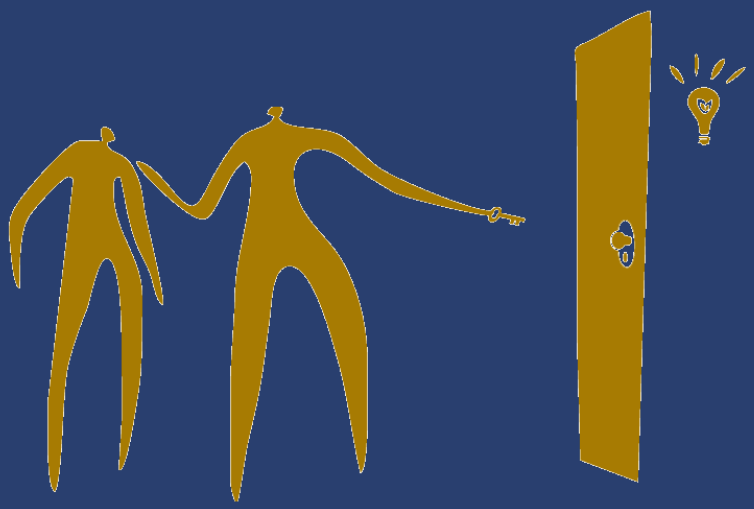
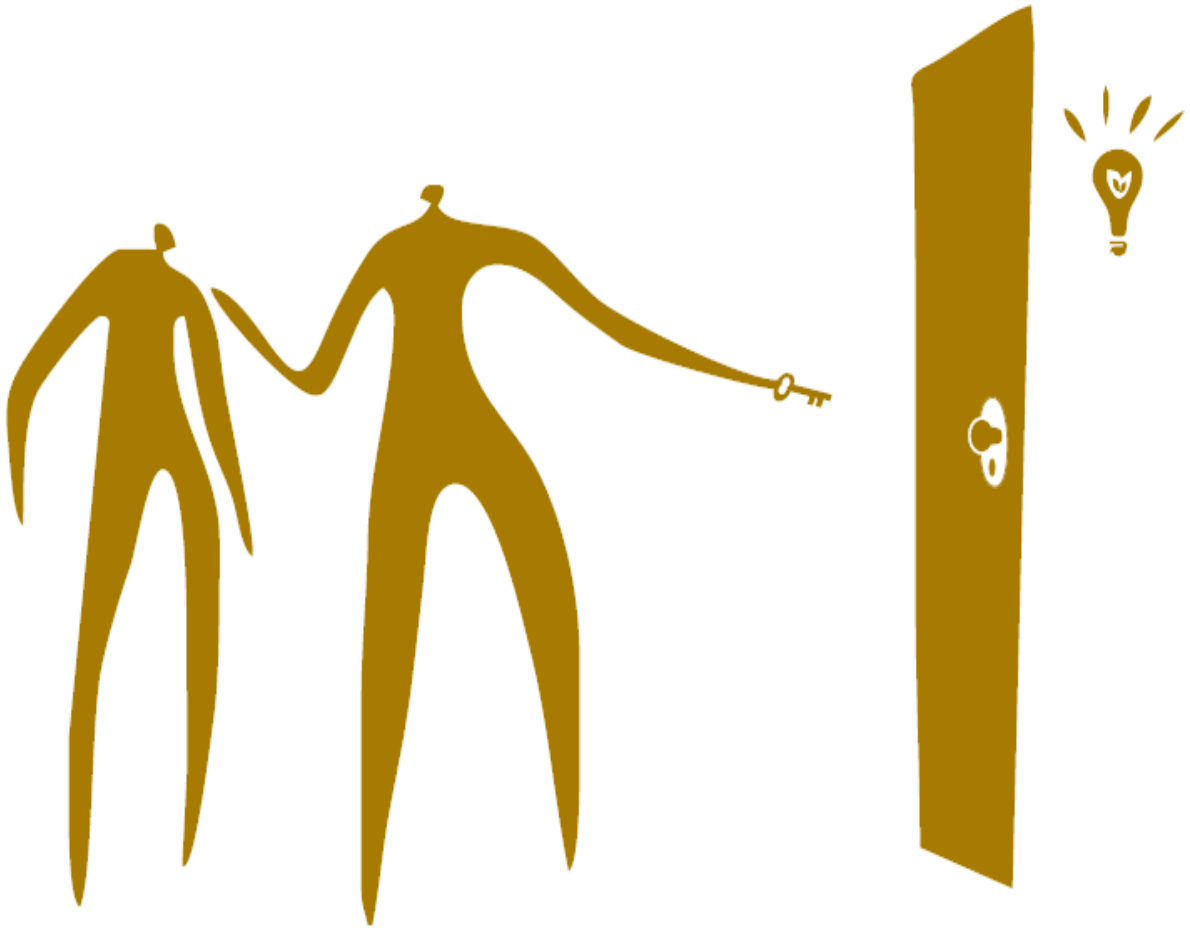
The College of New Jersey

