of their pieces go directly to them to continue their mission. Each artist participating agreed to donate a portion of her sales to a nonprofit of her choosing, as long as the goal of the nonprofit was to help women. I am calling attention for the show through social media outlets including Facebook and Instagram. I wanted to bring awareness to the show and to have audiences become familiar with the artists, their work, and their stories.

Recently, there have been many major feminist movements, including "Time's Up" and "Me Too," but the fight for equal rights continues. Art plays a major role in society. We see it everywhere. The visual aspects of art are what sticks in our minds, and this show hopes to help aid in the fight for women, as the art's message will stick in the minds of its audiences.

The three artists featured in this show are Abigail Lustig, Alexis Trionfo and Courtney Agnello. Each artist has taken a stance about women empowerment not only through her work, but also her overall goals as an artist. The work of Abigail Lustig, from Newtown, PA, focuses mainly on empowerment. Lustig volunteers at a local financial rehabilitation center called Homefront. The program offers art classes to many people, and many of the clients are women. During her time at Homefront, Lustig began an oil paint portrait series of some of the women she works with. She started the series by interviewing the women, asking what they love about themselves. For each portrait, Lustig uses their answers as inspiration for how she paints their portraits. Lustig built upon her interview questions by asking the women how they view themselves as artists. Each one of Lustig's portraits ranges from 1'x 2' and 2.5'x 2.5'. Lustig's main goal is to empower the women she portrays and to help them overcome the stigmas they face with homelessness.

Alexis Trionfo has experimented with multiple mediums throughout her artistic career. However, she found her passion through photography, feeling that it was the best method she could capture a person's soul. Trionfo works with both color and black and white photo; however, she finds that the black and white photos put more emphasis on the person and less emphasis on their clothes or their surroundings. The series that Trionfo is working on for the show features both color as well as black and white photography. In the majority of her photographs, the subjects are smiling. Trionfo feels that when a person is smiling we can see who the person really is. Additionally, Trionfo feels that women should be "viewed equally, spoken to equally, judged equally, etc." By trying to "capture" the souls of those she photographs, Trionfo unveils the way women should be viewed in a society as "strong, beautiful, intelligent, creative, and independent." She asserts, "Women do not need to be validated by a man before they contribute, they have earned the right to be heard and seen without justification."

Courtney Agnello, a visual and literary artist pursuing her BFA in New York, shows her firm support for feminism through her bold delve into the painting, film, and literary world. Her goal is to make a name for herself and stand out in an industry dominated by men. Agnello's work features some of her paintings, as well as some of her film and literary work. Her paintings include three portraits entitled "Queens" (12"x16") as well as an untitled painting (24"x18") about a mentally abusive relationship and the struggle between a woman's sexuality as well as her struggle with her reality outside of her relationship.

It's important that initiatives are taken to better represent women not only in the art world, but also in general society. This Summer Scholar's Project, not only showcases strong female artists, but also represents Saint Joseph's University as an advocate for gender equality.



**Virginia Goulding Johnson**  
Department of Teacher Education  
Chair, Department of Special Education  
Saint Joseph's University

Ph.D. University of Delaware

**Research Interests:** Teacher Thinking,  
School Climate, Educational Policy

At the beginning of the 21<sup>st</sup> century educational reformers/critics called for increased accountability in teacher performance as it related to student achievement. Spearheaded by the No Child Left Behind Act in 2001, school personnel were pressured to improve student scores on standardized tests with loss of federal funding to schools unable to achieve “adequate yearly progress”.

An outgrowth of this “test and measure” cycle began in earnest, a decade later when individuals at the state and national levels sought to establish a unified curriculum – a national set of curricular standards - for grades K through 12. The Common Core State Standards, as they came to be known, required strict adherence to the created curriculum. While its intent according to proponents, is to provide equal opportunities for learning, its implementation, like many recent reform efforts, has been less than ideal. Some critics point, yet again, to the limitations to its usefulness to the lack of teacher voice in the setting of the standards and the increasing limitations of their usefulness.

Fortunately, Summer Scholar James McCloskey, Jr, a rising junior elementary and special education major decided to investigate the Common Core by reviewing research on both the pros and cons of its implementation. His review of influences, policies and pitfalls along with teacher and administrator interviews will assist in revealing more about the Common Core Standards and in informing teacher candidates’ understanding for work in their future classrooms.

# **First Steps, False Starts: Examining the Creation and Implementation of the Common Core State Standards in American Schools**

James McCloskey, Jr., '20

Faculty Mentor: Virginia G. Johnson  
Department of Special Education



## **Supported by the SJU Summer Scholars Program**

In 2010, the Common Core State Standards (CCSS) Initiative—a national set of education standards for grades K-12—was nearing completion. As early as 2011, states began the process of adopting and ratifying the CCSS into law and practice. The thought behind the standards is to bring all children across the country to the same academic level, learn the same material, and be ready for college and careers. These Common Core State Standards are a crucial aspect of the American Education System of today, and I believe it is necessary for the current standards to be reviewed, reformed, and reimplemented into our nation's schools to meet the needs of students and educators regardless of ability, socioeconomic status, or geographical location.

Throughout the summer of 2018, I have compiled a Literature Review of the implementation process of the Common Core State Standards looking specifically at the perceptions of educators, parents, district officials, and state officials. My research led me to review articles, educational journals, interviews, and excerpts from novels which looked deeply into the creation of the Common Core State Standards and the implementation process which followed their adoption.

Since the turn of the 21<sup>st</sup> century, four new policies have been set into place by the United State government in regards to Education Reform—the No Child Left Behind Act (NCLB) of 2002, the Race to the Top Initiative (RTTT) of 2009, the Every Student Succeed Act (ESSA) of 2015—which is a revision to NCLB—and the Common Core State Standards (2010). The Common Core State Standards, unlike the policies which have preceded it, are marginalizing the teacher process because districts and schools are required to utilize specific CCSS-aligned curricula while simultaneously failing to equip educators with the necessary needs and supports for a transition of such massiveness as the Common Core State Standards.

My research has led me to three main conclusions: the Common Core State Standards have (1) caused teachers to change their teaching strategies, (2) caused schools to do an overhaul of their curricula resources, and (3) failed to meet a growing need for further professional development exercises for teachers. In order for the Common Core State Standards to become a lasting policy within our education system: teachers must be adequately trained on the teaching styles necessary to teach all subject areas as well as a diverse population of students; teachers must be provided with the necessary curricula materials which fully-align to the Common Core State Standards, and continual professional development must be provided for all educators to ensure each teacher has the knowledge, understanding, and skills required to educate our nation's children in accordance with the Common Core State Standards.



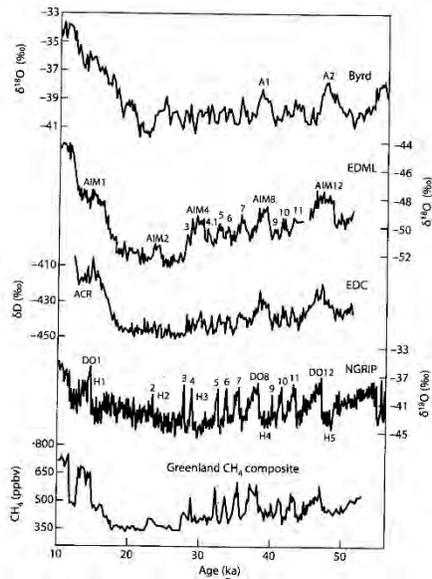
**Douglas A. Kurtze**  
Department of Physics  
Saint Joseph's University

Ph.D. Cornell University

**Research Interests:** Ocean Circulation and Climate;  
Theory of Pattern Formation

The global circulation of the oceans impacts many aspects of our climate, so understanding it is crucial for understanding the workings of climate. Large-scale computer simulations are effective at this, but they are expensive to run and their output can be difficult to interpret. So instead we often turn to highly simplified "box models" of the ocean -- mathematical models that represent the ocean by a small number of boxes of water, each with a uniform temperature and salinity, and hence a uniform density. Differences between the densities of neighboring boxes drive flows from box to box, as the denser water tries to sink below less dense water. Since these models are far simpler than the full-scale ocean simulations, it is much easier to understand their output, and much less costly to try out "what-if" ideas on them. On the other hand, it can be difficult to set up a box model in the first place and make it mimic the actual behavior of the ocean.

This project starts with a seven-box model of the Atlantic Ocean that is constructed to capture two important circulation patterns: the Meridional Overturning Circulation, which transports water north along



the surface from the Antarctic to just south of Greenland, and Antarctic Bottom Water formation, which buries surface water in the deep ocean. The aim is to tune the way this model predicts flow rates based on the densities of water in the various boxes, by using ice core data from Greenland and Antarctica. The Greenland ice cores show that during the last glaciation Greenland saw a number of "Dansgaard-Oeschger events," which are sudden warmings that give way to gradual cooling. A couple of decades after each DO event, the Antarctic ice records an "Antarctic Isotope Maximum," which is a smaller and more gradual warming that then dissipates. The cause of the DO events is not known, but presumably the influence of each DO event in Greenland gets transported to the Antarctic by the atmospheric and oceanic circulation, where it gives rise to an AIM. We plan to modify the box model so that when it is fed an input in the north that looks like a DO event, it gives an output in the south, after the correct time lag, that looks like corresponding AIM. We will then be able to use the improved model to investigate how the Atlantic circulation would respond to a variety of possible scenarios.

# **An Investigation of the Interaction Between Ocean Circulation and Sea Ice**

Emily Lehman, '21



Faculty Mentor: Douglas A. Kurtze  
Department of Physics

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

Global Warming has been a slow and silent killer of many different species of plants and animals since the beginning of the industrial revolution when a significant spike in the carbon dioxide level in the atmosphere was observed. Since that time, the level of carbon dioxide in the atmosphere has been steadily increasing, but had always remained below 300ppm. In 1950, however, at the very beginning of the technological revolution the levels of carbon dioxide soared right past 300ppm, something that had not been observed in the last 400,000 years of data. Marine ecosystems are especially impacted by this increase. In a process known as ocean acidification, carbon dioxide from the atmosphere is absorbed into the ocean. This absorbed carbon dioxide then reacts with seawater to form carbonic acid and therefore lower the pH of the water. Decreased pHs in ocean water lead to events like coral bleaching which in turn leads to ecosystem death and fish migration which then leads to decreased food supplies. Ocean acidification also creates a positive feedback loop which leads to increased rates of radiation exposure to the ocean. In this positive feedback loop, a lower pH leads to a decrease in microorganismal sulfur production which causes decreased cloud formation which allows an increase in solar radiation to be absorbed in the ocean, which leads to even less sulfur production and the destructive cycle continues.

In a similar system, as the ocean heats up from increased solar radiation exposure, the essential ice at the North and South Poles begins to melt. Even a thin layer of this sea ice drastically impacts the amount of radiation absorbed by the ocean. Albedo ice feedback is responsible for this. Because ice has a much higher reflectivity rate than seawater meaning that the more the increased solar radiation hits the ice instead of the ocean, the more solar radiation is deflected rather than absorbed. Sea ice and ocean water also interact when the ocean circulates. Ocean circulation causes friction and mixing of different temperature waters that leads to a more uniform, higher temperature in the ocean. Ice provides a physical block to this circulation and therefore keeps ocean temperatures lower.

The objective of my research project was to map the increasing trends in ocean circulation and therefore the increasing trends in sea ice melt. The two variables have a positive correlation. In order to map the ocean circulation rates of the present, I had to create a model with several variable inputs that could be adapted to predict past sets of data. I began by isolating factors of ocean circulation including temperature, salinity, wind, physical blockers, etc. I then began programming a set of equilibrium solution equations that would yield the relationships between individual variables. I programmed the equations to find exact relationships between variables two at a time until I would later combine the factors into one equation that would produce a flow velocity. I decided to employ a box model to my experiment as it would not only allow for a smaller breakdown of oceanic sections and therefore a more accurate flow rate, but also allow for a four-equation system per model. A box model is essentially thought of as four separated boxes indicating four separate sections of ocean each with a unique temperature, salinity, density, etc. each connected with the single, multivariable equation produced in the previous steps. This allowed me to map the flow of water both on a surface and deep-sea level, with connected boxes predicting the flow of the ocean in the Atlantic region from pole to pole. In conclusion, I was able to accurately map sets of circulation rates and therefore predicted ice melt in sets of past data and able to apply these box models to current conditions, allowing me to see the rate of ice decline in present day.



**Joseph M. Larkin**  
Department of Accounting  
Saint Joseph's University

Ph.D. Temple University

**Research Interests:** Cost-Volume-Profit Modeling, Ethics in Accounting and Job Satisfaction and Turnover in Accounting.

My research interests include job satisfaction and turnover, and has appeared in journals such as: *Advances in Management Accounting*, *The Review of Accounting Information Systems*, *Journal of Business Case Studies*, *Journal of Applied Business Research*, the *Pennsylvania CPA Journal* and the *Journal of Business Ethics*.

This summer I had the pleasure of working with Nathan Vrabel, '20 on his project, which dealt specifically with "workaholics." Last summer, I mentored Nathan on his study of job satisfaction of recent hires and interns with the Big Four accounting firms.

Nathan took a proven, validated research instrument (Work Addiction Risk Test) and used it to survey some of our students. His findings are quite interesting. For example, a student's major and gender were found to be related to a higher score on the test. Namely, females reported higher levels of "addiction" than males and accounting majors scored high, as well.

I applaud Nathan for his efforts and successful completion of this project. His "thirst for knowledge" and "inquisitiveness" will take him far in life. His involvement in the Summer Scholars Program has made him an ever better student than before.

# **An Exploratory Study of Student Work Habits**

Nathan Vrabel, '20



Faculty Mentor: Joseph M. Larkin  
Department of Accounting

Supported by the SJU Summer Scholars Program

Oftentimes, the assumed tickets to success are hard work and an industrious work ethic. Hard work is often one of the first few traits “successful” people attribute their results to. Naturally, this leads many people through all generations, particularly the younger generation, to see this model set forth and to try to emulate the work ethic of their predecessors. While a good work ethic can be helpful to achieving success in this world, there are certainly instances where it can have adverse effects.

“Workaholics,” or those who are addicted to working, seem to be arising at increasingly high rates among people of all ages. As the competitiveness of this world continues to increase to exponential levels and the bar continues to be raised, some people are forced to turn up the level of work they perform, while others crash and burn. This tendency is particularly of interest among college freshman. In this crucial transition from high school to college, teenagers are met with an entirely new set of expectations and are exposed to the world through a new scope.

To measure work tendencies and work addiction, the Work Addiction Risk Test (WART) was administered to college freshman within the Haub School of Business. One hundred and two usable surveys were returned. Respondents were representative of both genders, a variety of majors, and a range of academic achievements, both in high school and in college.

The Work Addiction Risk Test (WART) was developed by Bryan Robinson and Claudia P. Flowers to study workaholism. In 25 questions, respondents are asked to rank their feelings on a scale of 1-4 towards a variety of statements, with 1 representing never true and 4 representing always true. The questions aim to study five components of work addiction: compulsive tendencies, control, impaired communications/self-absorption, inability to delegate, and self-worth. Together, these contribute to their definition of workaholism, which Robinson and Flowers define as an “overindulgence in and preoccupation with work, often to the exclusion and detriment of the workaholic’s health, intimate relationships, and participation in child rearing.” Scores above 67 represent highly workaholic tendencies, 57-66 represent moderate workaholic tendencies, and scores below 57 are considered normal.

The results of this survey were analyzed across gender, major, ACT score, and GPA range. Females had higher average WART scores than males. In majors with more than 2 respondents, accounting majors had the highest average WART score, compared to 13 other majors. Not surprisingly, work addiction tendencies showed a positive relationship with ACT score and GPA. The findings of this study can be valuable to current and future students, professors, and various mental health experts.



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

Ph.D. University of Pennsylvania

**Research Interests:** Telomere Biology and Bacterial Genome

Telomeres are DNA and protein complexes that cap and protect the ends of linear chromosomes. Mechanisms must be in place to ensure that eukaryotic cells are able to distinguish broken DNA ends and telomeres and only initiate DNA damage signals appropriately. Cells, therefore, put in charge a large number of proteins and molecules in order to properly maintain the telomeres. My lab studies telomere maintenance using baker's yeast which has very similar machineries as those found in human cells. Yeast cells express telomere maintenance enzymes such as telomerase constitutively, but genetic manipulations can be done to disrupt their function. The *tlc1* mutant cells are missing the RNA template component of telomerase and behave similar to many human cells. In the yeast, numerous mechanisms are known to play roles in telomere maintenance that interact with telomerase or other telomere-specific proteins. We are especially interested in one particular RNA-processing protein, *Npl3*, and want to understand how it interacts with telomeres and thereby help maintain them. Yeast telomerase-null cells with the full *NPL3* gene deleted (*tlc1 npl3*) greatly accelerated the rate of senescence (cell cycle arrest) compared to telomerase-null cells with intact *NPL3* (*tlc1*). Furthermore, transcription in the telomeric region is turned on in the double mutant cells, generating non-coding RNA (*TERRA*); whereas in healthy cells, no such transcripts are made. This suggested that the expression of *TERRA* from telomeres is associated with cell senescence and that *Npl3* may have a functional role at their repression. *Npl3* is involved in gene expression from beginning to end, from unpacking the DNA so transcription machinery can gain access to transporting the transcribed RNA out to the nucleus for protein translation; we sought to ask how *Npl3* specifically regulates transcription at the telomeres. We have been overexpressing the Sub2 protein which have similar but narrower functions as *Npl3* to see if it can rescue the defects of cells lacking *Npl3*.

A second project in my lab seeks to understand the *Pantoea* bacterium and close relatives. Some of these pathogenic bacteria have been shown to cause Stewart's wilt in corn plants. An unknown *Pantoea* bacterium was extracted from corn flea beetles trapped at a local orchard. Based on sequencing analyses, this unknown species is closely related to *Pantoea agglomerans*. While it was unable to cause pathology in corn, unlike *P. agglomerans* and other similar *Pantoea* bacteria, we found some interesting gene sequences in the genome, including some derived from bacteriophages (or bacterial viruses). We continue to decipher the complete genome of our unknown *Pantoea*, and address the significance of the bacteriophage genes. The hope is to identify bacteriophages that would cause the death of pathogenic *Pantoea* as a method to protect corn plants from developing Stewart's wilt.

# Understanding the Importance of Npl3 in Telomere Maintenance by Overexpressing Sub2

Jessica Atkins, '20

Faculty Mentor: Julia Y. Lee-Soety  
Department of Biology



Supported by the SJU Summer Scholars Program

Npl3 is a multi-faceted yeast protein that plays a role in eukaryotic transcription and translation. We know that Npl3 is an RNA-binding protein that promotes transcriptional elongation, regulates termination, and carries mRNA from the nucleus to the cytoplasm. Npl3 is also involved in the transcription of TERRA which is telomere-containing, non-coding RNA that may activate the DNA damage response at short telomeres during senescence (also known as cell cycle arrest). TERRA accumulates at eroding telomeres and may facilitate the alternative lengthening of telomeres. The specific mechanisms in which Npl3 works at the telomeres are unknown, but the transcriptional mechanisms of the yeast protein Sub2 are better defined than Npl3 with some overlap.

Sub2 helps process and package mRNPs (messenger ribonucleoproteins) which are involved in gene expression and RNA metabolism. Before mRNPs are shuttled through the nuclear pore, they undergo several obligatory remodeling reactions, and Sub2 and Npl3 appear to play a role in many of these reactions such as 5' capping, splicing, polyadenylation, etc. Sub2 is also a component of the TREX complex required for nuclear mRNA export and a member of the DEAD-box RNA helicase family involved in early and late steps of spliceosome assembly.

Since Npl3 and Sub2 have overlapping functions, we wanted to determine if Sub2 could rescue *npl3* mutant phenotypes. We overexpressed Sub2 in mutant cells to see if sensitivity to hydroxyurea and doxorubicin may be reversed. Hydroxyurea inhibits DNA replication while doxorubicin stalls transcription. We observed that Sub2 was able to rescue the sensitivity of *npl3* mutants to hydroxyurea, but Sub2's ability to rescue the sensitivity of *npl3* mutants to doxorubicin was less obvious. To see if this effect occurs at the telomeres, the rate of senescence was measured to determine whether Sub2 can rescue accelerated senescence in *npl3* mutants that were also telomerase-null. We found that overexpressing Sub2 was not sufficient to rescue Npl3's effects at the telomeres, and the rates of senescence were comparable.

Baker's yeast is an exceptional model organism to study telomeres because yeast cells share similar features with those in humans. At both yeast and human chromosomes, telomeres protect the ends of linear chromosomes and understanding how the yeast proteins Npl3 and Sub2 help maintain telomeres may give insight into natural cell aging and the immortality of cancer cells.

# The Identification and Investigation of an Unknown *Pantoea* Species

Corinne Merlino, '20

Faculty Mentor: Julia Y. Lee-Soety  
Department of Biology



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

*Pantoea* is a genus of yellow-pigmented, rod-shaped, gram-negative bacteria belonging to the Enterobacteriaceae family. Certain species of *Pantoea* have been known to act as commensal or pathogenic bacteria within plants, animals, and humans. A member of *Pantoea* bacterium was extracted from corn flea beetles collected from a local farm and was tested for pathogenicity in corn plants. The infected corn plants did not appear to have increased symptoms of pathogenic *Pantoea* infection when compared to plants mock injected with sterile LB broth. The unknown *Pantoea* genome was also sequenced using Illumina Mi-Seq technology. The resulting reads were assembled to form a draft genome sequence, and when BLASTed, it aligned most closely to *P. agglomerans* C410P1 while the 16S ribosomal DNA matched best with *P. ananatis*. Due to their close alignment, annotations from the *P. agglomerans* genome with 80% or greater similarity to the unknown *Pantoea* genome were transferred to it to form a draft annotation of the unknown. Assembly to *P. agglomerans* on the Geneious (version 11.1.4) software program resulted in numerous gaps in the genome and the appearance of phage-related genes that may contribute to the evolution and diversification of the *Pantoea* genus.

Currently, attempts are being made to eliminate and shorten gaps and additional alignments are being performed in order to complete the assembly of the unknown *Pantoea* genome. Investigation of the phage-related genes has revealed an incomplete prophage or multiple prophages within the unknown genome, suggesting that the bacterium has been infected by phages at some point. Gaining a better understanding of the genomic characteristics of the various *Pantoea* species and their pathogenic capabilities in plants and animals could result in the development of agents for therapeutic use and biocontrol of this bacterium.



**Alison W. Lewin**  
Department of History  
Saint Joseph's University

Ph.D. Cornell University

**Research Interests:** Ancient Greek History; Ancient Roman History; Dark Ages, Church History; Justice Systems in the West 3000 BCE-1600 CE; Gender History 3000 BCE-1600 CE; Italian Renaissance History

The photo is with the statue of Frederick Douglass in front of the New York Historical Museum; even on vacation, history is my passion! I was fortunate enough this summer to mentor Jacqui Gibson in her research into Eleanor of Aquitaine. The topic originated in a seminar, "Gender and Authority, 500-1500," and was the focus of her paper for the course. Over the summer, Ms. Gibson deepened her knowledge of female authority wielded by Eleanor and her contemporaries. Eleanor is perhaps the most famous and written about women of the Middle Ages, so it required some ingenuity on Ms. Gibson's part to devise a new approach to studying her. She hit upon the idea of investigating a specific period in Eleanor's life, namely the years when her husband, Henry II of England, appointed her to rule in his stead in her native province of Aquitaine.

Many people assume that until recently, women exercised very little power outside the domestic sphere. It would be more accurate to say that the men who wrote most of the histories until recently made that assumption, and essentially wrote the women out of the past. As more scholars have turned from the often-misogynist chroniclers to deeds and charters that reveal how active women were in managing large regions, a more accurate picture is slowly emerging. Ms. Gibson's work will contribute to this new vision, arguing that Eleanor was in fact more capable of ruling Aquitaine than her formidable husband. She may even have assisted her grown sons to rebel against him.

At present, Ms. Gibson is studying abroad in Paris, where Dr. Kristin Burr and I hope she will be able to use her excellent French to do original archival research. That, coupled with the excellent work she did over the summer, will form the basis for the Honors thesis she is writing this year.

# **Eleanor of Aquitaine: Testing the Limits of Female Authority in Medieval Europe**

Jacqueline Gibson, '19

Faculty Mentor: Alison W. Lewin  
Department of History



Supported by the SJU Summer Scholars Program

In 1168, King Henry II of England stationed his wife, Queen Eleanor of Aquitaine, in her ducal domain of Aquitaine, which she governed until a rebellion against Henry II broke out in 1173—a rebellion that Eleanor’s contemporaries, including her husband, believed that she helped foment in cooperation with her sons. Eleanor’s time in Aquitaine was seemingly marked by the strengthening of her sense of autonomy: she exercised a notable degree of authority, issuing charters in her own right, and, in a seeming effort to assert her own authority, removing Henry’s name from several acts. Therefore, I found it fruitful to investigate the potential link between Eleanor’s growing sense of autonomy and her possible role in the rebellion of 1173.

That Henry stationed Eleanor in Aquitaine in 1168 is not surprising, as medieval aristocrats frequently depended on strong, capable wives to aid them in governing their far-flung holdings. Eleanor did indeed help Henry govern the unruly vassals of her native Aquitaine, who held their foreign overlord, Henry II, in considerable contempt. The questions that arise in this situation are, “What drove Eleanor to foment rebellion in the first place? And what did Eleanor’s role in the rebellion and the responses from Henry and the chroniclers reveal about this particular wife’s ability to wield power?” Contemporary sources suggest that her power was acceptable so long as it served the purposes of her husband.

In order to investigate Eleanor’s involvement in the rebellion, I examined primary sources and utilized secondary sources as well. A letter from Peter of Blois, written at the behest of the Archbishop of Rouen, who undoubtedly was influenced by his patron, Henry II, urges Eleanor to bring their sons into submission, reminds her of her duties as a wife to her husband, reminds her that as a wife she is subject to her husband’s authority, and threatens excommunication if she fails to comply with Henry’s wishes. Richard le Poitevin, a chronicler, similarly provides evidence of Eleanor’s involvement in the rebellion, though, as an Aquitanian, he is sympathetic to her plight. These two of the many sources I used reflect differing opinions and perspectives, in part because they serve different purposes. These differences and the enormous amount of material available about Eleanor and her peers provide me with many more avenues to explore in my honors thesis.



## **Edwin Li**

Department of Biology  
Saint Joseph's University

Ph.D. University of Rhode Island

**Research Interests:** Membrane Protein Structure and Assembly; Protein-Protein Interaction

My research area focuses on understanding the physical and chemical principles governing the interaction of membrane proteins. The membrane proteins that I study belong to a class that elicits the response to the extracellular signal by forming complexes with other membrane proteins. These complexes are often composed of two proteins interacting with each other, forming a stable new structure. In this context, dimerization, refers to the process in which two monomers (single proteins) come together to form a dimer.

Dimerization of membrane proteins is often one of the initial steps in a series of events that triggers cellular responses such as movement, division, and even cell death. Diseases in living organisms may arise because their cells cannot function properly if dimerization is out of control. The specific disease that may result depends on which membrane protein is affected. For example, unregulated dimerization of a membrane protein may result in unregulated cell growth and division, eventually leading to the formation of tumors. In some other cases, unregulated dimerization of another type of protein may lead to abnormalities during development such as cranial disorders. These are just a few examples highlighting the important physiological roles of these proteins and the medical relevance of studying membrane protein dimerization.

The main focus of my laboratory is to elucidate the physical and chemical principles behind the interaction of membrane proteins. This information will facilitate the design of better therapeutics targeting these proteins.

## Investigating the Potential Dimerization of Mucin 16 (MUC16)

Nicole Butch, '21

Taylor Micua, '19

Faculty Mentor: Edwin Li

Department of Biology



Supported by the Nicholas & Susan Nicolaides Research Fellowship and the SJU Summer Scholars Program

Mucins are proteins found in the epithelial tissue that produce mucus barriers to provide moisture and also prevent harmful, foreign material from entering the cell and causing possible cell damage. Transmembrane mucins are a type of mucin that sit within the lipid bilayer of the cell membrane and are characterized by having a large extracellular domain, a transmembrane domain located inside the lipid bilayer, and a small cytoplasmic tail.

Overexpression of transmembrane mucins have typically been correlated with the development of cancerous growths. When there are too many transmembrane mucins present in close proximity to each other, they can dimerize, or come together, and trafficked to other locations like the nucleus. When these dimers enter the nucleus, they can act as transcription factors that regulate the expression of genes associated with tumor formation.

Transmembrane mucins have been shown to be overexpressed in various diseases, especially in cancer. Transmembrane mucins including MUC1 and MUC16 have been associated with cancer, but the mechanism of MUC1 in cancer progression is the best characterized. MUC1 requires dimerization for it to be translocated to the nucleus and alter gene expression. The cysteine-glutamine-cysteine (CQC) motif located in the MUC1 juxtamembrane (membrane-proximal) domain is responsible for driving this dimerization process due to the disulfide bonds formed between the cysteines. MUC16 has a similar transmembrane domain to MUC1 in that it also contains two cysteines. Since there is little known about the mechanisms of MUC16, one solution is to compare it with the known mechanisms of MUC1. Our primary goal is to determine if the transmembrane domains of MUC16 can interact with each other to promote dimerization. To determine if the transmembrane domain of MUC16 dimerizes, we used the ToxR assay. This assay uses a chimeric protein comprised of the transmembrane domain (TMD) of interest, the *Vibrio cholera* cytosolic ToxR transcription factor, and the maltose-binding protein (MBP). Dimerization of the transmembrane helices brings the ToxR proteins to function in a pair as a transcription factor, promoting the expression of the *lacZ* gene which encodes the enzyme  $\beta$ -galactosidase ( $\beta$ -gal). This assay measures the amount of  $\beta$ -gal activity, which correlates to the amount of transmembrane domain dimerization.

The preliminary ToxR results showed that the transmembrane domain of MUC16 does undergo dimerization, similar to the transmembrane domain of MUC1 containing the CQC motif. The dimerization of the transmembrane domain of MUC16 suggests that MUC16 also dimerizes. Understanding that MUC16 dimerizes similarly to MUC1, our next goal would be to determine if the cysteines in the transmembrane domain specifically are required for dimerization. Learning more about the function of MUC16 in cancer cells can create more specific and effective therapeutic techniques in preventing cancer growth.



**Aisha D. Lockridge**  
Department of English  
Saint Joseph's University

Ph.D. Stony Brook University

**Research Interests:** African-American Literature,  
Women's Studies and Black Popular Culture

Aisha Damali Lockridge received her undergraduate degree in English from City College of New York and her Ph.D. in English from Stony Brook University. Aisha's research focuses on African-American Literature, Black Women's Studies and Black Popular Culture. She has written a detailed study – *Tipping on a Tightrope: Divas in African American Literature* – which traces the trajectory of the Diva figure in African American literature. Currently, Aisha is working on a book length project about the transformation of the Magical Negress figure in Black literature and popular culture.

Most recently Aisha has offered courses on the African American Post-Soul Imagination, Black Popular Culture, and Caribbean Literature in English. Her teaching style encourages students to make their own intellectual discoveries by engaging meaningfully with Black texts and interrupting spaces of privilege and power.

# Thurman and Cullen Were Playwrights Too: Blackness, Genre and Form in the Harlem Renaissance

Dominique Joe, '19



Faculty Mentor: Aisha D. Lockridge  
Department of English

Supported by the SJU Summer Scholars Program

The Harlem Renaissance, arguably, is one of the most significant artistic movements in the United States. Spurred by the Great Migration, WWI, and Post-Reconstruction access to education, large black communities began to form in urban centers like Harlem, Chicago, Washington D.C. and sought to establish themselves as a part of American majority society. This was the first time black people invited themselves to be a part of the conversation about what it meant to be Black and how Blackness shaped newly integrated spaces. Art was the primary language of this movement because many black academics and artists believed it most effectively expressed the complexity of Black identity. Given this, the Harlem Renaissance is most memorialized by its poetry and novels and yet plays were very much a part of the artistic period. Not much is said about the plays written during and after the Harlem Renaissance and what is perpetuates an overly simplistic understanding of those plays and authors who wrote them.

Much scholarly discussion on Harlem Renaissance plays suggests a dichotomy in expressing Blackness. Commonly there are plays that support Alain Locke's New Negro ideology and plays that support Du Bois' propagandist art ideology. Though different in practice, both centered on promoting a middle class metropolitan aesthetic as being the only acceptable and authentic way to express blackness. Apart from this was an idea of the southern, simple folk, seen in much of Zora Neale Hurston and Langston Hughes' work. These authors and ones who followed their lead believed this to be the only way to authentically express Blackness.

My research paper dismantles this oversimplified dichotomy and asserts that in part, Harlem Renaissance plays are discarded in how the period is memorialized because they reveal the complexity of defining Blackness. The plays show the dissension, the confusion, and the difficulty of finding common ground even when it is highly sought. In particular, I focus on plays by Wallace Thurman and Countee Cullen, *Harlem: A Melodrama of Negro Life* and *The Third Fourth of July* respectively, because neither artist fit the standard lifestyle and philosophy of the period.

Thurman espoused bohemianism and Cullen supported an artist first ideology. These two artists had a complex relationship with their own blackness and this may explain the nuanced ways they articulate different kinds of blacknesses through a subversion of form in their plays. Through Thurman's use of satire and Cullen's mapping of different artistic forms on top of the traditional play model, Thurman and Cullen's works reflect a desire for complex blackness that does not easily fall into strictly defined Harlem Renaissance categories.



**Kim A. Logio**  
Department of Sociology  
Saint Joseph's University

Ph.D. University of Delaware

**Research Interests:** Adolescent Health, Body Image, Deviant Behavior; and Cultural Differences in Language Learning

I have been teaching the research methods and data analysis courses for our criminal justice and sociology majors for over 21 years. When a student expresses an interest in doing research, I am happy to work with them. My interests are varied and I enjoy working on scholarship about law enforcement. I am currently working with a local police department on data analysis to uncover patterns of traffic stops.

When Julianna Hankinson presented her idea to talk with officers about their feelings toward media coverage and public opinion of their work, I was happy to oversee the qualitative project and learn from her interviews.

# **Exploring Police Officers' Responses and On-Duty Experiences Regarding Perceived Anti-Police Attitudes and Negative Media Attention**

Julianna Hankinson, '19



Faculty Mentor: Kim A. Logio  
Department of Sociology

## **Supported by the SJU Summer Scholars Program**

Tensions between police officers and communities around the nation seem to be at an all-time high according to media statistics and the rise of high profile incidents between law enforcement officers and black men. Much of the sociological literature focuses on the experiences of black men. I started this project because I was interested in the experiences of police officers. This isn't to take away from the experiences of minorities but rather to provide a unique perspective into the lives of those on the other side of the issue.

My project focuses on highlighting the experiences of law enforcement in a political and social climate where police are regularly being criticized and receiving negative publicity for use of force incidents. There exists survey data that show police believe their jobs are more difficult and are at an increased unwillingness to question and stop suspicious people. Studies also show that police officers will engage in community policing if they have confidence in their authority. However, it is hard for law enforcement to be confident in their jobs when they constantly experience criticism from news media and the general public. Constant coverage of high profile incidents have the ability to influence perceptions of police and therefore will have an effect on how police officers carry out every day duties. In the interviews, I explore possible job-altering effects of events like Ferguson, traffic stop frequency in the light of increased media attention, and the on-duty verbal or physical abuse of police officers.

Many police officers feel as though the general public has incorrect or incomplete knowledge into the life of a police officer. Therefore, I hope to provide the general public with a better idea of what police officers face daily and why these situations are much more complicated than news media and social media may make them out to be. This project will provide a unique glimpse into the lives of law enforcement and add diversity to the body of research currently available.



**Dennis E. McNally, S.J.**  
Department of Art  
Saint Joseph's University

Ph.D. New York University

## **Research Interests:** Painting, Architectural History, Liturgical History and Art and Spirituality

My work is about the relationship between faith and justice. I am a painter these past fifty years who has found influences in Monet and van Gogh at first, followed by an interest in the color field painters, Rothko, Motherwell, Ellsworth Kelley, then in Blake, Dante Rosetti, Hopper, and later still in Michelangelo, Cimabue, and Rublev. Most recently I recognize the influence of Anselm Kiefer. I know that my work is also influenced by Jesuit artists, Pozzo, Bernardo Bitti, Cabrera, and Andre Bouler. These later brothers touched me because their work is about “our” approach to the Christ of the Spiritual Exercises, finding God in all things, and following the prompts of the imagination.

I paint about finding God entering into our miseries, like the destruction of 9-11, the conquest of the Americas, the racial/ethnic and religious wars of the Middle East, Africa, Israel, Argentina, Brazil, the USA, and Russia. I also find God in other religions, Islam, Judaism, Buddhism, Taoism, and shamanism. And in the political reductions of value to fights over wealth, power, and position. I find God in all these things, thinking that They, the Trinity are deeply involved, *indwelling* in our experience because They, from the singularity of extra-temporal, extra-spatial Triune love, continuously created out of Their own substance.

I think it is in the spirit of this aesthetic and spiritual quest, which we discuss in my Faith and Reason class, *Encountering Mystery: Sacred Space, Sacred Time*, and cover in my four texts, is what led Rachel to ask me to be her mentor for this spiritual and political consideration---her desire to use arts; blog writing, musical accompaniment, image making, and filmmaking to make a strong contribution to creating awareness and developing concern about the plight of trafficked children in Ghana. She has produced a monumental work, full of youthful hope both in the children she photographs and the adults she captures trying to learn how to care for their children, and in her own attitude to the beauty of it all. There is charm and delight in the lives of these children whose lives are just again beginning to be valued by someone. There is a dark message bathed in voluminous light. The juxtaposition is palpable to the audience with eyes to see it. I am very proud of her work.

# City of Refuge Ministries in Ghana, Africa: Shining a Light on the Social Injustices of Human Trafficking in a Third-World Country

Rachel Ledbetter, '19



Faculty Mentor: Dennis E. McNally, S.J.  
Department of Art

## Supported by the SJU Summer Scholars Program

City of Refuge Ministries, CORM, is a non-profit organization based in Ghana, Africa. This past May I had the opportunity to volunteer at the CORM site. Its mission is as follows:

*“City of Refuge Ministries exists to provide holistic restoration for children who have been liberated from exploitation, abuse, or trafficking. We aim to prevent exploitation at its roots by empowering individuals and communities to eradicate child slavery and achieve personal and community goals.”*



The team at CORM is passionate about rescuing children from slavery and providing them with a safe and fulfilling childhood contrary to what they may be used to. Many of them spent the majority of their childhood working on fishing boats in unsafe and unethical conditions.

With human trafficking, single moms are often where the problem begins. They lack the necessary skills and income to adequately provide for multiple children. They do this by setting them up with the tools and skills they need to be successful. They learn how to cook and sew so that eventually they can begin their own business and sustain themselves. I was able to see this goal come to life during my time in Ghana.

As a volunteer, I shadowed the medical doctor on site. We taught health classes focusing on Malaria prevention and treatment, as well as the importance of personal hygiene. Other days, I acted as a teacher's assistant. I helped the children improve their reading and writing skills (eg, writing letters back to host families in the United States who help fund this program).

My research focuses on the injustices perpetrated on individuals in Africa. CORM exposed me to many personal encounters of human trafficking. As a Summer Scholar, I kept a detailed, online, daily blog, highlighting the injustices in Ghana and documenting what I saw, felt, and learned each day. You can find this at [NeverGhanaForgetThis.Blogspot.com](http://NeverGhanaForgetThis.Blogspot.com). In addition, I created a comprehensive video documentary with music and my own voice-overs about the people, stories, and life-long lessons I acquired along the way. This can be viewed on YouTube by searching “Never Ghana Forget This.”



I can confidently say that I enriched my knowledge of human trafficking and was able to interact first-hand with children who are victims. I gained a better understanding of how this violation of human rights occurs in the first place, how to prevent it, and how to stop it. This experience taught me impact of interacting with cultures and societies around the world. After all, that's the *magis*.

[www.CityofRefugeOutreach.org](http://www.CityofRefugeOutreach.org)



**Scott P. McRobert**  
Department of Biology  
Saint Joseph's University

Ph.D. Temple University

**Research Interests:** The Genetic, Ecological  
and Evolutionary Foundations of Animal  
Behavior

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 work with *Drosophila* involves an examination of the invasive species *Drosophila suzukii*. This true fruit fly is a major agricultural pest that had been introduced to the United States. My students and I survey the local *Drosophila* community for the presence of *D. suzukii*, and our laboratory work is aimed at understanding the sexual behavior of this species.