Mentored Undergraduate Summer Experience



2013 Abstracts



MUSE 2013

The College of New Jersey

The College of New Jersey's

Mentored Undergraduate Summer Experience – 2013

TCNJ's MUSE (Mentored Undergraduate Summer Experience) created an interdisciplinary scholarly community for eight weeks over the summer. The program brought together 45 faculty members and 92 students from all seven schools and 23 Departments.

Students engaged in immersive scholarly or creative projects full time during the eight-week program with intensive mentoring and interaction with a faculty mentor. They became junior collaborators to help further the scholarly aspirations of their advisor. The entire group gathered at the beginning to kick off our summer program and then again at the end with several groups presenting at the end. Groups of faculty and students were provided weekly bagel breakfasts to allow our students and faculty to have a casual networking gathering with a wide variety of topics to discuss their projects, successes, problems, and discussions on presentation skills. The MUSE director and Career Services ran pizza-fueled evening workshops on networking, resume writing workshop, and job searching. Faculty and students gathered for 2 large off site programs at the Grounds for Sculpture and the Triumph Brewpub. At the Grounds, participants discussed how their academic training changed how they viewed art. The Triumph, external speakers spoke about the science and engineering involved in brewing, tasting, and judging beer. Faculty and students were involved together in social activities together including a bowling night, indoor rock climbing, and laser tag. Students created their own community through social activities including barbeques, ice cream socials, game nights, Great Adventure trip, and a beach trip.

This program to enrich our scholarly community on campus could not have been done without the financial and personnel support of many groups and people. The Director and all the students and faculty of MUSE thank the Office of Academic Affairs with leadership from Provost Jaqueline Taylor and Vice Provost William Behre and invaluable administrative support from Janice Huang and student program assistant Kendall Ciriaco. We thank the Offices of Residential Education and Housing, Conferences and Meeting Services, Catering Services, Finance and Business Services, and every School and Department office and Chair with MUSE students for their administrative support. We thank the Faculty Student Collaboration Program Council for guiding the vision of MUSE, reviewing proposals and recommending funding: Jarret Crawford, Annie Nicolosi, Donka Mirtcheva, Mary Lynn Hopps, Jerry Petroff, Carol Wells, Trina Gipson-Jones, Anthony Deese, Angela Sgroi, John Pollock, Curt Elderkin, Karen Yan, Tara Carlin and Maria Spinosi. The program received major financial support from Academic Affairs with supplemental funding from the School of Humanities and Social Sciences (Dean Benjamin Rifkin), School of Engineering (Dean Steve Schreiner), School of Business (Dean William Keep), School of Education (Dean Jeff Passe). We are thankful to our external funders, Bristol Meyers Squib, National Science Foundation, National Aeronautic and Space Administration, Marshall University School of Medicine, Research Corporation for Scientific Advancement, Pennsylvania State Wildlife Grant.