Our work with amphibians and reptiles is focused mainly on conservation. We house many rare and endangered species, and a current research project involves an analysis of the effects of salinity on growth in hatchling diamondback terrapins (turtles).

**Population Survey of *Drosophila*  
*Suzukii* in the Philadelphia Area,  
Pennsylvania, U.S.A.**  
Ave Burleigh, '20



Faculty Mentors: Scott P. McRobert  
and Jonathan Fingerut  
Department of Biology

**Supported by the SJU Summer Scholars Program**

*Drosophila Suzukii* part of the *Drosophilidae* family have been migrating to the United states mainland since 2008, but they originate from Southeast Asia. *Drosophila Suzukii* were noted as an invasive pest in 2008, causing agricultural damage to America and Europe. Most flies in the *Drosophilidae* family infest rotting or decaying fruit, while *D. Suzukii* colonize on ripening fruit. These fruit flies pose an economic threat to small stone fruits due to their serrated ovipositors and bristles, which allow for easy access to ripening fruit to lay their eggs. This causes fruit to decay at a faster rate, exposing infested ripe fruit to pathogens and other flies such as *Drosophila Melanogaster*. Depending on temperature determines the reproductive rates, temperatures between 15-20°C range can increase oviposition rate, which increase population size.

The purpose of my research was to replicate the 1986 & 2013 collection surveys conducted In the Philadelphia area under Dr. McRobert. The 1986 survey found nine *Drosophila* species with no appearance of *D. Suzukii*. However, the 2013 survey collected thirteen known *Drosophila* species with *D. Suzukii* appearing in August, compared to others in the *Drosophilidae* family that started to appear in February. Studying this species can allow for information on how they are affecting the agricultural community and how their infestation effects the *Drosophilidae* community.

The goal for this summer was to begin designing a new trap that would efficiently collect flies without them escaping. The new traps are being designed using a 3D printer, which will contain an area for either one or more vials (containing bait) to be inserted. A wide range of bait (lure) was tested using choice chamber studies with *D. Melanogaster* to test the level of attractiveness. The three most successful lures (a variety of liquid slurries) will be the chosen bait for the finalized trap.

Once, the trap is finalized the traps will be set up many suburban locations within five miles of Philadelphia. Each trap will sit out for a consecutive three days each week for a year to track what month and how many fly species migrated to the area. Once, the flies are collected they will be identified using the dichotomous key of North American *Drosophilids*. Each species will be identified under the anesthetic using carbon dioxide to properly examine each fly under the microscope to be identified as a female or male designated to their specific species.

## Choice Studies of the Invasive Species,

### *D. suzukii*

Haley Patrick, '19

Kaleigh Williams, '19

Faculty Mentors: Scott P. McRobert

and Jonathan Fingerut

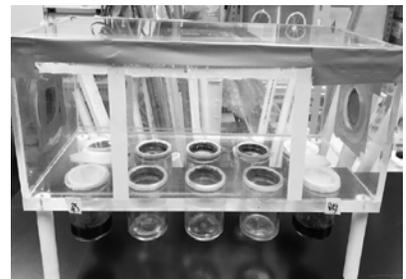
Department of Biology



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

*Drosophila suzukii* is an invasive fruit fly that has caused agricultural damage across the United States. This species has similar sexual behaviors to other *Drosophila* but differs in its tactic for feeding and egg deposition. While *Drosophila* commonly feed on rotten fruit, *D. suzukii* has the ability to penetrate the skin of healthy and growing fruit that is still attached to the plant. This ability is attributed to the morphology of *D. suzukii* females, who have large, serrated ovipositors that allow them to penetrate the firm skin of the ripe fruit and lay eggs inside. Because of this ability, *D. suzukii* are considered an agricultural pest and, at this point, there are no successful preventative methods to deter this species from targeting and damaging crops. For our Summer Scholar's project, we examined the choices of foods by different species of *Drosophila* in dichotomous choice chambers.

We conducted our experiments in a *Drosophila* population chamber (Fig. 1) that contained 10 media jars. We divided the chamber into thirds using tape and monitored the number of flies in each region. During an experiment, 10 male flies were collected under CO<sub>2</sub> anesthesia and placed into the chamber for 24 hours, at which time the number of flies in each end of the chamber was recorded.



Our first study compared the flies' response to empty jars at one end of the chamber and blended blueberries in jars at the other end of the chamber. Significantly more flies were found in the end near the blueberries as compared to the end with the empty jars ( $p < 0.05$ ). For our next study, we compared the flies' response to normal, blended blueberries at one end to blended blueberries in which we had manipulated the sugar concentration of the blueberries (doubling the amount of fructose and glucose) at the other end. Significantly more flies were found in the end near the blueberries with the higher sugar content ( $p < 0.05$ ). This suggests that sugar content is a factor that affects food choice in *D. suzukii*.

In our next study we examined choices in two species of *Drosophila* that are not agricultural pests: *Drosophila melanogaster*, the fly commonly used in genetic studies, and *Drosophila biarmipes*, the sister species to *D. suzukii*. Our results showed that there were no significant differences ( $p > 0.05$ ) between the number of flies in each end of the population chamber in either study (blueberries vs. nothing and normal blueberries vs. blueberries with 2x the sugar concentration). These results emphasize the differences between a true fruit fly (*D. suzukii*) and non-fruit flies (*D. melanogaster* and *D. biarmipes*) with regard to fruit preferences.

Future work will include comparing the specific sugars found in blueberries, and manipulating the pH using blueberries' natural acid, Citric Acid.



**Kaitlin K. Moran**

Department of Teacher Education  
Saint Joseph's University

Ph.D. Temple University

**Research Interests:** High-Quality Early Childhood Education; Access, Equity and Availability in Low-Income, Urban Neighborhoods

I believe early childhood education presents an absolutely critical educational opportunity during the first years of children's lives. With continuity in care and access to a high-quality education, early care has long-term, proven outcomes that stand to benefit the most vulnerable of young lives. Yet, every day in the United States, millions of children get dropped off at all kinds of settings and arrangements and the reality is, there is very little insight into what happens when they are there. Since one of the hallmarks of a high-quality early childhood education is having a strong curriculum with instructional environments and learning-based activities to support the physical, cognitive, and social emotional development of young children, my scholar and I decided to explore the curricular components of quality in-depth.

Specifically, my scholar investigated four of the most commonly used curricula in the United States, including The Creative Curriculum, HighScope, Curiosity Corner, and Tools of the Mind. We wanted to know how the curricula stacked up against one another in terms of both process and structural quality, the two ways to assess just how high-quality a setting really is. Structural quality refers to the elements that can be explicitly measured, such as maximum group sizes, student/teacher ratios, and teacher qualifications. Process quality evaluates the interactions and the learning experiences that are created and enhanced by the teacher, which are not as easily measured. To that end, we also wanted to know what research has shown as far as long-term outcomes for young children who were exposed to each of the four curriculum under examination.

To do so, my scholar conducted a curricular review, essentially collecting, cataloging, and subsequently evaluating the determinants of process and structural quality in light of the guidelines and expectations provided by the creators or publishers of each curriculum. In comparing all four, we found that while all curricula incorporate aspects of both process and structural quality, additional guidance is needed in each so as to ensure all facets of quality are covered. Further, an investigation into the long-term outcomes demonstrated that while each curriculum had proven strengths and provided learning opportunities for children, much more research is needed to truly evaluate the long-term impacts or benefits of each one.

# **Evaluating the Quality of Today's Early Childhood Education System: A Comparative Study of Four Widely Used Curricula**

Jillian Hayes, '19

Faculty Mentor: Kaitlin K. Moran  
Department of Teacher Education



Supported by the SJU Summer Scholars Program

A large concern within the current system of early childhood education in the U.S. is the quality of the programming and its ability to prepare students for kindergarten and beyond. Therefore, it is essential to examine curriculum for gaps in effectiveness so that we are not doing our students a disservice. To do this, we must ensure that the curriculum offers appropriate materials and methods for teaching and that high quality professionals are adequately trained to provide the correct supports that our students need to succeed.

In this project, I analyzed four of the most widely used early childhood curricula in order to assess the quality of each. Those curricula include The Creative Curriculum, HighScope, Curiosity Corner, and Tools of the Mind. Elements of structural quality and process quality were the primary focus in evaluating the effectiveness of each. Structural quality refers to elements that are readily measured, such as student/teacher ratios, maximum group sizes, and teacher qualifications. Process quality refers to the more complex aspects of learning within the classroom, such as student/teacher interactions and teaching strategies.

Findings showed that structural quality was largely determined by the state, which resulted in very few specific regulations within the curricula. Process quality was much more descriptive in expectations for teachers and administration, however, it lacked individualized information to guide children's overall progress. Some of the strengths across the curricula included a heavy focus on teaching the whole child, both socially and academically, to ensure that students were meeting developmental milestones, and purposeful planning combined with intentional teaching strategies so that each moment presented an opportunity for students to learn.

Overall, when using these categories to break down the effectiveness of the curricula, it was clear that more research must be conducted to sufficiently account for the expanding population of students from diverse learning backgrounds, including students with disabilities, advanced learners, and dual language learners. Through this comparison, specific areas of growth were established, which created an opportunity to more clearly define future research methods. This ability to label unproductive practices allows for more concrete solutions to take place. With this new knowledge base, it is possible to have a more substantial impact on current teaching methods so that they address immediate and long term issues within our educational system so that today's students can experience the success that they deserve.



**Emily M. Moscato**

Department of Food Marketing  
Saint Joseph's University

Ph.D. Virginia Tech

**Research Interests:** Consumer Wellbeing, Sustainable Food Systems, Food Practices, Consumer Culture, Transformative Consumer Research

The food industry has a significant impact on our planet; conversely climate change has a significant impact on the food system. With an interest in understanding ways to reduce ecological strain and promote consumer wellbeing, I explore cultural and psychological antecedents to decision making on food waste, food labeling and packaging, and animal protein consumption. Currently I am working on projects investigating edible insects. This is where the Summer Scholar project fits into my research agenda.

The ecological footprint of the human diet, especially the carnivorous aspects of our diet, is of particular concern because of resource (water, energy, land) use in livestock production and the contributions of livestock to greenhouse gas emissions. This has given rise to interest in alternative proteins sources, including edible insects. The repulsion towards entomophagy (eating insects) is conceptualized as form of 'acquired distaste' based on lack of sensory exposure to insects as food and cultural components which influence the categorization of insects. My research explores how to gain acceptance of edible insects, and importantly for sustainability purposes, how they can be integrated into our diet. At the core of this research is an investigation: How can marketers make this currently undesirable food source be truly perceived as desirable? From a marketing perspective, the positioning of insects in a food category is critical. Before positioning can occur, it is important to understand what is found acceptable and unacceptable by consumers in the perceived experience of eating insects. The Summer Scholar project integrates this line of research and provides an output of a case study for students to explore this market and expand their thinking on the business side of sustainability.

# **Edible Insects: An Investigation of Attitudes and Industry Case Study**

Madison Cassel, '20

Faculty Mentor: Emily M. Moscato  
Department of Food Marketing



Supported by the SJU Summer Scholars Program

With the world's population increasing, it is more important than ever to find sustainable protein sources that reduce strain on the planet's resources. The edible insect industry is a relatively new and expanding industry that seeks to supply people with safe, healthy, pleasurable, and sustainable food. The primary benefits to edible insects are that they provide equivalent protein to traditional meats (plus significant calcium and iron) while requiring considerably less resources in terms of land, feed, and water.

The first part of this project consisted of doing research and a literature review of the edible insect consumption and the industry. Research indicates there are a number of barriers to acceptance of insects in Western diets but having tried them in the past and having them incorporated into familiar foods are two strategies shown to overcome disgust. Regarding the edible insect industry, it began to flourish in the United States around 2010 and was led by industry pioneers such as Aspire Food Group, Entomo Farms, and Chapul. All these companies had a similar mission: to provide their customers with a tasty, safe, and sustainable alternative protein source. The products come in sweet options such as granola and chocolate covered crickets or savory options such as tortilla chips or spicy whole roasted crickets.

Next, I collected data on consumer attitudes towards edible insects and specific commercial products. I first distributed a survey among a small portion of the SJU student population. Some of the questions in the survey were about the importance of health to students, whether students think protein is important in a daily diet, whether they think insects have protein or not, and whether they would consider trying an insect. After we collected the answers and data from the surveys, we asked if some of the students who took the survey would be willing to participate in focus groups about protein consumption. My mentor and I conducted two focus groups. During these focus groups we asked students about their attitudes and opinions toward protein, health, and edible insects. We then conducted an optional taste test of edible insect products.

Using what I learned from this primary and secondary research, I have created a case study about the edible insect industry that assesses which are the best market positions for this type of industry. This case study outlines the background of this industry and the current company competitors. I also discuss the importance of edible insects, the varying kinds of edible insects and their health benefits, and the impact of switching to this alternative protein could have on the environment. The case study also describes the different market positions that companies have taken, and which positions are most effective at getting consumers to buy their products.

Alternative protein sources are not just a way to feed the world's growing population, but also are also a way to begin shifting away from non-sustainable animal agriculture. The companies who produce alternative protein sources, such as edible insects, will pave the way for a healthier and more sustainable future. Sharing this research through the case study expands the reach of the market and gives students the opportunity to think critically and creatively about these important economic and ethical issues.



**Matthew D. Nelson**  
Department of Biology  
Saint Joseph's University

Ph.D. New York University

**Research Interests:** Behavior and Genetics

Every animal on earth sleeps or displays quiescent behaviors that resemble sleep. Humans spend greater than a third of their lives asleep but, amazingly, fundamental questions about sleep remain unanswered including: What is its function? And; How is it regulated at a molecular and genetic level? In fact, sleep remains one of nature's greatest biological mysteries.

Simple animals such as fruit flies and nematodes have become key tools in the sleep biology field. These animals are called "model organisms" because many of the same genes and molecules that drive their biology also controls ours. The nematode *Caenorhabditis elegans* is a microscopic, free-living worm that has been widely used in the lab as a model for understanding development and behavior. *C.elegans* displays sleep behaviors at regularly timed intervals during larval development and in response to stressful environmental stimuli. But, why study sleep in a microscopic worm? First, *C.elegans* is a powerful genetic system that we can manipulate with ease. They are transparent and grow from an embryo to an adult in 4 days, thus allowing for fast genetic alteration and experimentation. Because of their simplicity, we know the location of every one of their cells and the connection of every neuron in its simple nervous system (Only 302 neurons!). My lab takes advantage of this amazing animal in hopes to further our understanding of sleep. Specifically, my research focuses on the following: 1) Identification of sleep regulating neurons and how they communicate as neural circuits to control sleep behavior and; 2) Characterize the mechanisms of how signaling molecules called neuropeptides regulate sleep. We use a combination of techniques common in the following disciplines: genetics, molecular biology, neurobiology and behavior.

# The Mechanisms of the NLP-14 Regulation of Stress-Induced Sleep in *Caenorhabditis elegans* Kristen “Kay” Buscemi, '20



Faculty Mentor: Matthew D. Nelson  
Department of Biology

Supported by the Peter & Dorothy Kowey Research Fellowship and the  
SJU Summer Scholars Program

Sleep/wake cycles are largely regulated by neurons that release protein messengers called neuropeptides. These peptide transmitters modulate synaptic activity. In *Caenorhabditis elegans*, Pigment Dispersing Factor (PDF) promotes activity (wake) (Choi *et al* 2013), while multiple neuropeptides regulate sleep, including NLP-22 and FLP-13 (Nelson *et al.* 2013 and 2014). In mammals, the neuropeptide orexin promotes arousal, while melatonin increases sleep drive. Consequently, neuropeptides play an essential role in modulating sleep in both vertebrates and invertebrates.

Worms display two distinct forms of sleep (Trojanowski *et al* 2015); first they sleep during a period called lethargus, which precedes each of the four molts (Raizen *et al.*, 2008), a behavior termed developmentally timed sleep (DTS). Second, they sleep following exposure to environmental stressors that are damaging to their cells; this is a behavior called stress-induced sleep (SIS) (Hill *et al* 2014).

Gene expression analyses show that out of the 873 genes that are upregulated during the lethargus period, 20 encode for neuropeptides (George-Raizen *et al.* 2015). Among these neuropeptides are the NLP-14 peptides, which share striking sequence similarity to orcokinin, a highly conserved class of peptides found in the Ecdysozoa clade. Previous studies suggest that orcokinin is involved in the regulation of circadian rhythms in insects (Hofer and Homberg, 2006). We report that NLP-14 neuropeptides regulate SIS but not DTS. We have found that over-expression of the NLP-14 peptides results in sleep-like behavior, characterized by the inhibition of basic behavioral functions such as locomotion and defecation.

The NLP-14 pre-protein contains 11 peptides, 5 of which are distinct. My project focused on determining which of the NLP-14 peptides are involved in inducing locomotion quiescence and which promote defecation quiescence during SIS. To begin this process, we obtained a strain carrying a deletion allele, *tm1180*. Through RT/PCR and sequencing, we were able to determine that *tm1180* animals possess a mutation which encodes for only 4 of the 11 NLP-14 neuropeptides: A, B, D, and E. Additionally, we created a new mutant, *nlp-14(stj10)*, using the CRISPR/Cas9 system which only encodes for NLP-peptides A, B, and C.

To quantify locomotion quiescence we use the automated tracking system called the Wormotel (Churgin *et al* 2017). Defecation cycles, a multi-step process constituted by a set of posterior and anterior body contractions and expulsion, were quantified manually after the UV shock by measuring number of expulsions per 5 minutes. I found that *tm1180* animals suppress locomotion and defecation quiescence during SIS, while *stj10* animals only suppress locomotion and not defecation quiescence.

Based off of these results, I hypothesized that NLP-14 peptides A and C were the central regulators in the defecation pathway during SIS. To further test this hypothesis, I created multiple transgenic animals inducible by heat shock promoter, which over-expressed each of the 5 NLP-14 peptides separately. Previous work in the Nelson lab shows that ectopic over-expression of all 11 NLP-14 peptides results in the inhibition of defecation and locomotion, suggesting that NLP-14 peptides are sufficient in inducing sleep-like behavior.

My results show that the over-expression of the NLP-14 A peptide induces a significant decrease in locomotion after heat shock, while not affecting the defecation rate in the animals. However, a second transgenic strain overexpressing NLP-14 peptides A, B, and C, resulted in a strong reduction in locomotion and defecation behaviors after heat shock. This tells us that NLP-14 peptides A and B mainly regulate locomotion quiescence during SIS, while NLP-14 C is the central player in modulating defecation quiescence during this sleep-like state.

# Quantification of cAMP Levels in Sleep Regulating Cells From Wakefulness to Sleep in *Caenorhabditis elegans*

Alana Cianciulli, '19

Faculty Mentor: Matthew D. Nelson  
Department of Biology

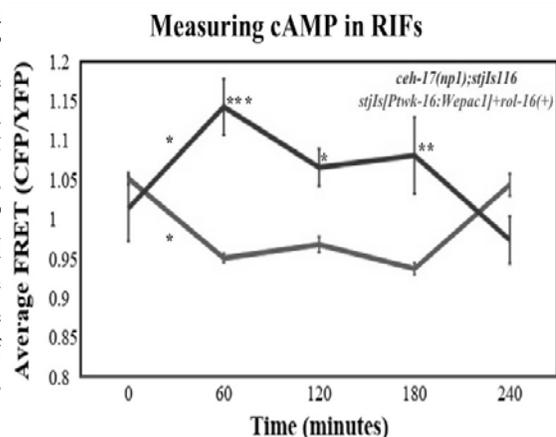


Supported by the John P. McNulty Scholars Program and the SJU Summer Scholars Program

Sleep is essential for life but surprisingly the molecules and signaling pathways which regulate sleep in various organisms are still largely not understood. *Caenorhabditis elegans* is an ideal organism for studying sleep since the pathways identified to promote sleep in this animal have proven to be conserved in human sleep. Sleep in *C. elegans* is characterized by lack of locomotion and feeding and an increased threshold to arousal. *C. elegans* has periods of developmentally timed sleep during their larval stages and stress induced sleep when affected by unfavorable environmental conditions such as a lack of resources or fluctuating temperatures. In the lab, the behavior of the worms during stress induced sleep is observed by applying a stress to the animals such as UV or heat shock.

One pathway that regulates sleep in mammals and worms is the cAMP/PKA pathway. A decrease in cAMP levels leads to decreased wakefulness while higher levels promote arousal. However, how these molecules specifically connect to these behaviors is unclear.

This summer, my project focused on the quantification of cAMP levels in vivo, specifically in the RIF neurons, a pair of neurons in the head of the worm. Using a cAMP biosensor, which has flanking fluorescent proteins CFP and YFP and a cAMP binding site, the change in the levels of cAMP as the worm falls asleep is analyzed by changes in FRET. The biosensor was expressed in the worm using the promoter *twk-16* as stimulating the production of cAMP in these cells drastically reduced sleep in the worms. The cells that express this gene are the CEP Glia cells and the RIF interneurons in the head of the worm and the DVA interneuron in the tail. This past summer, I observed cAMP changes in each of the cells as the worms became quiescent after exposure to UV shock. In these initial experiments, I found cAMP levels remained relatively constant in both the DVA interneuron and the Glia cells but cAMP levels showed a downward trend in the RIF interneurons. As cAMP is a wake promoting signal, the decrease shown in the RIF interneurons was consistent with our hypothesis of cAMP being reduced in the *twk-16* expressing cells during sleep. To further investigate the roles of each of these cells in the sleep pathway, I analyzed cAMP levels after UV stress in a sleep defective strain as well. I compared the results and found the RIF interneurons to have highly significant differences between the two strains. In the sleep defective strain, cAMP levels rose over the course of the sleep period while in the wild type strain cAMP levels were reduced during this period.



# Identifying Genes Downstream of the Sleep-Promoting Neuropeptide NLP-14 in *Caenorhabditis elegans*

Madison Honer, '19



Faculty Mentor: Matthew D. Nelson  
Department of Biology

Supported by the GeoKids LINKS Undergraduate Fellowship, the NIGMS at the NIH (R15GM122058) and the SJU Summer Scholars Program

Sleep is an essential behavior that occurs in all animals. However, little is known about how sleep is regulated and the reasons for its function. Because of the conserved nature of sleep across the animal kingdom, the nematode *Caenorhabditis elegans* is a powerful model organism for studying how sleep is regulated at the molecular level. *C.elegans* is ideal because of a simple nervous system (302 neurons), ease of maintenance, availability of genetic tools, and the conserved neurochemistry to humans.

One of the primary objectives that our lab focuses on is the molecular regulation of sleep, specifically stress induced sleep, or SIS. SIS is a behavior that occurs after the worm is exposed to a stressful environment. A single neurons, the ALA, is responsible for controlling this behavior (Hill *et al.* 2014). In response to a stressor, the ALA neuron secretes a series of signaling molecules called neuropeptides (Nelson *et al.* 2014), molecules that control sleep in both *C.elegans* and humans.

Our lab focuses on the neuropeptides encoded by the gene *nlp-14* because we have found that ectopic over expression of *nlp-14*, induces sleep like behavior. Through a forward genetic screen, suppressor mutants were isolated that fail to become quiescent following over expression of the *nlp-14* gene. The genomes of the mutant worms were sequenced, and the strain *stj9* harbored a mutation in the *cat-1* gene as the strain *stj6* and *stj8* harbored mutations in the *fipr-22* and *fipr-23* genes, respectively. Since there were many additional mutations in these mutagenized animals, my project focused on determining if *cat-1*, *fipr-22* and/or *fipr-23* are the ones responsible for the NLP-14-suppression. To accomplish this I quantified SIS in these mutant strains and found that SIS was reduced in each background. Future work will measure SIS in transgenic animals in which the candidate genes are rescued; this will allow us to determine which genes are downstream of NLP-14-signaling. Understanding these pathways in *C. elegans* will shed light on how sleep is regulated in all animals, even humans.

# Investigation of cAMP *in vivo* Using the Optogenetic Tool Ilac22 in *Caenorhabditis elegans*

Lauren Yoslov, '20

Faculty Mentor: Matthew D. Nelson  
Department of Biology



Supported by the NIGMS at the NIH (R15GM122058) and the SJU Summer Scholars Program

For all animals, sleep is essential and the mechanisms that control it are conserved. A detailed understanding of the pathways that regulate sleep is lacking. The genetically tractable nematode *Caenorhabditis elegans* is a powerful model for studying sleep pathways with cellular and molecular precision. In *C. elegans*, the sleep states are defined by a lack of movement and feeding with an increased arousal threshold. Sleep occurs in these animals during a period called lethargus, which is the transition between larval stages; this type of sleep is called developmentally time sleep (DTS). Additionally, if a worm encounters an environmental stress, they will sleep in response to it. It has been proposed that this is to allow for recovery from any injuries; this sleep is called stress induced sleep (SIS).

We can manipulate and measure the activity of *C. elegans* neural circuits using genetically-encoded biosensors and light-activated proteins. One pathway that can be leveraged using these tools and that regulates sleep in animals is the cyclic adenine monophosphate (cAMP)/Protein Kinase A (PKA) pathway. An increase in cAMP levels leads to increased arousal and lower levels promote sleep. cAMP levels can be measured *in vivo* using the genetically encoded biosensor epac-1 camps. This biosensor has two fluorophores, cyan fluorescent protein (CFP) and yellow fluorescent protein (YFP) that change conformation when cAMP is present, resulting in a different transfer of energy, a phenomenon known as Förster Resonance Energy Transfer (FRET). When cAMP is present, CFP does not transfer as much energy to YFP because the fluorophores move further apart. Relative cAMP levels can be measured by calculating the CFP/YFP ratio over time.

The objective of this project was to ensure the functionality of the epac-1 camps biosensor *in vivo* since it has never been used to measure cAMP in a living animal like *C. elegans*. To do this, we made a transgenic strain that expresses epac1-camps and a red-light activated adenylyl cyclase called Ilac22 in the same neurons. Ilac22 converts ATP to cAMP when the animals are exposed to red light. We focused on single neuron called AIY and exposed the animals to red light for a period of 20 minutes and compared the CFP/YFP ratio to control animals that were left in the dark for the same period. We found that there was a significant increase in the CFP/YFP ratio and thus cAMP levels as the 20 minute red light period progressed and compared to those animals in the dark. Thus, our data suggests that epac1-camps is indeed functioning *in vivo* and can be employed for studying the cAMP pathway during sleep.

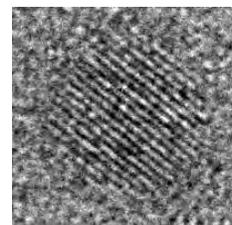


**J. Scott Niezgoda**  
Department of Chemistry  
Saint Joseph's University

Ph.D. Vanderbilt University

**Research Interests:** Nanotechnology, Materials Chemistry, Semiconductor Nanocrystals

I am constantly fascinated by all things tiny. The world dictated by quantum fluctuations and indeterminate probabilities is like a nonsensical mystery that we can actually experience through experimentation. This interest in the atomic world led me to the field of colloidal semiconductor nanocrystals; miniscule pieces of crystal suspended in liquid that we can rather easily synthesize and characterize in lab. These little crystals are so small, in fact, that when imaged with a high-resolution electron microscope, one can often see the individual atoms or rows of atoms that make up the crystal (as seen in the inset image). Furthermore, because these crystals inhabit size scales that are so small, their electronic properties are heavily influenced by quantum mechanics, which is why they are usually referred to as "quantum dots" (QDs). If one held a chunk of cadmium selenide (CdSe) crystal in their hand and shined a UV light on it, the material would emit a very dark red light. However, a materials scientist can controllably synthesize QDs of CdSe that emit any color from violet to red, just by changing the size of the individual crystals. Their electronic tunability, strong fluorescence and liquid stability has made QDs exciting candidates for applications in LEDs, solar panels, biological imaging agents and solution-processed transistors, to name a few. Imagine being able to use a laser printer to print a solar panel from quantum dot ink, or imaging tumors ex vivo using IR-emitting QDs.



Regardless of the specific QD material, in order to preserve the stability of the nanocrystals in solution they must be coated with soap-like surfactant molecules known as "ligands". Generally, these ligands have a polar head group that binds to the QD surface and a fatty carbon chain that solubilizes the crystals in organic solvents. A major thrust of my research involves the customization and on-particle alteration of these ligands. By utilizing chemical techniques to transform or alter the ligands on the surface, we can tune the solubility, electronics and interparticle spacing properties of the QDs to our liking. For instance, by synthesizing QDs with long fatty ligands containing an engineered glycol group within the carbon chain, we are able to cleave, or snip, these ligands to shorter chain aldehydes. This cleaving spontaneously changes the solubility and interparticle distance of the QDs.

Another area of interest in my lab involves the formulation of new synthetic method for relatively understudied systems of QDs. In particular, we are interested in synthesizing Sn(IV) dichalcogenide (S, Se, Te) QDs. These materials are composed of relatively low toxicity, earth abundant elements, compared to many other QDs containing Pb, Cd, In, etc. Furthermore, their crystal structure forms 2D sheets, placing them in the interesting and state-of-the-art 2D semiconductors field.

# On-Particle Ligand Modification of Quantum Dots

Erica Litle, '20

Faculty Mentor: J. Scott Niezgoda  
Department of Chemistry

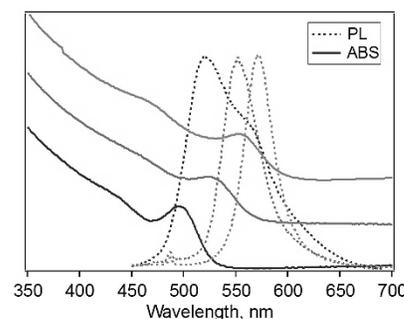


Supported by the Robert & Carla Conaty Research Fellowship and the SJU Summer Scholars Program

Quantum dots (QDs) are tiny particles that have properties that vary from their bulk material counterparts. The semiconductor properties these particles exhibit allow for the manipulation of their optoelectronic properties through a process called “quantum confinement”. These dots can have radii from ~2 to upwards of 10 nanometers. Alteration of quantum dot’s size, material, and shape can change the frequency of light emitted. In addition, these particles are coated with ligands that allow for the colloidal suspension to form in which the QDs are fully dissolved in solvent. Generally, these ligands are long fatty carbon chains, which render the QDs soluble in nonpolar media.

On-particle ligands influence many properties of quantum dots, such as their solubility, spacing, and optoelectronic properties. If one wishes to vary the properties of these dots, the original ligand must be removed entirely and be replaced with the desired ligand. There are many issues with this method including the difficulties of performing such an exchange in solution as well as this exchange resulting in a reduction of the photoluminescence of the dots, a feature greatly valued. My research this summer has centered around avoiding these issues by custom tailoring a ligand, attaching it to a quantum dot, and then attempting to cleave this ligand as it remains attached to the dot.

This summer began with making our desired ligand: dihydroxystearic acid (DHSA). From there, the cadmium:dihydroxystearate precursor was formed utilizing heat, DHSA, cadmium oxide, dimethylformamide (DMF), and diphenyl ether (DPE). After many trials to create quantum dots ligated with the DHSA ligand, a reliable synthesis was found. Octadecene (ODE) and the precursor are first placed in a flask and heated under vacuum in order to remove the DMF and DPE. This key step is necessary in order to raise the boiling point of the reaction. The diagram at right shows the photoluminescence and absorbance of three separate batches of these quantum dots. After the successful synthesis of the quantum dots with the desired ligand, various molarities of lead tetraacetate (LTA) were employed to attempt to cleave the ligand. Upon introduction to the cleaving solution, the dots maintained their coloring, were capable of redissolving in solution, and showed shifts in their FTIR spectrum suggesting successful cleaving. Continued experimentation with this cleavage is still necessary as we hope to take NMR spectra of the LTA treated groups to ensure the ligand was cleaved as well as to take more concentrated NMR spectra to find better peaks.



# Progress Towards Synthesis of Size Tunable Tin (IV) Chalcogenide Quantum Dots

Griffin Spence, '19



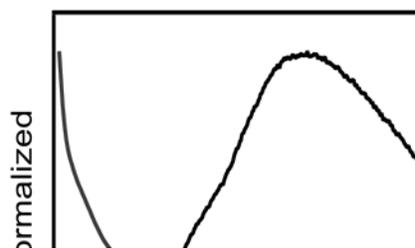
Faculty Mentor: J. Scott Niezgoda  
Department of Chemistry

## Supported by the SJU Summer Scholars Program

As technology advances, we are turning to new ideas to increase our efficiency. Quantum dots (QDs) are a relatively new semiconductor nanomaterial that have become a hot topic within the scientific world because of their tunable properties and low-cost fabrication. The process of synthesizing quantum dots depends heavily on temperature and monomer size in order to have control over their final size and optoelectronic properties. This nanomaterial's size allows it to emit sharp colors almost saturated as those observed in nature. For instance, smaller QDs (2-3 nm) are able to produce colors like blue and green whereas larger examples (5-6 nm) are able to produce colors like orange and red, due to an effect called "quantum confinement". Tin has become a popular area because of its cheap price and low toxicity.

The objective of this research project is to find a new synthesis for size tunable tin (IV) chalcogenide quantum dots. The chalcogenide group contains the elements sulfur, selenium, and tellurium. The tin (IV) precursor consists of a reactive tin (IV) salt, a surfactant, and a solvent. The chalcogenide precursor consists of a chalcogenide dissolved in a liquid to make a reactive solution. The synthesis is done by injecting the chalcogenide precursor into the tin (IV) precursor under heat and rapid stirring. The nanocrystals will form and grow as long as heat is applied to the flask. After the reaction is done, the solution is taken off the heat and cleaned using a solvent/antisolvent mixture. This mixture allows the QDs to precipitate while all of the waste stays dissolved in solution. This was done with the help of a centrifuge so the QDs were pulled to the bottom of the tube.

The most promising experiment done was with selenium to try to make tin (IV) diselenide,  $\text{SnSe}_2$ . An absorption and photoluminescence graph was obtained that showed the product fluoresced bright blue with UV light. The product also starts to absorb around 400 nm which can also be seen in the graph to the right. A transmission electron microscope (TEM) image was obtained and it confirmed that some sort of nanocrystal was made. In the future, an X-ray diffraction analysis, elemental analysis, and high-resolution TEM is needed in order to obtain better data to keep on working with our product.





**Monica L. Nixon**  
Office of Inclusion and Diversity  
Saint Joseph's University

Ed.D. University of Washington

**Research Interests:** Agency and Positionality of Women of Color Leaders in Higher Education; Intersections of College Students' Racial/Ethnic Identity and Sexual Orientation; Integration of Inclusion Practices in University Structures

Research demonstrates that four interconnected core principles are necessary to developing institutional capacity for inclusive excellence into all aspects of a university's functions (AAC&U, <https://www.aacu.org/making-excellence-inclusive>). First, there must be attention to building compositional diversity of the community across individual and group/social identities and experiences. Second, intentional and consistent attention must be committed to increasing inclusion through developing broader content knowledge, deeper cognitive complexity and empathic understanding of the ways that people interact with one another and with systems. Third, the university must create opportunities for minoritized groups to achieve equity of access to educational programs and learning opportunities. Finally, individual members of the community, as well as the organization itself, must demonstrate equity-mindedness in committing resources and energy to addressing the complex challenges and tensions of inclusive excellence.

The university is committed to preparing our students to understand, live among, and work in an inherently diverse and multidimensional country and world. Saint Joseph's University is a place that invites our community members to learn and grow from one another's experiences. To do this well, the institution must commit to fostering a learning and working community that not only values diversity, but also models the principles of inclusive excellence throughout the university. The goal is an institutional culture where there is no false dichotomy between our values of diversity and inclusion, and our goals of educational quality and excellence.

Students who engage diversity in their academic coursework demonstrate a wide range of individual, institutional, and societal benefits, including critical thinking, moral development, intellectual engagement, interactional diversity, vocational preparation, and civic engagement (Bowen & Bok, 1998; Gurin, Dey, Hurtado, & Gurin, 2002; Hu & Kuh, 2003; Parker, Barnhardt, Pascarella, & McCowin, 2016; Sulé, 2011). A key part of inclusion work on college campuses should focus on creating structures that consistently expose students to diversity and equity in their coursework and in co-curricular opportunities.

# Effectiveness of Diversity Courses at SJU: Analysis and Assessment to Track Student Progress

Tamar Bourdeau, '20

Faculty Mentor: Monica L. Nixon  
Office of Inclusion and Diversity



## Supported by the SJU Summer Scholars Program

Part of Saint Joseph's mission statement includes “striving to be an inclusive and diverse community that educates and cares for the whole person.” Diversity is one of the university’s 6 student learning outcomes. Learning about diversity prepares students to engage with diverse groups. It illuminates, explains, and helps students understand everyday dynamics.

At many universities, students are required to take courses outside of their majors/minors to enhance their knowledge. At Saint Joseph’s University students choose from courses offered in the General Education Program. Specifically, there are requirements for Diversity/globalization/non-western area studies (DGNW). All undergraduate students must take one class meeting the DGNW overlay. In the DGNW overlay, there are specific outcomes for diversity, globalization, and nonwestern area studies subcategories. Although these subcategories are different, they are grouped into one overlay. Courses are certified by the General Education Program DGNW committee to meet one or more of the overlay subcategories.

In my summer research, I focused on the diversity subcategory of the DGNW overlay. With a strong emphasis on diversity in the university’s mission statement, it's important to analyze the diversity courses offered by the university to understand whether students are meeting the outcomes of the overlay. My project involved two components: analyzing what percentage of students are exposed to the diversity overlay and how student learning in the diversity courses is measured. Currently professors utilize a variety of assessments. I investigated whether the current assessment structure could be enhanced with more consistent assessment strategies.

My study provides an analysis of the DGNW overlay through a dataset of student enrollment in courses fulfilling the DGNW overlay from the past 8 years. I used a dataset from the Registrar's Office of 11,170 students who have taken a diversity indicated course from fall 2010-fall 2018. Students’ identities were anonymous, but the dataset included ethnicity, gender, and college. Students enrolled in the College of Arts and Sciences enrolled more often in diversity courses than students in the Haub School of Business. Tables 1 and 2 below show student enrollment in diversity-indicated courses by ethnicity and gender.

I investigated current assessment methods used by professors to fulfill the diversity learning outcomes. For the past several years Dr. Ken Weidner has used the Social Dominance Orientation as a pre- and post-test for students enrolled in his DGNW-certified first-year seminar. Students demonstrated drops in their social dominance orientation between the administrations of the pre- and post-tests (Weidner, personal communication, June 2018). The test is validated and easy to administer. I recommend an integration of the social dominance orientation survey across all diversity overlay courses.

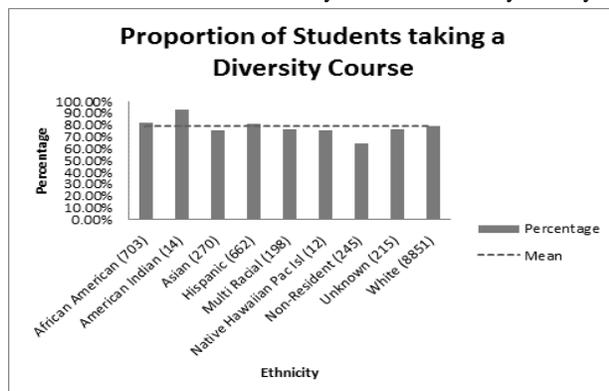


Table 1

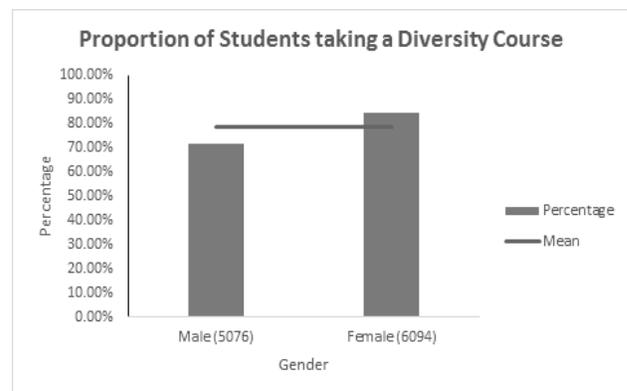


Table 2



**Peter C. Norberg**  
Department of English  
Saint Joseph's University

Ph.D. Rice University

**Research Interests:** American Literature Prior to the Civil War with Emphasis on Writings of Herman Melville, Ralph Waldo Emerson, Margaret Fuller, Henry David Thoreau, Nathaniel Hawthorne and Harriet Beecher Stowe; New England Transcendentalism and its Origins in British and German Romanticism; the Transatlantic Literary Marketplace; Political Theories of Democracy

In addition to my other projects, I am Associate General Editor of *Melville's Marginalia Online* (<http://melvillemarginalia.org/front.php>) an electronic archive of Herman Melville's reading that includes critical editions of surviving books from Melville's personal library. The marginalia Melville left in his personal library are essential to the manuscript archive for his fiction and poetry because many of these volumes served as primary source material for his published works. The working manuscripts for most of Melville's major works are either unlocated or destroyed, but one can find valuable clues to his compositional processes in the margins and on the endpapers of the books he had before him while he wrote. In writing such masterworks as *Moby-Dick* and *Billy Budd, Sailor*, Melville drew heavily from other books for factual details, stylistic techniques, and aesthetic form. Using digital photographic enhancement processes, we have also recovered significant new evidence that reveals previously erased marginalia in multiple volumes, including, most recently, Melville's personal copy of *The Poetical Works of John Milton* (Boston: Hilliard, Gray, 1836). This recovery work has uncovered new evidence of Melville's creative processes and his aesthetic, religious, and political concerns. To date, we have published 26 titles, including Melville's 7-volume set of *The Works of William Shakespeare*, his copy of the *New Testament and Psalms*, and his copy of Thomas Beale's *The Natural History of the Sperm Whale*, a significant source for *Moby-Dick*. There are also an additional 21 titles in production, representing one sixth of the 285 extant titles from Melville's library.