Benny C Chan, Ph.D.
Director of Faculty-Student Scholarly and Creative Collaboration Activity and MUSE

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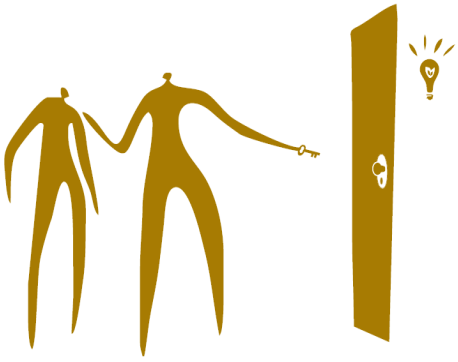

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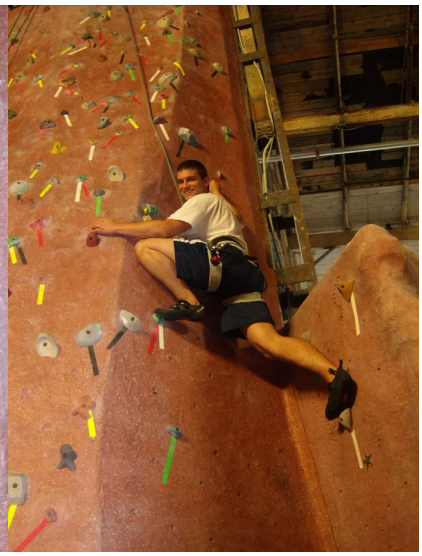



DO NOT GO
BEYOND THE
FOUL LINE

The Educational Consequences of Autism

Nicholas Malmi, Business
Faculty Mentor: Dr. Michelle Naples

2013 MUSE Project

The research Nicholas Malmi is currently performing with Dr. Naples involves studying the costs of autism in the education sector within the state. New Jersey has an unusually high number of children who have been diagnosed with autism, nearly 1 in 50 children. This is twice the national average. Nicholas plans to analyze the costs of state education programs geared for autistic children. Since autism is a wide range of disorders that differ greatly in their severity, He will look at how the state and local schools adjust their programs to accommodate children across the autism spectrum and whether the treatment is appropriate. After understanding how the school system is addressing the massive increase in children diagnosed with autism, He will analyze the costs involved within the education system by reviewing the school budgets of 3 school districts closely and performing interviews with staff within the each school district to see how they have adapted to the higher percentages and varieties of autistic children and how it has affected their resource allocation.

Nicholas Malmi Personal Statement

I researched how the New Jersey education system is adapting to the rise of autism. According to a CDC study, nearly 1 in 50 children are estimated to have autism. Since school districts are required to provide the best education to all its students, special resources must be set aside to teach children with autism. My project this summer was to discuss the economic, educational and policy implications of these programs. I believe I benefited greatly by gaining experience on how one can research such an important and relevant topic, experience that cannot be gained easily by simply going to class.

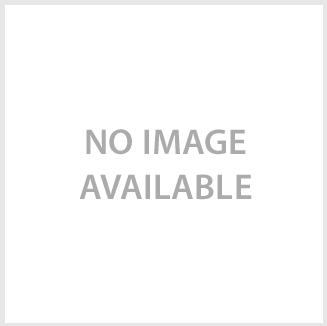
A Portrait of Afghanistan

Sara Seich, Art
Victoria Weiss, Art
Faculty Mentor: Dr. Gregory Thielker

2013 MUSE Project

Throughout the summer Dr. Gregory Thielker, along with his two mentees Sara Seich and Victoria Weiss, has been focusing on the life of Afghanistan. Their research aimed towards depicting life in Afghanistan through the use of paint. Both Sara and Victoria, with the guidance of Dr. Thielker, managed to create portraits of Afghanistan. The idea of these portraits required extensive research on the lifestyle in Afghanistan to create ideal and realistic images. Not only are they working on this specific project for research purposes, but they are also preparing work for an exhibit in Paris.

Sara Seich – Personal Statement



The MUSE program has been a wonderful adventure allowing me to develop as a scholar, and as a person. Over the course of only a few weeks I built new connections, developed my artistic skills, and had many exciting new experiences with my mentor and colleague. My research experience has been a once-in-a-lifetime opportunity that has enriched my time here at The College of New Jersey. I cannot be more thankful for everything I have experienced this summer.