# **The American Back-to-Nature Movement: Literature, Film, and Social Reform**

George A. Frattara, '20

Faculty Mentor: Peter C. Norberg  
Department of English



Supported by the SJU Summer Scholars Program

American conflicts in socio-economics, morality, and ethics have drawn many people to abandon societal obligations and set off, as Henry David Thoreau put it, "to live deliberately" in nature. The quest to secluded life in the wild is to many a chance to rediscover life in its most essential parts and, for some, to become exemplary figures for social reform. The back-to-nature movement, beginning in the 19th century as embodied by Thoreau, has found a revival in recent times. Such resurgence has accumulated cult followings and is manifested in popular culture by the likes of Christopher McCandless and Richard Proenneke, who have come to represent an archetypal division in American ecological sentiment. These cases illustrate both a crucial warning against the idealized misinterpretation of Thoreau's ideas and a path to the improvement of society.

McCandless, after graduating with honors from Emory University, abandoned both law school aspirations and contact with his family and friends. Inspired by Thoreau, he instead set out alone into the wilderness. For him, confused and adolescent interpretations of Thoreau's call to freedom inevitably proved fatal. After spending 122 days alone in Alaska, his body was found in an abandoned transport bus miles outside of Fairbanks. His story became wildly popularized by Jon Krakauer's book, "Into the Wild", and a cult-classic film bearing the same name.

Proenneke tells a much different story. After building a log cabin alone and by hand in Twin Lakes, Alaska, he spent 35 years in Thoreauvian living. Proenneke documented these years in a series of journals and movies which were later converted into a novel and PBS film. He used this popularity to spread messages of the benefits of simplistic living and the protection of nature. His demonstration of responsible exposure to the wild shows a true understanding of Thoreau's call to prudent, deliberate living.

Thoreau's famous expedition, living in isolation at Walden Pond for two years, directly inspired these unlike cases. "Walden" calls on those who feel trapped in the vanity of society and are missing the connection with nature that is necessary for self-fulfillment. Thoreau challenges readers to build a new foundation for life which incorporates self-reliance and simplicity. For Thoreau, isolation from society is a means to clear oneself from the clutter of everyday life. As we rush headfirst into the age of technology, it becomes easy to confuse the essential parts of existence with unnecessary obligations. Temporary, deliberate isolation from the tedium of daily life is a means by which one can recoup lost perspectives. Filtering one's perceptions through the minutiae of nature, as Thoreau often describes in his walks and environmental descriptions, is a meditative act which can help breed ecocentric views and self-fulfillment.

With the popularization of the back-to-nature movement, it is important to monitor the ways in which Thoreau's ideas are manifested in reality. Lawrence Buell famously advocates for a "green" reading of Thoreau. We are thus challenged to use the lessons of "Walden" to re-examine modern life and redefine our relationship with nature as one rooted in reciprocity. Knowing this, we have a crucial chance to follow Proenneke's example and implement the use and preservation of nature in modern living and public policy.



**Michelle M. Rowe**  
Department of Health Services  
Saint Joseph's University

Ph.D. Temple University

**Research Interests:** Autism Spectrum Disorders, Stress, Burnout and Coping

Dr. Michelle Rowe is the Executive Director of the Kinney Center for Autism Education and Support and Professor of Health Services at Saint Joseph's University. Dr. Rowe is a biopsychologist who focuses on how the physiology of the brain affects health and behavior. Over the past 15+ years her research has explored how people cope with significant stress, and more recently, how families and service providers cope with the unique demands of living with, caring for, and/or working with individuals with autism. Her hope, in working in the field of autism, is for those with autism to be integrated as valued and contributing members of society, and for their families to see them reach their full potential.

Dr. Rowe has been teaching at the college level since 1990 and joined the faculty at Saint Joseph's University in 1993, where she received both teaching and research awards. Dr. Rowe is also a licensed psychologist. In 1997, Dr. Rowe developed the undergraduate major in Interdisciplinary Health Services in the Department of Health Services. In 2004, she created the Saint Joseph's University Autism Awareness Day, which occurs annually in April. She teaches undergraduate and graduate courses in autism spectrum disorders, chronic illness and disabilities, health behavior and research design and statistics. She has authored over 70 peer-reviewed scholarly papers, chapters and presentations.

# **A Survey Study to Identify the Outstanding Educational Needs and Sources of Education for School Nurses Regarding Autism and the Needs of Students With Autism**

Evelyn Russo, '19



Faculty Mentor: Michelle M. Rowe  
Department of Health Services

## **Supported by the SJU Summer Scholars Program**

Autism spectrum disorder is extremely complex, and the unknowns seem to be endless at times. Fortunately, research on the disorder has been on the rise. Many studies have delved into possible causes, treatment methods, medications, and various other aspects of the disorder. However, there seems to be a gap in knowledge of the disorder as a whole, including area specialties such as school nursing. School nurses work closely with many individuals on the spectrum, yet they require additional education to assist these students in the best, most effective ways possible. Through my Summer Scholars research, our hope was to determine the gaps in education for school nurses. In the future, this research can help reveal where the gaps lie, and where improvements can be made to enhance Autism spectrum disorder education within local school systems.

Research was conducted using surveys that were sent out via email through the National Association of School Nurses (NASN) to school nurses within the NJ, PA, DE educational systems. Of the 108 individuals in the Tri-state area who responded to the survey, nearly 77% of nurses answered that they felt competent in carrying out their role as a school nurse. However, about 40% of respondents felt that their education did not prepare them well enough to handle this population of individuals. In order to draw more conclusive results from this research, further surveys will need to be sent out and completed. Full research results to be analyzed during the 2018-2019 academic year.

My overall contribution to this research project included literature review, data assessment, and writing on key areas regarding autism in relation to the educational needs of school nurses. Initial Summer Scholar work required me to meet with SJU Librarian, Brendan Johnson, for training on the use of proper research key terms, search engines, reference lists, and literature review techniques. Firstly, I utilized different SJU databases to collect information for my literature review, assessed all literature for use within manuscript writing, and entered all information into an electronic literature repository. Secondly, I conducted an ongoing review of the NASN survey submissions, results, and submitted feedback, and survey gap assessment. Thirdly, once all of the above items were complete, the last portion of my Summer Scholar work included formation of a manuscript template, inclusion of my found literature, section writing, use of electronic literature repository, and identification of all survey results for inclusion into publication submission. Our hope is to submit this study for publication in Fall 2018.

Having a minor in Autism Studies and working at the Kinney Center for Autism Education and Support have been extremely beneficial for me in conducting this research. These experiences have exposed me to individuals across the spectrum, helped me gain a better understanding of autism as a disorder, and have helped me achieve a greater sense of compassion for all people.



## **Brendan T. Sammon**

Department of Theology and Religious Studies  
Saint Joseph's University

Ph.D. Catholic University of America

**Research Interests:** Theology of Beauty,  
Theological Aesthetics, Theology of Disability

One of my primary areas of research concerns the theology of beauty or what is more commonly known as theological aesthetics. This is, in its simplest expression, a way of approaching God through the event and experience of beauty. Historically, this approach to God derives most fundamentally from the tradition of the divine names—a tradition found in all three major monotheistic faiths (Judaism, Christianity, and Islam). In Christianity, one of these names for God was beauty, identifying the way in which our natural experiences of beauty open us to something beyond nature, something divine. From the earliest origins of philosophical inquiry up to contemporary aesthetic discourse, beauty has always proven itself to be something that resists conventional modes of human thought while simultaneously uplifting that thought into something beyond, something that nourishes, fulfills, and augments it. Beauty, it might be said, calls us to new ways of thinking and being.

For this reason, beauty proves itself to be not only helpful but indelible for enriching both human experience and the reflection upon that experience found in the variety of discourses that constitutes human thought. Beauty is the first event of attraction to any experience or thought and so is there at the origins and activity of human consciousness. Beauty also expands that consciousness by instilling a desire for more of itself, pushing the inquiring intellect into ever new frontiers of exploration. Beauty is unique in that it both provokes and excites human desire while simultaneously bringing that desire to rest without causing desire to stagnate. Classical accounts of beauty saw it as a mode of being whereby the unity of existence itself appeared and attracted through the diversity of beings that exist. In this way, beauty balances in glorious harmony a unity in plurality and a plurality in unity.

The theological study of beauty, then, is the study not only of how God attracts or calls human beings to his own divine beauty, but also, as Hans Urs Von Balthasar—the father of contemporary theological aesthetics asserts—a new way of seeing. This capacity to see enriches every facet of human existence, whether social, political, economical, educational, and even mathematical and scientific. When beauty opens new ways of seeing it also impacts the variety of practices that constitute human activity.

One area of particular, though long term, interest to me concerns the phenomenon of human disability. It is my contention that a theology of beauty holds important riches for seeing the beauty of persons who are considered 'disabled' or 'differently abled.' The many strategies for approaching disabled persons today have proven fruitful. However, many of these strategies, informed as they are by trends in modern and postmodern thinking, tend to function as values extrinsically imposed upon social consciousness. It is my belief that a theology of beauty offers a more organic or internal way of embedding these values, thus fortifying them for posterity. Beyond attempts either to integrate disabled persons into a supposedly neuro-typical world, or to elevate them beyond the world into some holier-than-us status, a theology of beauty enables the beauty of human disability to contribute in its own unique way to the overall beauty of a creation brought forth from the Divine Source of all beauty.

**“You Never Had A Camera In My Head”:  
The Contribution of Thomas Aquinas to  
Contemporary Disability Discourse**  
Meghan Quinlan, '19

Faculty Mentor: Brendan T. Sammon  
Department of Theology and Religious Studies



Supported by the SJU Summer Scholars Program

The forms of disability discourse examine the way in which disability is understood from different perspectives and how it is constituted due to its relationships with the social, medical, and political practices. The contemporary approach to disability tends to uncritically adopt the anthropology dominant in the modern period. The modern period, identified as the span of time from the European Renaissance to the middle of the 20th century, brought about a new story of the world. This story, influenced largely by the so-called “enlightenment” reconfigured how Western social orders understood God, human nature, society, and the interrelations among these. More particularly, certain theories about human nature began to challenge the more traditional notions concerning the pre modern vision of the human person. In this early Christian story humans were viewed as creatures whose very being derived from a divine Creator in which they shared a divine bond, not only with God, but with one another. Since the humans within this story are understood according to a relational principle, the idea that all are brothers and sisters whose very existence is bound up with the existence of others was enabled. Yet, throughout time this began to change with the so-called ‘turn to the subject’, marking the anthropology that is present in the modern period.

This anthropology is one which prioritizes independence and autonomy as necessary components of authentic human nature. When human nature is configured according to the principles of autonomy and independence, it follows almost necessarily that knowledge of another person can only be acquired, and thus the value of the human person affirmed, according to the individual person’s self-expression. Although there is value in this position, conditions are then created where self-expression becomes viewed as the most, and if not the only, legitimate way one can manifest their humanity. Given this, the main question explored in this project was what this means for those with cognitive impairments. What is the impact of this modern day anthropology on those with cognitive disabilities? Are there alternative ways or other resources to better understand this situation? The goal of this study was to demonstrate the limits of such a value when confronted by cognitive impairments and proposes a way forward.

As a biology major, this interdisciplinary study required utilizing diverse research methods. The project was carried out primarily through independent research using a dynamic critical integration of historical inquiry with contemporary disability discourse. The historical inquiry consisted of reading the 13th century theologian and philosopher, Thomas Aquinas, who offers an alternative perspective about human rationality and the overall value and dignity of the person. In particular, his position regarding our inability to ever fully know or understand the internal dimensions of a person, in order to investigate how a theology of disability fills this missing part. Using the medical and social model within this discourse, research also focused on the limits and benefits of these models from primarily first person experiences.



**Becki S. Scola**  
Department of Political Science  
Saint Joseph's University

Ph.D. University of California, Irvine

**Research Interests:** American Political Institutions, Gender Politics, State Politics, Inequality, Representation, Intersectionality

Who is represented in American institutions, broadly defined? Whose voices are heard and whose are ignored or overlooked? Who has power, and who does not? Where, how, and why? These are the primary questions that guide all of my teaching and research projects, and I am especially interested in how representational variation impacts the politics and policy of historically disadvantaged groups of citizens through an intersectional lens.

My students and I have been working on a project that assesses anti-hunger advocacy in Philadelphia and across the nation. Families who are food insecure are not well-represented within our political system, and they often lack a voice in the public policymaking process. We are mostly concentrating on the type of policy agendas and advocacy that anti-hunger non-profits produce and advance, as well as measuring the success of these initiatives. Our goal is to shed light on why the rate of food insecurity within Philadelphia continues to rise, despite the presence of several advocacy organizations within the city and the state that are committed to alleviating hunger. After our Philadelphia study is completed, we will expand this project to other states and compare how anti-hunger organizations impact social policy within the larger and interrelated realm of local, state, and federal agencies.

This project is an expansion of other areas of my research agenda, where I study how the intersection of gender, race/ethnicity, and class affect and inform civic participation within several representational arenas, including state legislatures, community organizations, and among the voting populous. At the state level, I examine the variation in state legislative office holding among women and people of color, as well as how their presence affects voter turnout across the states. Importantly, a legislator's gender and race/ethnicity matters because it tends to increase the likelihood of voting among constituents with similar identities.

# **Where Democratic Representation Intersects Food Insecurity: SNAP Enrollment's Influence on Pennsylvania State Representatives**

Megan Lynott, '19



Faculty Mentor: Becki S. Scola  
Department of Political Science

## **Supported by the SJU Summer Scholars Program**

In the United States, food insecurity continues to be a persistent issue faced by the poorest Americans. The primary program used to alleviate food insecurity is the Supplemental Nutrition Assistance Program (SNAP). SNAP is a federally funded program that is administered by state governments, and it provides individuals and families with an electronic benefits card (EBT) that allows them to purchase food. Because SNAP is administered by the states, state legislators' actions on policies that both restrict and expand access to SNAP have significant impact on who can be eligible for SNAP enrollment as well as the extent to which food insecurity can be alleviated within communities. Therefore, it is important that researchers, advocates, and citizens grasp a thorough understanding of the significant factors that influence the way law makers act on food and SNAP policy.

In terms of representing the poor, scholars debate over the most important factors that influence legislative activity related to poor constituents. Some of the most discussed factors include institutions, the affluence of constituencies, and the financial background and identity of individual legislators. However, the factor I investigated this summer, which has resulted in divided scholarship, is the severity and presence of an issue within a congressional district. In other words, does the size of an issue - such as poverty and food insecurity - within a district have any influence on how legislators represent its poorest constituents? This is the question I investigate with my research, and specifically analyze if the number of people enrolled in SNAP within Pennsylvania State House Districts has any influence on the way representatives act on food and SNAP policies.

I conducted analysis of voting and sponsorship decisions on selected legislation from the 2017-2018 Regular Session of the Pennsylvania House of Representatives that either sought to restrict or expand SNAP accessibility and food access. I then assessed if the percentage of SNAP enrollment per house district had any influence on legislative decisions by pairing legislators with opposite voting and sponsorship records, while controlling for party, the socioeconomic status of the representatives, and the Median Household Income per district. I then proceeded to analyze if the number of people enrolled in SNAP had any influence on the representatives' legislative activity.

Conclusively, I found that SNAP enrollment per district does appear to have influence on the way representatives act on food and SNAP policy. I found in most cases, legislators with more SNAP recipients in their district voted against restrictive policy and sponsored expansive policy. These results are important and useful because they show that the number of people participating in SNAP in a district can be used to anticipate how representatives will act, and should encourage advocates to assist in getting more food insecure people enrolled in SNAP, as larger participation rates tend to result in favorable actions toward expansive SNAP and food policy.



**Elaine M. Shenk**

Department of Modern & Classical Languages  
Saint Joseph's University

Ph.D. University of Iowa

**Research Interests:** Linguistics

As a sociolinguist, I am interested in the interaction of linguistic and social phenomena. Linguistic phenomena include phonetic, morphological, syntactic, and pragmatic features. Social phenomena include symbolic values assigned to different language varieties, ideologies about specific language features, and language policy, among many other possibilities. One way that we can analyze language in specific social contexts is through Critical Discourse Analysis (CDA). We examine how spoken or written texts are produced and distributed in society, we analyze discourses about those texts, and also situate them within a social framework, moving between a micro- and macro-analysis of text and context. CDA considers the spoken content, who is speaking and to whom, the words, pronunciations, or grammatical options that the speaker chooses, and the contextual information that can shed light on these choices. As one specific example, the use of particular pronouns (she, he, they) to refer to ourselves or to others is one of innumerable linguistic features that we as speakers make choices about on a daily basis. These decisions are significantly affected by social factors, including, for example, an active construction of gender identity.

In this way, Critical Discourse Analysis is used to examine a wide variety of linguistic decisions that we as speakers make every time we communicate with others. Some decisions occur in situations of language contact. As one example, bi- and multilingual speakers choose which of their languages to speak at any given time, taking into account their interlocutor(s), context, topic, symbolic values, sociopolitical factors, and much more. Much of my research focuses on contexts of Spanish-English language contact, particularly among Latinx populations in the United States as well as among Puerto Ricans in both the U.S. and Puerto Rico. On the Island, Spanish and English have been co-official for over one hundred years, and although Spanish is the clear language of choice, English is also present to varying degrees in oral and visual language practices. In the United States, these two languages are also in frequent contact in heritage language populations as well as in immigrant communities. The sociopolitical context of these interactions is crucial since the predominant perspective in a society about the topic of immigration, for example, may impact a speaker's decision to use one language instead of the other at a given point in time, based on who is listening. I typically collect data through personal interviews, participant observation, the content of public speeches, legislative debates, and the news media. I am interested in exploring speakers' ideologies about topics such as language officialization, dialectal features, loanwords, and codeswitching, as well as speakers' decisions about their own language use and practices. Language ideologies are often based more on socially- or politically-determined values than on purely linguistic values, and for this reason we incorporate linguistic, social, historical, and political realities into our research objectives and analysis.

# Defying the (Hetero)Norm: Accommodations of Gender Non-Conforming Identities

Rachel Cox, '19

Faculty Mentor: Elaine M. Shenk  
Department of Modern & Classical Languages

Supported by the SJU Summer Scholars Program



Queer Linguistics (QL) is an area of language study that focuses on gender identity and sexual orientation. In terms of gender identity, QL examines the ways in which language often reflects the binary (where the only two genders are man and woman) as opposed to the continuum (where there are more than two genders). In the English language, gender is assigned to other people largely based on appearance, even though personal identities are shaped mentally and physically. Gender assignment can be references like “man, woman, boy, or girl” or pronouns such as “he/him”, “she/her” or “they/them.” There are other gender-neutral pronouns like “zie/zir” or “xe/xem” as well. Thus, my project sought to consider how people accommodate gender in their usage of pronouns when telling stories about people solely based on photos.

The data collection consisted of two parts. First, a slideshow was shown to each participant. On each slide was a picture of a model and the participant was asked to tell a short story about each one. There were nine photos, with the models split into three categories: androgynous, traditionally feminine, and traditionally masculine. After each participant told their story, they filled out a questionnaire that asked about their personal identities as well as probed the ways in which they have thought about gender and what it looks like.

Forty participants were interviewed. Ages ranged between 18-55 with 19 of the participants being in college. Racial identities were Asian, Black, Cuban, Hispanic/Latinx, Indian, White, or biracial. Sexual orientations were queer, straight, or bisexual, and their gender identities were female, male, and non-binary. There is a consistent pattern of pronoun usage for the models with traditionally masculine or feminine features. For the masculine-presenting models, “he” pronouns were used, and “she” pronouns were used for the feminine presenting models. For the three androgynous models, the results were mixed. Each androgynous model had a consistent gender assigned to them, but 10 participants also used gender-neutral language or noted that they were uncertain of the gender of the model. Three commented that they never hesitated to gender the traditionally feminine or masculine models, even though their appearance does not necessarily mean the model identifies along the binary.

Pausing, or hesitation was also a factor in the assignment of gender. All participants paused to a certain degree before beginning to talk about each model. However, it is possible that the pausing is just the result of each participant thinking about the story they are going to tell, and not them spending time trying to figure out the gender of the model before them. To determine whether pausing could be an indication of gender assignment, more data is needed.

Every participant struggled to answer the questions “What does it mean to be a man?”, and “what does it mean to be a woman?” in the questionnaire. 10% of participants left both questions blank, and another 10% only left the question that asked about the identity they did not have blank. 42% of those who did answer the questions fully did not resort to physical genitalia but rather to personality characteristics, for example linking women with nurturing and men with leadership. My study shows how the understanding of the gender continuum can manifest itself in language use, where 30% of participants tried in some way to express nonbinary options. Participants did use gender-neutral pronouns, and those with more knowledge of gender non-conforming identities were more likely to use these pronouns. Participants who had little knowledge did not use “they/them” pronouns.



**Katherine A. S. Sibley**  
Department of History  
Saint Joseph's University

Ph.D. University of California, Santa Barbara

**Research Interests:** US-Soviet Relations in  
the Twentieth Century (trade, espionage);  
Presidential History; American First Ladies

While my research interests over the last two decades, from my 1996 book on Soviet-American trade to my 2016 volume on First Ladies, may seem rather divergent, I have found there are some links; one in particular is the way in which compelling stories are often overlooked in the traditional narratives of modern American history. Thus, what initially got me interested in Soviet-American relations in the 1920s was the discovery of little-known trade deals between the two nations during a time commonly thought to be one of isolation and hostility. And there was another story; in the 1920s Russians began actively spying on American industry, a practice which only expanded further in the ensuing decades, culminating in their espionage on the atomic bomb in World War II.

Meanwhile, one of the overlooked presidents of the 1920s, Warren G. Harding, was married to an often scorned First Lady, Florence Kling Harding, who, as it turned out, made significant contributions to raising the profile of her office, and well before the better known Eleanor Roosevelt: Florence made the cracks in the mold that Eleanor broke with her concerns about women's political activism and social justice issues. At present, I am working on a new study of Southern first ladies—these women, too, from Martha Washington to Laura Bush, have had an outsize role in shaping the office of First Lady, as well as in their own activism.

My work on First Ladies stemmed from the opportunity to teach a course in women's history here at Saint Joseph's almost 25 years ago, when I noticed such an offering was missing from our catalog. Megan Gentleman '20, a double history and biology major, took this course with me last fall, and was spurred to combine her interests in both fields to explore the historic role of women in STEM as a summer scholar. While many are familiar with the story of the pioneering female mathematicians in Margot Lee Shetterly's *Hidden Figures*, less appreciated is that today, fifty years or more after the Cold War space race, the fields of physics, engineering, and math draw much fewer women than biology, ecology, and genetics. Megan set out to get to the bottom of this disparity in her interdisciplinary project which draws on primary sources, interviews, many secondary sources, and statistical data.

# **The Success of Women in Biology Since World War II**

Megan Gentleman, '20

Faculty Mentor: Katherine A. S. Sibley  
Department of History



Supported by the SJU Summer Scholars Program

This paper seeks to evaluate the roles of women in the field of biology and determine factors that have allowed women to be successful within the field of biology as compared to other fields of STEM. Through focusing on women within the disciplines of health care, genetics, and ecology; the paper discusses important female biologists.

In the discussion of health care, there is a focus on the disciplines of bioethics and obstetrics. Women are crucial to obstetrics because they work in every aspect of the field from midwives to doctors and nurses. The emergence of childbirth education and new birth options is due to an emphasis on patient care and female reproductive health care. Childbirth education is an example of women working to educate other women to improve their health. This can be connected to the end of paternalism and beginnings of bioethics. The discussion of bioethics covers important cases that set legal precedents for medical research and medical practice. It also covers examples of female advocates, such as Barbara Seaman, who worked to protect women from dangerous drugs and misinformation.

Second, the paper covers female geneticists such as Rosaline Franklin. Genetics is complicated and new field of biology, so it is important to highlight the core discoveries made by women. Third, the paper discusses female ecologists. In a world challenged by climate change, this field will increasingly become important. Finally, three potential reasons why women choose to study biology are suggested. One factor is the need to study biology to work within health care. Another is that women believe they are bad at math, and choose a field they see as less math intense. Finally, mentors are needed for success within academia and many are willing to teach women within biology.



**George P. Sillup**  
Department of Pharmaceutical &  
Healthcare Marketing  
Pedro Arrupe Center for Business Ethics  
Institute of Clinical Bioethics  
Saint Joseph's University

Ph.D. The Fielding Institute

**Research Interests:** Media Coverage of Ethical Issues About the  
Pharmaceutical Industry; Levels of Care in Nursing Homes

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 U.S. authorities, to include the FDA and CMS (Centers for Medicare & Medicaid Services). He is and has been a member of several boards of directors, e.g., Daemion Counseling Center, American Heart Association. In 2018, he and colleagues, Dr. Eileen Sullivan, College of Arts & Sciences, and Dr. Ronald Klimberg, Haub School of Business, have published an article in the *International Journal of Behavioural and Healthcare Research* entitled "Reduction of Agitation and Anxiety Observed in a Clinical Study of People with Dementia Using the Timeslips™ Creative Expression Program". Additionally he and Dr. Stephen J. Porth published their 13<sup>th</sup> consecutive audit of the newspaper coverage of ethical issues affecting pharmaceutical industry in *Pharmaceutical Executive* entitled "Pharm Exec's 13<sup>th</sup> Annual Press Audit: Pharma in the Spotlight as Media Coverage Increases" and are working on the 14<sup>th</sup> with the Haub School of Business's Reference Librarian, Cynthia Slater, Pharmaceutical & Healthcare Marketing student and EthicsTrak® Database Administrator, Tyler Pham, and the 2018 Summer Scholars, Kayla Herbert and Caitlin Landau.



**Stephen J. Porth**  
Department of Management  
Saint Joseph's University

Ph.D. Temple University

**Research Interests:** Strategic Management, Leadership and Ethics in the Pharmaceutical Industry

Dr. Stephen Porth is Professor of Management at the Haub School of Business, Saint Joseph's University (SJU), Philadelphia, PA, USA. He also serves as the Senior Editor of the *Journal of Jesuit Business Education*. Steve has chaired three academic departments at SJU and served for 17 years as Associate Dean and Executive Director of Graduate Business Programs. He is the university's Faculty Athletic Representative to the NCAA and has served as chair of the Atlantic 10 Conference Council of Faculty Athletic Representatives (FARs).

Steve's research and teaching interests are in the areas of strategic management, leadership and ethics. Steve provides consulting services specializing in leadership development and strategic management programs. He has written two books, one which is now in its fifth edition and has been translated into Chinese, and he has published extensively in management journals.

Steve serves on the Executive Committee of the Board of *Colleagues in Jesuit Business Education* and on the Governance Board of *IgnitEd*, the platform to support Jesuit higher education. He served as Treasurer of the Board of Directors of *Nutritional Development Services* and is a former trustee on the Board of *Sacred Heart Academy*, Bryn Mawr, PA.

# **Media Portrayal of Big Pharma – An Extension of Research**

Kayla Herbert, '19



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

## **Sponsored by the SJU Summer Scholars Program**

Continuing my research from the summer of 2017, I have expanded my knowledge base interpreting how the pharmaceutical industry is portrayed through different media sources. The Pharmaceutical & Healthcare Marketing Department summer scholars are assisted by SJU's Business Reference Librarian, Cynthia Slater. Ms. Slater's research tactics include using specific keywords to search through different databases to get current and applicable information on the pharmaceutical industry. After Ms. Slater locates the articles we are seeking, she sends them to our mentors, Dr. George Sillup and Dr. Stephen Porth. After Dr. Sillup and Dr. Porth review the articles, they pass them along to the Summer Scholars team for analysis and interpretation. This year, I am collaborating with my peers, Tyler Pham '20 and Caitlyn Landau '20. As a team, we analyze and interpret media opinions through newspaper sources, including the, *New York Times*, *LA Times*, *Wall Street Journal*, *Washington Post*, and *USA Today*.

This years' summer scholars' team is unique; Tyler functions as the facilitator of our team and also as an analyst alongside Caitlyn and me. He distributes the articles from the different media outlets that Ms. Slater locates, and then inputs the data that the three of us determine into our 14 -year compilation of data, known as the EthicsTrak™ Database. Tyler, Caitlyn and I do research based on certain criteria that has evolved as this research continued over the years. Specifically, the system we use includes determining whether each article we analyze has a positive, negative or neutral affect for "big pharma" (a.k.a. the pharmaceutical industry). Once that is determined, we further assess which pharmaceutical companies are mentioned by name in the articles and what kind of representation they receive in the article using the same metrics -positive, negative, or neutral. This process also includes different pharmaceutical products or medical devices mentioned in the article to determine how products from big pharma products are viewed by the media. After all articles are analyzed using this process, we determine whether the articles were directly related to big pharma, healthcare reform, or unrelated to either. This final categorization aids Tyler as he inputs the analyzed data into the EthicsTrak Database.

As of 2017, the pharma industry has seen increased criticism over opioids and how they are one of the leading causes of death. This criticism has only gotten worse while placing more blame on pharmaceutical companies that produce these prescription pain killers. Because our research has found that prescription pain killers tend to start an individuals' addiction, the media usually blames big pharma for pushing these opioids to doctors to prescribe and to make more money. While the pharmaceutical companies do produce and sell opiate painkillers, the blame is often directed to them, giving big pharma a negative representation in the media.

Through this two-year experience, I have learned how conducting efficient research can be difficult when the topics are very sensitive. The Summer Scholars Program has helped me grow not only intellectually but also as an informed adult. What I have learned the past two summers will help me in the classroom and has applied to my work with companies supporting big pharma as well.

# **The Portrayal of the Pharmaceutical Industry in Media**

Caitlyn Landau, '20



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

Sponsored by the SJU Summer Scholars Program

This year I was granted the opportunity to conduct research with the Summer Scholars Program (SSP) by investigating the portrayal of the Pharmaceutical Industry in the Media. The project, led by Dr. Sillup and Dr. Porth, and in collaboration with SSP peers, Tyler Pham '20 and Kayla Herbert '19, was a great way to educate myself about the industry, as well as allow me to theorize my beliefs about the industry. Our research starts with SJU's Reference Librarian, Ms. Cynthia Slater, who sifts through research databases by keywords to identify articles for our project. The articles are then sent to Dr. Sillup, who sends them to Tyler, the EthicsTrak™ Administrator, who distributes the articles among himself, Kayla, and me. Our job is to analyze the top five newspapers in the United States- *New York Times*, *LA Times*, *Wall Street Journal*, *Washington Post*, and *USA Today*.

Our analysis is based upon a protocol that helps us determine whether a specific article and its headline portray the pharmaceutical industry as positive, negative, or neutral. The article is also analyzed for specific pharma companies and/or their products and whether the article identifies them. Tyler, Kayla, and I separate the articles into the categories of Big Pharma and Healthcare. The purpose of the analysis is to notice trends among the media coverage and recognize the big pharma issues of the year. We also look at *Google Trends*, *NBC*, and *NPR* to see how they portray the industry and compare it the other trends.

One of this year's main research concentrations was opioid usage and addiction. When analyzing the big issues, it was crucial to look at them through the lens of a pharmaceutical executive, to see it from the industry perspective. Drug companies are blamed for producing opiate drugs because, for many, they are an addiction. However, they also provide pain relief to those with chronic pain.

Through the SSP, I have gained significant insight about hot topic issues and trends in the pharmaceutical and healthcare industry. This is important because, through the research, I have gained knowledge of the industry for which I plan to work upon graduation. This summer has taught me to open my mind to all sides of a topic and to make informed opinions about them. I know that what I have learned, through my research, this summer will also be useful as a Pharmaceutical & Healthcare Marketing major.

# Portrayal of the Pharmaceutical Industry by Newspaper Coverage

Tyler Pham, '20

Faculty Mentors: Stephen J. Porth and

George P. Sillup

Departments Management and  
Pharmaceutical & Healthcare Marketing



## Supported by the SJU Summer Scholars Program

When it comes to the media, the pharmaceutical industry is not always represented in a fair manner. The media has been known to cover the pharmaceutical industry in a negative tone merely to make a profit rather than report the entire truth. As a result, businesses, potential investors, and consumers, who read these publications, may fall victim to bias against these pharmaceutical companies. This in turn can be unfair to the companies at hand. There may, of course, be some truth in the negative articles that must be reported; nevertheless, our focus consists of evaluating whether or not the positive information about the industry is also being reported.

For this project, we used an Excel spreadsheet to classify, summarize, and review pre-selected articles from five different newspaper sources - *The Los Angeles Times*, *The New York Times*, *The Washington Post*, *USA Today*, and the *Wall Street Journal*. SJU's Reference Librarian, Cynthia Slater, searches through databases using keywords to find articles related to our research. These articles are then sent to Dr. Sillup to be formatted, who sends the articles to me, the EthicsTrak™ Database Administrator. I am then responsible for distributing the articles evenly among my partners, Caitlyn Landeau, Kayla Herbert, and me. Once we receive the articles, our job is to analyze the articles in numerous ways. First, we analyze the title/headline of the article and determine whether it is positive, negative, or neutral from the point of view of the pharmaceutical industry. While reading the article, we look for any pharmaceutical companies that are mentioned and/or any specific drugs mentioned. After reading the article, we determine whether the article itself was positive, negative, or neutral again from the point of view of the pharmaceutical industry. We also look at whether the article represented the pharmaceutical industry's perspective as well as any ethical issues that appear in the article, such as high drug prices. All of our findings are recorded into an Excel spreadsheet, which I enter into the EthicsTrak database. This year we also implemented a new form of research consisting of recording the number of articles about a specific ethical issue within NBC Nightly News, NPR All Things Considered, and Google Trends. For this, the three of us compiled a list of all of the most popular and relevant ethical issues we read about and researched how many articles were reported for each issue within the three new sources.

I have learned a lot through the Summer Scholar's Program. Besides analyzing the articles, I was given the task to be the EthicsTrak Database Administrator. This job consisted of not only distributing articles to my partners but also creating numerous tables and graphs to organize all the information we compiled throughout the summer. I worked a lot with Microsoft Excel and Microsoft Access and was able to learn the ins and outs of each program. Similar to last summer, I have learned so much about the industry and the way it is perceived through the media. Overall, the Summer Scholar's Program has been an amazing learning experience and I hope to continue to be involved in the program in the years to come.



**Alexander J. Skolnick**  
Department of Psychology  
Saint Joseph's University

Ph.D. University of Georgia

**Research Interests:** Emotion, Disgust,  
Gender and Emotion, Emotions Involved in  
Health and Stress

Life's path can be nonlinear. As a kid I loved learning about different animals and would go to the American Museum of Natural History, the Bronx Zoo, and Aquarium in New York City as often as I could. Then in college and graduate school I was drawn to the behavior of primates and studied orangutans in zoos, capuchins in group colonies, and rhesus monkeys on an island off Puerto Rico. My PhD focused on the biopsychology of social relationships in primates. Then life's twists and turns led me to focus my research on stress and emotions in humans! Who knew that humans were so interesting? My scientific path led me to specifically examine the emotion of disgust in all its icky glory. Since disgust is the only basic emotion that animals do not express, it might be an odd research choice for me. However, this pathway was possibly inevitable as I have come to discover (and research) the relationship between nature and disgust, as the two are intricately linked. What things gross people out the most? All the things found in nature: things that are rotten, decayed, slimy, squishy, moist, and things related to death, sex, food, animals, and yes, things that bodies produce (blood, mucus, poop). Therefore, disgust is the greatest emotion to study (if one is not too queasy)! Why do these things disgust humans? They can all be related to contagious agents in the environment and disgust might help keep us safe. I study this relationship and how and why men and women differ in their disgust. I am also fascinated by the ways that disgust influences people's lives, for example, affecting food choices, occupations, politics, or even moral decisions. Recently, we have focused our research on how one's disgust personality (being low or high in sensitivity to disgust) relates to being healthy.

During the past year and a half my Lab tested whether people that are easily disgusted (high disgust sensitivity) would be less likely than those low in disgust sensitivity to get sick. We followed over 100 students for 6 weeks, and each week participants reported any bodily symptoms they incurred. We found a positive relationship among disgust sensitivity and the likelihood of reporting cold/flu-like symptoms during the 6 weeks, a finding counter to what one might expect if disgust sensitivity helps people avoid contagious elements in their environment. This year Emily Vance's Summer Scholars project with me addressed whether there is a relationship between how easily disgusted someone might get and their anxious attitudes about their own health. Emily used several measures of health anxiety and a measure of mental toughness (the opposite of anxiety) to investigate the disgust-health relationship further.

# The Relationship Between Disgust Sensitivity, Catastrophizing and Mental Toughness

Emily Vance, '20

Faculty Mentor: Alexander J. Skolnick  
Department of Psychology



Supported by the SJU Summer Scholars Program

Disgust is a basic emotion characterized by a feeling of revulsion aroused by something unpleasant and is theorized to play a role in maintaining one's health in the face of contagious elements. In terms of being a trait for individuals, disgust is characterized by disgust sensitivity. This trait is frequently linked to other traits in individuals. Two of these proposed traits are the tendency to catastrophize, and mental toughness. Catastrophizing is a construct that involves an exaggerated negative orientation toward harmful stimuli, such as expressing worry about harmful physical, emotional and social effects of pain. Additionally, health anxiety is a similar construct to catastrophizing and is linked to hypochondriasis, which is characterized by emotional distress about having a serious illness.

Regarding these characteristics, we predicted that a person high in disgust sensitivity is more likely to be high in catastrophizing (and other health anxieties, like hypochondriacal tendencies), given the strong emotional responses commonly seen in both traits. On the other hand, the trait of mental toughness describes someone who can perform well in competitive situations and who shows flexibility, responsiveness, strength, and resiliency. We predicted that a person high in mental toughness will be more likely to have a lower disgust sensitivity, since they should be less emotionally perturbed when presented with something that evokes disgust.

Our research was conducted through the use of an internet survey that measured the level of disgust sensitivity, catastrophizing, health anxiety, and mental toughness in participants. The scales that were utilized in our survey were a four-question pain scale, DPSS (including two subscales) and DSR for disgust sensitivity, PCS for catastrophizing, SHC for health anxiety and the MT18 for mental toughness. A total of 158 participants were included in the analysis.

The results indicated that our hypotheses were strongly supported. Participants that had higher disgust sensitivity were significantly higher in their tendency to catastrophize and experience health anxiety. Participants that had higher disgust sensitivity had significantly lower mental toughness. Participants that catastrophized more had significantly lower mental toughness. There was a trend in differences between genders for disgust sensitivity, but not for the other traits. These traits did differ with respect to age. Older participants had higher mental toughness, lower disgust sensitivity, and lower health anxiety. In conclusion, there was a significant relationship between these traits and more research should be done to further understand how disgust might function to keep people healthy.

	<b>MT18</b>	<b>PCS</b>	<b>SHC</b>
<b>DPSS</b>	-.291**	.339**	.369**
<b>Sensitivity</b>	-.346**	.350**	.438**
<b>Propensity</b>	-.191*	.281**	.240**
<b>DSR</b>	-.334**	.174*	.426**
<b>MT18</b>		-.246**	-.444**

\* Correlation is significant at the .05 level (2-tailed); \*\* Correlation is significant at the .01 level (2-tailed)



**Karen M. Snetselaar**  
Department of Biology  
Saint Joseph's University

Ph.D. University of Georgia

**Research Interests:** Plant Biology, 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. One current project is characterizing mutants that can't begin the infection process properly.

Another area of research has involved experiments trying to figure out 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. We are also

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 studying the distribution of plants and microbes on the green roof that was planted on top of the science center several years ago.