Victoria Weiss – Personal Statement

I worked a lot on paintings and learned new techniques. It was really cool to learn about what the art world is really like first hand and to experience what preparing for a show is really like. I did the base layers of three paintings, worked on making books for the show and researched Afghanistan. It was a great learning experience and I am so happy that I had the chance to improve my painting skills!

This Trenton Life Documentary

Joshua Lewkowski, Communications
Nicole Thompson, Communications
Faculty Mentor: Dr. Susan Ryan

2013 MUSE Project

The film worked on by both Nicole Thompson and Joshua Lewkowski, under the direction of Dr. Ryan, documented the impact of performing arts education on youth from urban backgrounds. Their particular film focused primarily on a group of students in Trenton. From the paper to the stage, their film followed the lives of varying students as they brainstormed, wrote out, edited, practiced, and performed their own original plays in front of an audience. Thompson and Lewkowski's work will be part of Trenton's upcoming event "Art All Night", as they perform outdoors in the Ghandi Garden. The students who were researched will performing a performance which is often referred to as "street theatre."

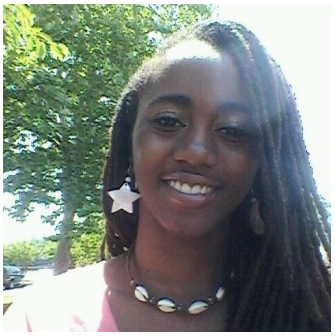
The students' performance, titled "This Trenton Life", speaks to many of the social issues that each one of them face in their community. The documentary created by Thompson and Lewkowski will show how participating in the arts promotes self-confidence, tolerance, and empathy. Also, it will debunk questions such as whether the experiences of these students in Trenton is a microcosm of how the arts can transform the lives of these students all over. It also debunks other questions such as how it can be an avenue to reform communities, as seen with the transformation of their stage for their performance, the Ghandi Garden, which once was an abandon lot.

Joshua Lewkowski- Personal Statement

This summer I was fortunate enough to participate in the MUSE program at The College of New Jersey. The project I worked on was the creation of a documentary entitled This Trenton Life. The documentary follows the production and performance of a play by Trenton youth, and explores the importance of the arts as an outlet for the participating students. The students channeled their personal experiences in order to write and perform a selection of acts, utilizing the play as a means of sending a greater message about the city of Trenton and its residents. With regards to the film, I was responsible for all of the production processes including: shooting, cinematography, file management and organization, logging, editing, transcribing interviews, and workflow management. I believe my participation in MUSE gave me invaluable experience managing and executing all the technical aspects of producing a documentary film. I want to thank the MUSE program, as well as Dr. Ryan for an incredible opportunity and learning experience that will certainly help prepare me for the workplace and my future career.

Nicole Thompson- Personal Statement

Under the instruction of Dr. Ryan, during the 2013 Mentored Undergraduate Summer Experience I have had an amazing expiernce with my partner Josh working on this documentary. I also had an amazing time getting to know the group of students we have been following since the genisis of their playwriting workshops to their practices, and finally their final performance. This MUSE expiernece has taught me lessons. First, it has taught me the importance of time management. When you are working their will be many things in life that can ask of your time, but while working with MUSE I learned how to juggle it all, and put what's most important first. I also learned the importance of communication, for if you are struggling with something it is always best to let your partner or mentor know so that all of you as a team can pull together and accomplish your goal. Finally, I learned as technology advances, it is always good to look back to how things were originally done before all of the advancements, for sometimes things such as keep a log, may seem simple and out of date, but can be very beneficial to the film in the long run. I am extremely thankful to MUSE for this experience and Dr. Ryan for teaching me these lessons that I will keep with me as I take steps in beginning my professional career.

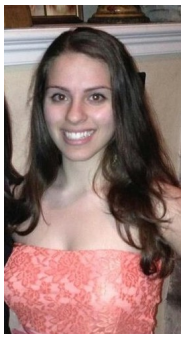


Surviving Sandy & Rebuilding the Community
Jessica Scardino, Sociology & Anthropology
Faculty Mentor: Dr. Elizabeth Borland

2013 MUSE Project

Jessica Scardino worked with her mentor Dr. Elizabeth Borland on a project titled "Surviving Sandy, Rebuilding Community." This particular project is a visual sociology project that examines community development after Hurricane Sandy. This two-part project enabled both Jessica and her mentor to understand community rebuilding in New Jersey shore towns by assessing visual representations of the shore community that have been produced and publically displayed since the store. First, Jessica and her mentor, Dr. Elizabeth Borland, created a database of newspaper imaged by examining three New Jersey Newspapers. These newspapers were: The Asbury Park Press, the Record, and the Star-Ledger. Their systematic coding of the photographic images from these newspapers enabled them to understand how others represent shore towns and how they depict themselves. Finally, Jessica was responsible for interviewing local artists and others who have been involved in the creation or display of public images that represent the shore community and will photograph related images. Both student and mentor analyzed the material to understand the meanings of the symbols and imagery, as well as the impact people anticipate from displaying these art works. This understanding ultimately supported Jessica and Dr. Borland's goal to understand how community identity is depicted and deployed by art and other imagery., and what significance these representations have to those involved.

Jessica Scardino- Personal Statement



The MUSE Program has been the most impactful learning experience of my undergraduate career. Working with Dr. Elizabeth Borland has contributed significantly to both my educational and personal development. First, the academic rigor of the program provided me with an opportunity to participate in every step of the research process and learn a variety of applicable qualitative research skills. Our two-part project about community redevelopment after Hurricane Sandy helped me to cultivate data collection skills such as database creation, participant recruitment, interviewing and transcribing. I also learned to use Atlas TI and Excel to code interview transcripts and newspaper photographs related to Hurricane Sandy. In addition to contributing to my educational development, the immersive structure of the MUSE program supported my personal development. Committing to a forty-hour workweek helped me to learn time and stress management techniques. I am leaving the MUSE Program not only with a marketable set of research skills but also a valuable mentor/mentee relationship.

Psychological Predictors of State-by-State Electoral Outcomes
Sophie Kay, Psychology
Faculty Mentor: Dr. Jaret Crawford

2013 MUSE Project

With Jaret Crawford as her mentor, Sophie Kay, a rising senior at The College of New Jersey, performed research on the psychological predictors of State-by-state electoral outcomes. Social psychology research shows that psychological variables predict a number of important political outcomes, such as political biases, and political intolerance. Psychological variables can also predict political outcomes such as voting behavior. This summer, with the help of zip code information from aggregated dat. Sophie and her mentor Dr. Crawford, examined how individuals' personalities and dispositions correspond to the political stances of elected officials in their respective congressional districts and states.

Sophie Kay- Personal Statement

The Mentored Undergraduate Summer Experience gave me an extraordinary opportunity for me to further explore the life of a researcher. From Dr. Crawford, I have learned so much about the world of research and how it is often more messy than one would like. Since the beginning of this summer, I have become more confident in my ability to analyze data, understand academic papers, and write and communicate with clarity. I am grateful for all that I have learned during my time in MUSE, and I look forward to the fall where I will continue to conduct independent research.

Associative Deficit in Older Adults
Kimberly Newberry, Psychology
Faculty Mentor: Dr. Tamra Bierta

2013 MUSE Abstract

Kimberly Newberry worked with Dr. Bireta in the Psychology department this summer. They both worked on the associative deficit in older adults. As we age, certain aspects of our memory worsen. One of the areas is binding. Binding signifies when one makes associations between two things. These two things can range from anything and can refer to aspects such as shape or color. Older adults will be run on a computer based task and asked to remember paired shapes and colors. Kimberly and Dr. Bireta's research compared the data from older adults and college students in an attempt to see if binding is automatic or more effort-full in older adults. They also attempted to figure out the cause of the associative deficit that range with age.