Graduate and undergraduate students are involved in all of these projects.

# Investigating Induced Resistance to Later Leaf Infection Due to *Ustilago maydis* Root Infection

Marly René, '19

Faculty Mentor: Karen M. Snetselaar  
Department of Biology

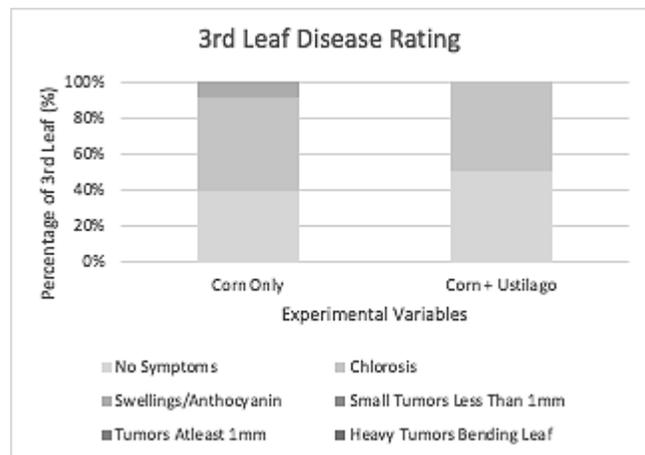


Supported by the SJU Summer Scholars Program

*Ustilago maydis* is a basidiomycete that is related to mushrooms. It is a fungus that is a causative agent for smut disease when it infects maize by the ears or leaves. For the first part of its life, the fungus lives as a saprophyte where it can be grown in media. However, to complete its life cycle, *U. maydis* requires a host to enter into its pathogenic stage of life. This occurs when two genetically different haploid strains, FB1 and FB2, fuse to form a dikaryon. A dikaryon is when the cells are fused, but the nuclei remain separate from one another. This is when the fungus becomes an obligate parasite. Because it can exist both as an obligate pathogen and a saprophyte, *U. maydis* can be easily manipulated and is thus a good model system to study plant disease

Like humans, plants have an immune or defensive response. Theirs is known as Systemic Acquired Response (SAR). When the plant is exposed to the pathogen, the plant sends signals throughout the system to other parts of the plants to let them know that infection has occurred and may result in resistance to the pathogen.

For my first experiment I planted seeds and a week after growth inoculated the plants when the third leaf was 2.5cm to 3.5cm in length. The smaller leaves had more severe symptoms than the 3.5cm leaves. Therefore, in my next experiment I only inoculated leaves smaller than 3 cm. For this experiment half of the pots had *U. maydis* in the soil and the other half did not. A week later,



all the plants were inoculated with *U. maydis*. A week after inoculation disease severity was scored for all plants. As the figure shows, when plants were exposed to *U. maydis* in the soil a week before being inoculated in their stems, their disease symptoms were less severe. This suggests that the presence of fungus in the soil induces a defense response. For the future, this experiment will be conducted again with a larger sample size. It will also be interesting to examine the roots microscopically to follow any host-root interaction.

# Experiment: The Infection Process of *Ustilago maydis* on Teosinte (*Zea. mays ssp parviglumis*) Seedlings and Ears

Sydney Taggart, '20

Faculty Mentor: Karen M. Snetselaar  
Department of Biology



## Supported by the SJU Summer Scholars Program

*Ustilago maydis* is a type of fungus, specifically a basidiomycete related to mushrooms. For part of its life cycle, the fungus exists as a saprophyte, meaning that we can easily grow it in liquid medium or on agar plates in the lab. For the other part of the *U. maydis* life cycle, the fungus exists as an obligate parasite within a host, specifically Maize or Teosinte. Teosinte shares a common ancestor with maize but has smaller seedlings and ears. Whenever the fungus exists as a parasite within a host, it causes a smut disease within that host. This fungus causes the development of large, black, spore-containing tumors on either the leaves or the ears of its host. Infection of teosinte by *U. maydis* has been reported, but not in detail. I aimed to document the infection processes of *U. maydis* on Teosinte (*Z. ssp parviglumis*) seedlings and ears.

Seedlings were inoculated, or injected, with the fungus in their main stem, so that all the inoculum reached the entirety of the seedling through the hollow column at the center of the seedling. Infection would typically occur 3-4 days after inoculation. Initial infection would appear as small, yellow chlorotic spots on the third leaf of the seedling. In seedlings that were inoculated with longer third leaves, infection would also appear on the fourth leaf as well (see Figure I). Around 6-7 days after initial inoculation, the infected area became red. This indicates the presence of anthocyanin, which is a molecule produced in teosinte linked to plant defense. The infected area would also begin to develop a bumpy texture around this time, indicating the formation of tumors (see Figure II). None of the inoculated seedlings developed mature, spore-containing tumors.

For the other part of the experiment, ears will be inoculated in a growth chamber. Certain hybrids and subspecies of teosinte, such as the kind used in the experiment, are short day plants. This means that they only flower during short day lengths. In order to induce flowering, the plants are being grown in a growth chamber that could simulate short daylengths during the summer. The infection process of the ears will be documented in comparison to the infection process of *U. maydis* in maize ears.



Figure I: The images (left to right) show the infection of a seedling starting at three days after inoculation and ending at seven days after inoculation.

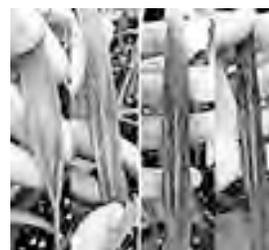


Figure II: The images (left to right) portray the infection of a seedling starting at three days after inoculation and ending at eight days after inoculation.



## **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.

## **Junior Year Voice Recital**

Jennifer Tague, '20

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

Supported by the SJU Summer Scholars Program



As a Music major entering my junior year at Saint Joseph's University, I was looking for a way to expand my knowledge of music and performance skills. So this summer, I worked on a Junior Year Recital under the guidance of Dr. Suzanne Sorkin, Chair of the Music, Theatre, Film department, and the help of my voice teacher, Rebecca Siler. The project consisted of research of various genres of music to create a theme that would be interesting and be a great learning opportunity. I would then perform the recital at a local nursing home during the summer, and perform a full recital on campus in the early fall of my junior year.

Rebecca and I tried and researched various themes, and eventually settled upon an Irish theme. This was close to home for me since I grew up listening to Irish music and was always fascinated with the culture and the stories that seemed to be behind every song. We began research into various Irish composers, traditional Irish tunes, and focused on creating a set that would cover as many bases of the culture as possible. We began working on the pieces we chose, transposing keys and making sure each arrangement was a great fit for my voice type, while still allowing for a bit of a challenge. The result product is a set of about thirty minutes, with a variety of styles and composers. I have been working hard daily on memorizing and perfecting each piece to make sure it is ready for the performance.

With this process set in motion, and with the help of Dr. Sorkin, we arranged a performance at Symphony Square retirement home in Bala Cynwyd. There I would perform two sets for the residents, with the help of accompanist Barbara Browne. The fall recital will be in the beginning of the semester in Nicoletti Music Hall, with the date yet to be determined. I have learned so much through this process about music, time management, and performance skills and the overall process. I look forward to the upcoming recitals so that I can show the hard work that went into this project by myself and my mentors.



**Jennifer Spinner**  
Department of English  
Saint Joseph's University

Ph.D. University of Connecticut

**Research Interests:** Journalism, Women  
Essayists, Writing Center Pedagogy, Creative  
Writing

I believe that students best learn to write in a classroom setting by forgetting that classroom setting. Certainly, the classroom community is relevant, but I urge my students to think beyond the classroom, to think of the skills they learn as transferable, that is, applicable in any writing situation they encounter, both inside the university and (especially) beyond. Ultimately, I want my students to understand that every act of writing—whether a poem, a news story, a tweet, a research paper, a biology lab report, a design project description, or a personal essay—inhabits a different set of rhetorical circumstances, some inherent, some invented. Moreover, every act of writing carries responsibility with consequences outside the experience of composing.

I also emphasize critical reading and thinking in my courses. Good writers are good thinkers, and good thinkers are people who read widely and are engaged in the world. For me, that means not only being tapped into what is going on in the world but also tapped into the technology that makes the world so much more accessible to us.

# **An Exploration of the Intersection of Spirituality and Creative Nonfiction**

Erin Breen, '19

Faculty Mentor: Jennifer Spinner  
Department of English



Supported by the SJU Summer Scholars Program

The overarching goal of this project has been to discern and explore where spirituality and literary creativity intersect. Creative nonfiction writers seek to tell true stories, to communicate the abstract in tangible and visible ways that often allow for better self-understanding. Because of the abstract and individualistic nature of spiritual development and the fluidity and malleability of Creative Nonfiction as a style of writing, the two fields blend and interconnect. Theologically, examining the language and thinking tied to forms of expression and art can reveal a great deal about the interconnectivity between one's encounters with God, human reason, and the continuous divine revelation available to individuals through their spirituality. Artistically, a growing comprehension and development of skill surrounding one's ability to reflect, synthesize and express the innermost moments and experiences in a way that her audience, each with their own background and relationship with the Divine, can somehow still understand and relate to reflects true proficiency in writing as a form of storytelling and expression.

The first portion of this project has been educating myself in the styles and techniques of modern authors. C.S. Lewis, Pádaig ó Tuama, Leslie Jamison and Gillian Flynn have served as examples of writers within the nonfiction genre. Mary Oliver's and Jan Richardson's poetic storytelling, although outside of the Creative Nonfiction genre, contributed to my understanding of how writers of different stages of spiritual journeys, representing different faiths, crafted their works to tell true stories of spiritual quests while utilizing literary techniques. I am particularly interested in how they balance their individual experiences, their personal spiritual journeys, while also tapping into universal themes and connecting to their audiences.

The second portion of this project has been a development of my own literary voice as I explore the spiritual and the universal through creative nonfiction. I have composed my own collection of four literary essays. In their own way, these pieces have interweaved my own spirituality and life experiences with the same universal themes such as grief, family life, relationships and mental health, that have been grappled with in each of the authors I have analyzed. In the vein of the authors I exposed myself to, the essays I constructed have struck a balance between my perspective while being recognizable and relatable to the collective human experience.



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

Ph.D. West Virginia University

**Research Interests:** Biological Effects of  
Global Climate Change on Plants; Urban  
Agriculture; Science Education

Atmospheric carbon dioxide concentrations ([CO<sub>2</sub>]) are rising at an alarming rate due to fossil fuel combustion and changes in land-use such as deforestation. Most of the attention surrounding changes in [CO<sub>2</sub>] focuses on the indirect effects that this greenhouse gas has on global temperature, however atmospheric CO<sub>2</sub> is also a primary substrate of photosynthesis. Therefore, changes in [CO<sub>2</sub>] have profound effects on plant physiological functioning. Research in my lab examines plant responses to changes in [CO<sub>2</sub>] and other global change phenomenon such as global temperature and water availability and the mechanisms through which these responses occur. I am especially interested in the response of plant traits that are relevant to plant evolution such as flowering time and reproduction. Recently, I reviewed the effects of elevated [CO<sub>2</sub>] on plant flowering time and found that like changing global temperatures, rising atmospheric CO<sub>2</sub> will likely dramatically change the flowering time of both native and crop species in the future. Therefore, a major area of my research is aimed at elucidating the molecular mechanisms that account for these elevated [CO<sub>2</sub>]-induced changes in flowering time. To accomplish this goal I make use of the powerful model plant species *Arabidopsis thaliana*. These experiments use techniques based in traditional plant physiology, molecular genetics, and functional genomics.

# Investigation of Developmental Phase Changes of Several Different Ecotypes of *Arabidopsis Thaliana* When Exposed to Ambient and Elevated CO<sub>2</sub> Environments

Michael Fontana, '20

Tyler Newman, '19



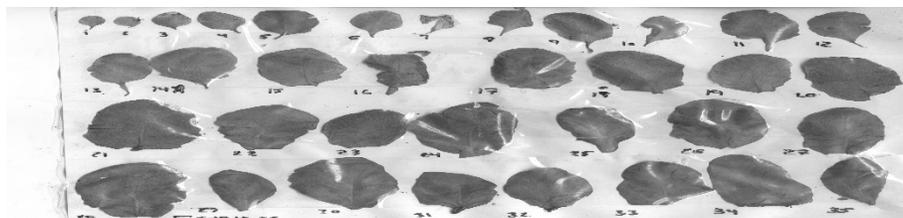
Faculty Member: Clint J. Springer  
Department of Biology

Supported by the SJU Summer Scholars Program

What triggers the changes in development from germination to juvenile stage, from juvenile to adult, and from adult to the flowering stages of plants? We believe that the microRNA MIR156 has something to do with the cause of when plants change phases. We are specifically interested in whether an elevated CO<sub>2</sub> environment can influence the timing in *Arabidopsis* phase change.

Together, we began the investigation of developmental phase change in *Arabidopsis Thaliana* by using several different ecotypes such as the Colombia, SPL mutants, FT-10, SOC1 and Mimic mutants. We planted 30 replicates for each ecotype. After initiating the germination of all of the plants, 15 of the 30 replicates from each ecotype were placed into an ambient growth chamber. The ambient growth chamber simulated an environment that has a regulated amount of CO<sub>2</sub> inside of the chamber. It is maintained at approximately 400 ppm, using a CO<sub>2</sub> scrubber. The other 15 replicates of each ecotype were placed into an elevated growth chamber, where the CO<sub>2</sub> level was maintained at approximately 900 ppm, using a CO<sub>2</sub> tank, continuously feeding CO<sub>2</sub> into the chamber. The plants were able to grow in the respected chambers for about three weeks before the first ecotypes began to flower.

The objective of this investigation was to record the flowering times of each ecotype and compare their flowering times to their countered CO<sub>2</sub> environment as well as other ecotypes. Once a plants flower stalk reached 1 cm, the plant was removed from its chamber and went through a phenotyping process, which is where we could find more information on the timing of the plants phase changes. Below is an example of an elevated SPL mutant ecotype phenotype.



In investigating vegetative phase change of plants, we can continue to learn what environmental conditions accelerate and delay timings of phase change. With CO<sub>2</sub> levels increasing in our environment today, the concentration of CO<sub>2</sub> could soon impact the timing in which these developmental phases of plants change.



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

Ph.D. University of Illinois

**Research Interests:** Sustainability and Environmental  
Cost Disclosures, Social Accounting and  
Accountability Reporting

Finally, sustainability issues emanating from the economic production system are reaching the top of the agenda in corporate board rooms around the globe. Natural resource exhaustion, renewable energy source development, climate change, global warming, workplace threats to health/safety of employees, and accountability, access, and affordability to customers are matters of increasing importance in the corporate governance process. Progress toward fulfilling the promise of achieving the United Nations Sustainable Development Goals now is discussed in the financial press. While the fundamental issues involved have been disquieting for years to social activists, the range of interested parties has broadened as a result of legislation and regulation. The deleterious effects of degradation of the planet and its resources have spilled over into the political and financial areas such that questions about sustainability have become a standard daily news item.



Managing in a responsible manner that respects the environment of today and the needs of future generations requires new measures of success. In fact, defining success in business today demands that we alter our view that profit alone should be the essential focus and metric to judge achievement in business. Disclosures made, as well as those hidden, by companies about their firm's sustainability impact weigh heavily on our judgments about companies and their managers. This is an area in which empirical investigation will lead to useful outcomes that can inform future public policy decision making.

An independent organization, the Sustainability Accounting Standards Board (SASB), was formed to develop new measurement methods and reporting guidelines for major sectors in the U.S. economy. The SASB's work complements regulatory reporting by U.S. and foreign companies as they comply with mandatory filing requirements of the Securities and Exchange Commission. Of interest to both investors and consumers is whether the voluntary disclosure guidelines developed by the SASB are being implemented. This is the focus of a large-scale research project that assesses sustainability disclosure postures of major firms during the past decade. The startling result seen so far is that little substantive attention is being given in published reports to companies' efforts to explain their impact in the sustainability arena.

# **Cybercrime Financial Disclosures by Large U.S. Retailers and Sustainability Disclosures by Public U.S. Healthcare Companies**

William Legg, '20

Faculty Mentor: A.J. Stagliano  
Department of Accounting



## **Supported by the SJU Summer Scholars Program**

For this project, the focus was on the transparency of publicly traded companies. This project is an extension of a similar project done by two accounting students several years ago. In their project, the focus was on the types of disclosures made by companies from many different sectors, and to what extent these disclosures were made. What made us want to reboot this project is because, while three years does not seem like a lot of time, in the world of technology this is an eternity. Likewise, sustainable business practices have gone through all kinds of changes in this period.

For the first part of this project, we examined what kinds of disclosures related to sustainability publicly traded healthcare companies and hospitals made. We focused on 10-K reports first. I used a key word search on a PDF of the 10-K reports for each company. We focused on phrases such as “climate change”, “global warming”, and “greenhouse gases”. I then looked through other documents such as sustainability reports, environmental reports, press releases, etc. What I found was that many companies do not release large amounts of information regarding their sustainable practices.

For the second phase of the project, I followed a similar process. We wanted to see what kinds of disclosure publicly traded retailers made to their stock holders regarding cyber-crime. The procedures were similar and involved using key word searches to find disclosures in 10-K statements. Again, we found there was a shocking lack of disclosures involving these topics, however, the trend shows the number of companies making these disclosures is increasing.

The main take away from this research is the simple fact that most companies will not make disclosures unless they must, or unless it benefits them. I believe the research I conducted this summer will prepare me for a career in forensic accounting, which is a field that intrigues me, and I am grateful to have been given the opportunity to pursue this topic of academic research.



**Eileen L. Sullivan**

Department of Health Services  
Saint Joseph's University

Pharm.D. Shenandoah University School of Pharmacy

**Research Interests:** Studying the Use of Non-Pharmacologic Activities to Enhance the Quality of Life in Patients with Alzheimer's Disease and Dementia

Dr. Sullivan is a registered pharmacist in the states of NJ and PA and has worked continuously in Retail Pharmacy, Hospital Pharmacy, Pharmaceutical Industry and Long-Term Care. Her Pharm.D. Clinical rotations included Drug Information (Janssen Pharmaceutia), Acute Care (St. Mary's Medical Center), and Ambulatory Care (St. Mary's Medical Center). Dr. Sullivan worked for the UMDNJ system (University of Medicine and Dentistry) before transitioning into the role as a Principal Research Pharmacist for The R.W. Johnson Pharmaceutical Research Institute from 1998-2001 a division of Johnson & Johnson. The R.W. Johnson Pharmaceutical Research Institute conducts research and development in a variety of therapeutic areas for the Johnson & Johnson family of companies.

Dr. Sullivan continued her career within the Pharmaceutical Industry within Drug Information and possesses extensive professional experience within Scientific Affairs, Medical Communications and Medical Affairs from various subsidiaries of Johnson & Johnson. She has held various positions within Johnson & Johnson including but not limited to Associate Director, Medical Education Manager, and Scientific Affairs Associate. Dr. Sullivan's primary area of concentration was Neurology and Mental Illness.

# **Timeslips – A Non-Pharmacologic Tool for Nursing Home Residents With Dementia and Early Onset Alzheimer's Disease**

Gabrielle Mrozek, '19

Faculty Mentor: Eileen L. Sullivan  
Department of Health Services

Supported by the SJU Summer Scholars Program



Timeslips is a picture based storytelling activity designed to decrease anxiety and aggression in nursing home residents who suffer from Alzheimer's disease or dementia. The intention is that Timeslips will allow for creative expression in a way that stimulates constructive imagination instead of requiring residents to recall memories from their past, which is often difficult and frustrating for residents. A standard Timeslips session involves a trained facilitator and a group of residents. They are shown a picture that is clearly unrealistic and asked questions regarding the picture, such as "what is the character doing?" or "what does the character want?" The responses from the residents are written down and the full story is read back to the residents upon completion of the activity. The goal is that creating something using imagination as a group will instill a sense of fulfillment in the residents who participated.

The objective of this study is to compare the difference between Timeslips storytelling and other non-pharmacologic activities that stimulate creative expression such as art or music. This comparison was studied through 12 Timeslips sessions at the Parker Nursing Home where 18 residents with dementia participated. 12 sessions of regularly scheduled activities were also studied at the nursing home, with 14 residents participating as the control group. Both the Timeslips group and the control group were studied using the Overt Agitation Severity Scale (OASS). A pre- and post- score was obtained for each participating resident before and after each activity in both the Timeslips group and the control group. The score is a numerical assignment based on the observed levels of agitation through vocal and physical cues. The goal of the sessions, Timeslips and otherwise, was to observe lower scores on the OASS scale after the completion of the activity. There was a significant decrease in agitation in residents who participated in the Timeslips study, however there was no change in residents who participated in the control group. Therefore, the Timeslips activity reduced agitation better than the usually scheduled activities.