Kimberly Newberry- Personal Statement

I worked with Dr. Bireta in the Cognitive Psychology Department. We looked at different factors that can influence certain theories pertaining to memory and aging. Specifically, we studied older adults who engaged in serial and free recall at test after encoding lists of words to see if the type of test influences whether or not an isolation effect is obtained. We analyzed a lot of data and wrote our hearts out for a paper that will hopefully be published. My experience with the research project and the MUSE program was definitely worthwhile and I wish I had been able to do it sooner.

Pyschological Mechanisms Needed to Achieve Positive Career Attitudes
Taylor Lauricella, Psychology
Faculty Advisor: Dr. Jason Dahling

2013 MUSE Project

According to the Bureau of Labor Statistics, Americans spend over a third of their day at work on average. Because we invest a great amount of time in our jobs, it is important to understand how work environments can promote successful career development and job satisfaction. Taylor Lauricella with the help of her mentor Jason Dahling will perform a study to determine what psychological mechanisms need to be satisfied in order to successfully achieve positive career attitudes. Both Taylor and Dr. Dahling believe that providing autonomy and support in the workplace helps to fulfill psychological needs that allow for career adjustment. The fulfillments of these psychological needs that allow for career adjustment occur when employees perceive that they have the abilities to perform their jobs. To assist in their research, Taylor and Dr. Dahling will test a model of this process on a large sample of working adults over the summer by collecting date at several points in time from participants.

Taylor Lauricella Personal Statement

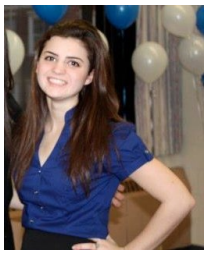
My work with Dr. Crawford has helped me to understand the realities of doing research. At the beginning of the program, my head was filled with unwavering hopes of finishing four studies and writing a paper – all in eight weeks. After diving head-first into our project, I soon realized the proper mindset for doing these kinds of investigations: hope for the best, but expect the worst. While some of our plans did not go as expected, Dr. Crawford helped me forge ahead with brain-storming sessions and positive criticism. Along with preparing my own research, I enjoyed conversing with other students and discussing our projects at length. I left the Mentored Undergraduate Summer Experience with a new array of research-related skills, and a desire to pursue this line of work into graduate school.

Food Study
Noelle Calvello, Psychology
Faculty Mentor: Dr. Chu Kim- Prieto

2013 MUSE Project

In this study, both Dr. Kim and Noelle Calvello performed research on emotion. This included the study of the people's emotions with respect to their food choices. Dr. Kim and Calvello used participants throughout their research. These participants were given the chance to write about recent events that evoked feelings of happiness, pride, sadness, gratefulness, or neutral feelings. The use of participants was to collect respectable data to observe. The respectable data collected would soon lead to conclusions proven by the research. Participants get a choice between six snack foods: apple slices, baby carrots, raisins, chocolate, chips, and cookies. Relationships between the evoked emotions from the various foods were analyzed throughout this summer of research.

Noelle Calvello Personal Statement



Participating in the MUSE Program with Dr. Kim-Prieto this summer has been a very rewarding and exciting experience. Continuing to work on the food study, which studies the effects of different emotions on an individual's food choice, was great because I have been involved with this project for a year, so I was thrilled that I got to see the project through to the end. Dr. Kim and I were able to successfully enter, as well as analyze, all of the data that was collected over the past two semesters. The research experience that I gained through this program will undoubtedly be essential to my success in applying to and attending graduate school next year.

"The Art of Indifference: Representing the Unthinkable in Shalamov's Kolyma Tales"; "The Starving Artist: Life, Death, and the Role of the Storyteller in Varlam Shalamov's "The Snake Charmer" and "Cherry Brandy""
Maria Mostyka, English
Faculty Mentor: Dr. Harriet Hustis

2013 MUSE Project

Kolyma Tales is a collection of short, semi-autobiographical stories written by Varlam Shalamov who spent 15 years in various Gulags in the Siberian towns of Kolyma and Magadan. Gulags were Soviet forced labor camps that not only constituted a part of the Soviet penal system, but were also an epitome of the system of state repression and terror . Many were arrested on the grounds of being an ideological and political danger to the regime. Anywhere from several million to 15 million people died in the camps, in unbearable conditions of cruelty, starvation, and inhumane labor. This MUSE project focused on an analysis of Shalamov's Kolyma Tales in the historical context of the Gulags and in contrast to other accounts of Gulag survivors. The literary analysis undertaken tested French psychoanalyst Catherine Malabou's hypothesis of "destructive plasticity" by means of close examination of the role of language in the stories' depiction of "the unthinkable". Malabou proposes that identity of the individuals who experience political persecution is completely destroyed and through this destruction, a completely new identity is formed. Malabou argues that the shock and unpredictability of political trauma remains fundamentally "unthinkable" and irrecoverable for the individuals. An analysis of Kolyma Tales revealed that through his particular use of language, Shalamov was able to represent an inherently complicated emotion of indifference that allowed him to survive Gulags. Furthermore, Shalamov structured his stories to make them emotionally charged documents in order to capture the horror of the Gulags while addressing the issue of authenticity. Contrary to Malabou's argument, it was found that Shalamov's identity was not completely destroyed, and there was an indestructible artistic core that remained intact. For a long time, Gulag survivors were not able to speak and write about the Gulag and the devastating effect it had on their lives. Working with Gulag literature, such as Kolyma Tales, is the least that we can do to commemorate those who perished in the Soviet state-wide system of repression and terror.

Maria Mostyka Personal Statement

Participation in the MUSE program provided me, a pre-med student, with a unique opportunity to pursue my other passion—literature. I also was able to study the history of GULAGs which form an integral part of Russian history.

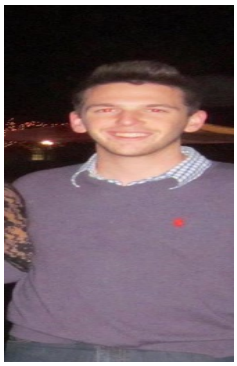
By reading and analyzing "Kolyma Tales" and memoirs of Gulag survivors, I became more connected to the history of my own country—Belarus—which was part of the Soviet Union. Although I expected very little overlap of literary research with my future career as a physician, I discovered numerous works on trauma narratives which made me rethink the patient-physician relationship and the way patients' stories are told. Working with professor Hustis was an exhilarating experience since I not only honed my close reading and critical thinking skills, but also learned how to analyze literary texts in a historical context and how to develop plausible and evidence-based interpretations. Furthermore, I learned an invaluable skill of being open-minded to the new directions and staying focused on the task. This unforgettable summer, when for the first time I engaged myself in a scholarly research, was rich in intellectual and personal growth.

Anthropology Project on Global Youth
Jack Meyers, Anthropology & History
Faculty Mentor: Dr. Miriam Shakow

2013 MUSE Project

In the first ever MUSE Anthropology project, Jack Meyers will be working with Professor Miriam Shakow to discover what scholars have to say about global youth. Professor Shakow has provided Jack Meyers with a bibliography that includes a variety of books, articles, and essays that explore various themes related to youth. These books relate to their identities, their fears, their culture and how politics and policy treat youth or, sometimes, how youth are mistreated. Jack worked this summer to summarize and analyze the works given while comparing and contrasting them to one another. These comparisons were necessary in order to catalog the global scholarly debates on youth experiences. Professor Shakow plans to use this annotated bibliography toward other projects, including one on Bolivian youth, which has been a common theme in her fieldwork in Bolivia since 1995. This summer Jack Meyers was also helping Professor Shakow edit her current book manuscript, called "States of Discontent", on the middle class of Bolivia.