Anxiety and agitation are often side effects of dementia and Alzheimer's disease, but most often these issues are combated with pharmaceutical intervention. Unfortunately, most medication used to treat this decreases cognitive function even further than the resident's disease does naturally. Therefore, it is imperative to find effective non-pharmacologic treatments, such as Timeslips, to combat agitation and preserve cognitive function.

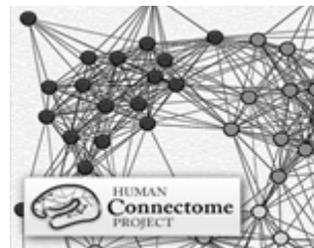


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**Research Interests:** Applying Graph Theory  
in Neuroscience

What the Human Genome Project did for genetics, the Human Connectome Project (HCP) holds promise to do for the human brain. Just as a *genome* refers to all of the DNA present within a single cell, a *connectome* refers to all of the neuronal connections within the brain. Mapping the human brain is one of the most challenging efforts that neuroscientists face today. In addition to neuroscientist, HCP involves biologists, physicians, physicists and computer scientists. The project aims to collect and organize large sets of data from neuroimaging techniques such as electroencephalography (EEG) and magnetic resonance imaging (MRI). Researchers involved with HCP use concepts from graph theory to study how different regions of the brain are connected anatomically (structural connectivity) or actively (functional connectivity). The goal of HCP is that it will lead to improved diagnosis and treatment of brain disorders such as autism, ADHD, schizophrenia, stroke, and dyslexia.



In this project we give an introduction to some of the fundamental concepts of graph theory including the history of its beginning. A brief overview of the anatomy of the brain is discussed and an illustrating of it as a neural network is presented. We introduce quantitative measures that are used to describe connectivity in the brain. In a study by Zhu and others we use a graph to model functional connectivity changes in the left frontal-parietal network (LFPN) of patients that have suffered an aphasic stroke. We compare six quantitative properties of the patients to that of the controls. For a future project we will illustrate the use of open-source software BRAPH that can be used to obtain quantitative measures through the use of EEG or MRI data. Given the important nature that quantitative analysis plays in most fields of study today, graph theory will become increasingly important in helping to understand the complexity of the human brain.

# **The Human Connectome Project: Using Graph Theory to Model Connectivity in the Human Brain**

Ckyam Saint-Cyr, '19



Faculty Mentor: Elaine A. Terry  
Department of Mathematics

Supported by the SJU Summer Scholars Program

Just as a genome refers to the complete set of genes present in a single cell, a connectome refers to a complete map of neural connections in the brain. What the Human Genome Project did for genetics, the Human Connectome Project (HCP) plans to do for Neuroscience. Mapping the human brain is one of the most challenging efforts that neuroscientists face today. In 2010, the National Institutes of Health (NIH) was awarded \$40 million to map neural connectivity in the human brain. To do so, HCP scientists and researchers collect and share data about the structural and functional connectivity of the human brain. It is the intention that HCP will lead to improved diagnosis and treatment of brain disorders.

The brain is often described as the most complex organ. While it weighs a mere three pounds and makes up only two percent of body weight, the brain performs a large number of tasks. In its simplest form the brain consists of the cerebrum, cerebellum and the brain stem. The four regions of the cerebrum are responsible for our higher cognitive skills, personality, sensation and perception, hearing, and vision. The cerebellum coordinates movement while the brain stem controls primitive functions such as breathing. The brain is made up of 100 billion neurons and trillions of synapses. Together, neurons and synapses, transmit electrical and chemical signals throughout the brain which allows neuroscientists to study the brain as a complex network. Electrical brain activity can be observed from data received from noninvasive neuroimaging techniques such as electroencephalography (EEG) and functional magnetic resonance imaging (fMRI). Using this data HCP proposes to use mathematical graph theory to map and understand connectivity in the human brain.

In this project I give an introduction to some of the fundamental concepts of graph theory. I define a graph and give background to the concept by tracing it back to the mathematician Leonhard Euler (1707 – 1783) and his attempt at solving the Konigsberg Bridge Problem. Basic concepts and definitions that are foundational to the study of graph theory are presented. I illustrate that graph theory is an active field of study by describing its use and application of Hamiltonian circuits, minimal spanning trees and the Four Color Theorem. I introduce quantitative measures that are important to neuroscience. The equation of each measure is presented and its relevance to neuronal structure is described. In a study by Zhu, et al, functional connectivity changes in the left frontal-parietal network (LFPN) of patients that have suffered an aphasic stroke is studied. The LFPN consists of six regions of the brain that involve language cognition. Aphasic patients tend to lose connectivity in this network of the brain and thus experience language impairment. The study uses fMRI to makes a comparison between the aphasic patients and a control group. I applied six of the measures to the connectogram of both groups to illustrate the quantitative differences between them.



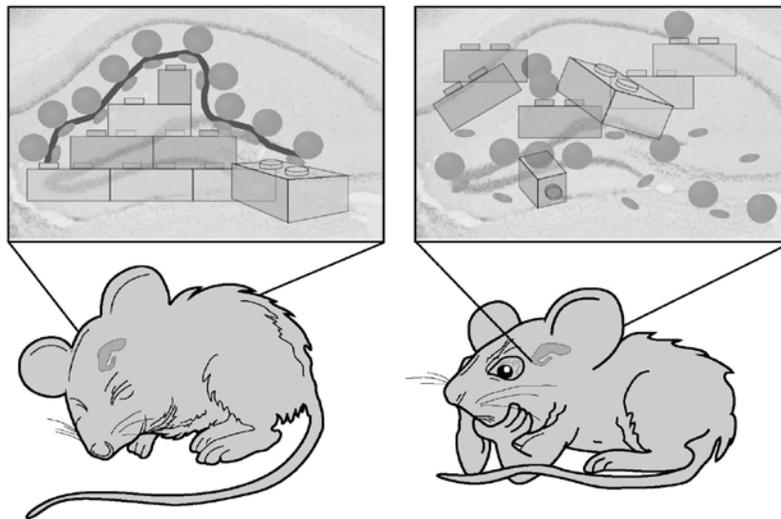
**Jennifer C. Tudor**  
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## **Research Interests:** Molecular Mechanisms of Memory, Neurodevelopmental and Neurodegenerative Disorders, and Sleep

Sleep deprivation is a public health crisis with more than a third of American adults not receiving enough sleep. Even short periods of sleep deprivation are detrimental to cognition. More specifically, lack of adequate sleep can affect attention, mood, judgement, and memory. I have previously described that sleep deprivation impairs memory by attenuating the production of proteins in the brain required for memory formation. This is due to reduced activity in the insulin signaling pathway in a region of the brain called the hippocampus, which is particularly important for memory. My students and I are investigating how this signaling pathway affects memory formation and the role of sleep in memory.

The insulin signaling pathway has also been implicated in several neurodevelopmental and neurodegenerative disorders, such as autism and Alzheimer's disease. My lab is focused on understanding how changes in the insulin signaling pathway in the brain cause the behavioral deficits associated with these disorders. Interestingly, problems with sleep have also been associated with many neurodegenerative diseases. Therefore, we are interested in examining the interrelationship between the behavioral and cognitive deficits associated with these disorders and sleep dysfunction.



Sleep deprivation impairs the production of proteins required for memory formation.

# Variable Stress Granule and P-Body Expression in *Caenorhabditis elegans*

Mary Kate Dougherty, '19

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Department of Biology



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

Stress granules and P-bodies are non-membrane bound aggregates of messenger RNAs and their associated proteins. It has been shown in cells grown in culture that suppression of the mammalian target of rapamycin (mTOR) signaling pathway and its non-mammalian orthologue target of rapamycin (TOR) is associated with an increase in stress granule formation. Despite the possible connection via the TOR/mTOR pathway, there has not been any previous evidence directly linking sleep deprivation with stress granule formation. This summer I worked with the microscopic, transparent, and genetically tractable nematode, *Caenorhabditis elegans* as a model for examining stress granule and P-body formation in response to sleep deprivation.

*C. elegans* experience two different types of sleep, developmentally-timed sleep and stress-induced sleep. Developmentally-timed sleep occurs between the different larval stages of the worm lifecycle, while stress-induced sleep occurs in response to a stressor, such as heat or UV shock. These different types of sleep are mediated by different mechanisms, and mutant strains have been developed that are deficient in the mediators of each type of sleep. I crossed a strain of *C. elegans* with a mutation that is known to drastically reduce developmentally-timed sleep with another strain that was genetically manipulated to have fluorescently labeled P-bodies and stress granules. This new strain has both fluorescently labeled P-bodies and stress granules and is deprived of developmentally-timed sleep.

To quantify P-body and stress granule formation, I imaged live *C. elegans* on a confocal microscope by mounting them on slides and immobilizing them in a bead solution. Before I could compare the levels of P-bodies and stress granules in the new sleep-deprived strain and the sleeping wild type, I needed to establish a threshold to be used in the image processing software for later analysis. Heat shock at 32°C for 2 hours was previously induced stress granule formation in *C. elegans*, so I heat shocked fluorescently labeled worms according to this protocol. In the strain that I was working with, I saw a wide variation in the numbers of stress granules and P-bodies in each worm regardless of heat shock status, and no significant differences overall. Moving forward, I will be working with a new fluorescent strain of *C. elegans* that express a stronger fluorescent label and will continue to investigate the link between sleep deprivation and the formation of stress granules and P-bodies.

# **Sleep Deprivation Affects the mTOR Pathway Differently in Varying Brain Regions**

Lakshmi Narayanam, '19

Isabella Succi, '20



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

Sleep deprivation leads to impairments with memory and cognition. The hippocampus is a region of the brain that is required for memory. Hippocampal neurons require protein synthesis for memory formation. After sleep deprivation, the signal transduction pathways that regulate protein synthesis are affected. Previous research has shown that sleep deprivation increases the activity of adenosine monophosphate-activated protein kinase (AMPK), which then inhibits the mammalian target of rapamycin (mTOR) pathway. Brain regions other than the hippocampus are also affected by sleep deprivation. The goal of this research was to assess other regions of the brain and determine how the AMPK-mTOR pathway is affected by sleep deprivation.

Mice were sleep deprived by gentle handling for five hours. Following sleep deprivation, the mice were sacrificed via cervical dislocation, and the cerebellum, frontal cortex, hippocampus, and striatum tissue were collected. The control group consisted of non-sleep deprived mice that were left undisturbed. The brain regions were separated during dissection and subsequently flash frozen using liquid nitrogen. Then, the brain regions were homogenized and analyzed for protein levels by western blotting techniques. Western blotting consists of sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE), which separated proteins on a gel using an electric field. The proteins were then transferred to a membrane and antibodies were applied to identify and measure specific proteins and phosphorylated proteins. The membrane was subsequently imaged using chemiluminescence.

Our preliminary data suggests that sleep deprivation may affect the AMPK-mTOR pathway differently depending on the specific brain region. In the frontal cortex, sleep deprivation may not affect AMPK, but it may increase mTOR activity in the frontal cortex. In the striatum and cerebellum, our data suggests that sleep deprivation may not affect AMPK or mTOR activity. We will continue our experiments to confirm our preliminary findings. In addition, we will analyze the hippocampus tissue to confirm the previous findings. We also plan to evaluate phosphorylation of proteins downstream of the mTOR pathway, such as 4EBP2 and p70S6K.



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**Research Interests:** Social Justice in Organizations; Ethics in Academe, Business, and the Professions; Change and Change Agents; Learning and Teaching, and the Subjects My Students are Interested in Exploring for Themselves

My interest in both laws and organization's policies ensuring that direct and contract workers are paid a living wage began during my work with Elizabeth Sohmer ('16), one of my Summer Scholars in 2015. I had no idea then that Liz's summer research project would come to redirect my own scholarship and lead me to design the Living Wage Policy Study, a multi-year research project into the policies and practices adopted in American higher education (details at [justwage.org](http://justwage.org)).

To date, I've found that relatively few American colleges and universities have published a living wage policy, and those policies that do exist vary widely in terms of their scope and as a measure of the institution's *enacted commitment* to social justice. Jesuit institutions, led by Georgetown University, are disproportionately represented among those schools that have publicly published a living wage policy. Fortunately – and somewhat surprisingly – higher education institutions (HEIs) that have enacted living wage policies have not been adversely affected when examined through financial outcomes, operations, or measures of reputation. In addition, we've found that living wage *practices* may be more prevalent than living wage *policies*. Thus, the focus of my research has moved from working with publicly available data (published policies) to seeking information from each HEI, which requires time, persistence and, most essentially, the participation of Chief Human Resources Officers at each institution. Since higher education institutions are very reputation-sensitive, the entire process must be handled with the utmost care.

Ethan Dias's research project has advanced the Living Wage Policy Study substantially, helping to design and implement systems to manage the project from initial contact through post-interview follow-up. Based on preliminary results available at this writing, it appears that higher education HR leaders are knowledgeable and concerned about the adequacy of compensation of their lowest paid employees. However, HR leaders cannot reset institutional policies alone, nor do they operate in a vacuum. American HEIs are facing, in varying degrees, competitive and financial pressures. Ethan's research can help leaders of HEIs understand the prevalence, nature, and feasibility of living wage policies and practices.

# Living Wage Policies in American Higher Education Institutions: A Review of Literature and Qualitative Study

Ethan Dias, '19

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Department of Management



Supported by the SJU Summer Scholars Program

*How can colleges and universities create a sense of community for students, faculty, and staff – and not simultaneously provide an adequate living wage for all of their employees?*

I explored this question as part of Dr. Weidner's Living Wage Policy Study, an analysis of the prevalence and nature of living wage policies and practices in American higher education institutions (HEIs). His research to date has found that out of several thousand American four-year public and private non-profit HEIs, fewer than 35 institutions have implemented living wage policies that are available online to the public. However, a number of institutions that have not adopted a living wage *policy* may have implemented a living wage *practice*, in part because a living wage practice can be adopted with less cost – and without drawing adverse attention to an institution's on-campus "supply chain." Given the outsourcing of low-wage jobs and "non-core" functions across higher education, the costs of adopting a living wage policy that applies to contractors would be more expensive than solely adjusting pay rates for an institution's direct workforce.

A living wage is based on market conditions (expenses), and in that sense is geographically specific. For example, areas with above average prices for food, education, housing (e.g., San Francisco) have a higher living wage rate than places with a lower cost of living (e.g., Salmon, Idaho). A number of platforms exist that calculate location-specific living wage rates, including the MIT Living Wage Calculator and the National Education Association (NEA) Living Wage Calculator. Since most HEIs are fixed in location, comparing compensation systems to the living wage is a simple enough task. However, at a time of funding cuts in public institutions and intense competition across higher education, universities are more focused on reducing than increasing costs. The challenge for HEIs considering living wage policies/practices lies not in computing the living wage rate, but instead in marshaling an institution's financial and moral obligation to not only direct employees but also contracted workers.

An institution adopting a living wage policy covering only direct employees raises the question why are contractors excluded from said policies. Encouraging on-campus activism is infrequently among an institution's goals in a competitive marketplace where HEIs vigorously protect their reputations. My initial evidence suggests that for institutions that have adopted living wage practices, the financial effects have been manageable, in part due to the outsourcing of "non-core" functions to contract providers. The case to be made for ensuring all of an institution's contractors provide their employees a true living wage rests upon each individual HEI realizing their obligation to treat all persons with dignity.



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Gavin O'Reilly in an 'alum' of my first year seminar, Serious Comedy and Social Justice, where we study how comedy has been used to call out social injustice – humor is a very efficient way to speak truth to power. After the laughter subsides, the issues we examine, including race and racism, are both real and serious. Historically, racism has played a significant role in the history of the United States; to date our society has yet to adequately address racism and its multiple harmful legacies. Overt racism has increased recently, and previously latent racial animus has been revealed, organized, and weaponized. Society's journey to the acceptance and equality of all people looks a bit longer than we might have thought a few years ago.

Gavin's research project is inventive, exploring desistance from hate groups. Examining first-person accounts of desistance, one of his findings is that hate is overcome individually, for individual reasons. Further, the reasons a person leaves a hate group are different than the reasons that they joined; indeed, one cannot well study the former without an understanding of the latter. Thus, Gavin's work set out to explore why people leave hate groups, but he also shed light on the reasons that people explore and join those groups in the first place. An understanding of both hate group enlistment and desistance can both inform and encourage people who are horrified by the race-baiting and racial vitriol we have seen.

It's possible to feel relatively powerless about an intractable problem such as hate. Racism is fairly easy to identify, and straightforward to condemn. However, Gavin's work suggests that we need to look past the groups and understand the people in them as individuals, individuals who can grow and learn and change – and redeem themselves. We can help them. Racism dies hard, and I do not expect all hate groups members to renounce their beliefs. Gavin's research suggests we need to "lean in" (instead of looking away) to listen to and talk with people consumed by hate and hate groups. While more complex than condemnation, that may be more effective at diminishing the power of hate groups, one person at a time. We also need to consider and address the root causes of enlistment: a struggle for social identity, social support, and a sense of personal relevance and importance.

# On the Other Side: A Thematic Analysis of Former White Supremacists and Examination of Desistance From Ideological Extremism

Gavin O'Reilly, '20

Faculty Mentor: C. Ken Weidner  
Department of Management



## Supported by the SJU Summer Scholars Program

American society – like that of many other countries – appears to be struggling to come to terms the recent increase in overt racism. It is certainly possible that broad, sustained progress toward social equality encounters backlash; ideological organizations like the Ku Klux Klan, neo-Nazis, and Aryan Nations rally in anger, promising racial violence and even war. Following incidents like the Charlottesville rally, a larger conversation has developed regarding the number of people who support these movements, both publicly and away from the public eye.

Prior research has come to understand white supremacist hate groups as a form of terrorism, and research on terrorism has uncovered data about who joins these groups, why they join, and how those who subsequently leave these groups terrorism behind. This dangerous transition out of terrorism is often called *desistance*. I decided to research 30 publicly available accounts of former white supremacists, and examine them through the lens of existing research on terrorism, in hopes to learn more about the process of desistance from these hate groups. In particular, I sought to establish what role, if any, white supremacist/racist ideology plays in desistance from such groups, as racial ideology distinguishes them from other domestic criminal groups such as gangs.

A major takeaway of the research is that, in terms of inspiring membership, ideology is often a secondary consideration. More often, falling in with a white supremacist neo-Nazi hate group is a result of factors like isolation, bullying and abuse, lack of a social support network, and repressed anger. A struggle for social identity makes young people especially desperate for a sense of importance, which fuels destructive habits like alcoholism and violence. Numerous academics and activist “formers” such as Christian Piccolini, Angela King, and T.J. Leyden testify as to the powerful emotions of fear and isolation, and some describe using both feelings in their roles as ex-recruiters. Lacking a sense of significance, satisfaction, or direction in their normal lives, young men in particular are easily convinced by groups confidently telling them of the important role they can play if they join.

Meanwhile, desistance is inspired less often by factors like prison and corrections, and more by a sense of purpose and identity unassociated with the identity they receive from joining a hate group. Their new-found, contrasting identity may be as a parent, a friend, a spouse, or even an anti-hate activist. In around 40% of all cases, subjects were softened from hate after establishing a meaningful relationship with a person of color or of a different faith whom their ideological indoctrination had taught them to hate and dehumanize. Still others find their way out by means of a religious or spiritual awakening, or a cultural learning experience.

As an ideological movement, white supremacy is a becoming steadily more dangerous and difficult to track. It comes with doctrine, goals, and the means to coordinate activities underground. However, the personal accounts and prior research seem to suggest that extremism is not driven by the finer details of ideology, but rather by the need to feel a sense of personal empowerment, to vent repressed anger, and to feel a part of something meaningful. Organizations such as *Life After Hate* and *The Forgiveness Project* offer key resources, outreach, and therapy to those looking to leave or join hate groups. It is also worth thinking about combating terrorism not just on battlefields, but in schools, households, and religious institutions. The availability of responsible role models, positive experiences with multiculturalism, and the prevention or treatment of trauma all help to limit the appeal of aggression and hate to those who, righteously or not, feel disempowered as human beings. It seems that by understanding hate group members on an individual basis, rather than seeking to hide ideological hate altogether, is an effective way to empower individuals while disempowering the ideology.