Jack Meyers Personal Statement



I have learned in this research program arguably one of the most important skills in college and in life: how to read strategically. It's not about reading everything or even reading exceptionally fast, but about knowing what you want to get out of a reading, and knowing exactly where to look for it. Since my research has me waist-deep in complex theories, metaphors, and symbols, I spend a significant amount of my time thinking, often more than I do actually reading the words. This tactic, I've found, is extremely helpful, because instead of getting caught up with each sentence and its meaning, I go back and forth between pages, reading for consistent themes that will lead me to the meat of what the author is saying. Overall, I'd saying I'm having a great time, learning more than I could have imagined, and I am lucky enough to have a mentor who supports not only my learning and skill-refining, but also my mental health. Professor Shakow is understanding, helpful, and refreshingly sincere. Every discussion is meaningful, as she helps me to place what I am reading in the context of our project, as well is in the context of my life, and in relation to the world around me as well.

Four Alternatives in Interpreting Parmenides
Yale Weiss, Philosophy
Faculty Mentor: Dr. John Sisko

2013 MUSE Project

During this summer, Yale Weiss was lucky enough to work with Dr. John Sisko. They worked together to evaluate the work of the Pre-Socratic Greek philosopher Parmenides. This kind of research is multifaceted and complex according to Weiss. Yale Weiss was challenged to do some heavy loads of reading and summarization. These readings included scholarly texts whose arguments were to be analyzed. Yale Weiss was also responsible for doing translation work. Translation meaning, translating from ancient Greek into English. Yale will also be working with Dr. Sisko to write a literature review on an upcoming book. Finally, both Yale and Dr. Sisko planned on co-writing an articles that assesses interpretations of Parmenides and his place in Pre-Socratic philosophy.

Yale Weiss Personal Statement

During this summer I worked with Dr. Sisko on interpreting Parmenides, a notoriously difficult to understand pre-Socratic philosopher. We read both primary sources (a series of Greek fragments) and the extensive secondary literature about them. Were it not for his guidance, encouragement and careful selection of resources, I doubt I would've been able to do as much as I've done in developing alternative ways of understanding Parmenides. It has been wonderful to have so much funded time to work through these difficult and lengthy texts; during the academic year, I could never have been so thorough, and in this respect, MUSE is really great in allowing for the possibility of in-depth, original research. By the end of the summer, both Dr. Sisko and I will be well on our way to having completed our own and joint papers.

Trope of Epiphanal Blackness

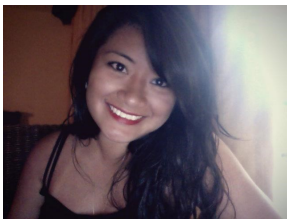
Maria Samantha Pena, African American Studies

Faculty Mentor: Dr. Piper Williams

MUSE 2013 Project

Maria Pena will be offered Dr. Piper Williams a helping hand in the English and African American Studies departments. Maria will be researching for Dr. William's next book. Her next book will be both a memoir that will trace her family's history of racism and survival in American Society. It will also include a critique of canonical African American literature using deep textual analyses and race theory. The research performed this summer focused on the trope of "epiphanal blackness." The term "epiphanal blackness" is a term Dr. Williams noticed is present in all African American texts and coined to represent the moment when a Black person realizes he/she is the "other" in society. Maria, overall, was responsible for close reading primary documents and researching current scholarship on the repercussions of epiphanal blackness on the psych and the dominant group's response to resistance against the norm.

Maria Samantha Pena Personal Statement



I am working with Professor Piper Kendrix-Williams to trace the trope of epiphanal blackness in literature and the ways in which the ideology of white supremacy creates physical and psychological boundaries that those of a minority race must negotiate in order to exist. I have read a lot of important literature this summer that is integral to my development as a student, and I think this summer is helping me grow as a person and explore potential career options.

Social Support for English Language Learners
Caitlyn Connolly, Counselor Education
Lindsey Williams, Counselor Eduction
Faculty Mentor: Dr. Stuart Roe

MUSE 2013 Project

Both Caitlyn Connolly and Lindsey Williams, under the direction of Dr. Stuart Roe this summer, performed a qualitative research study for the Counseling Education department. As a team, they all worked to discover issues that English Language Learners experience and need help with. Their research involved one on one interviews with several English Language Learners from Trenton High School about support they have received, who has played a vital role in their progression in and out of the classroom, and techniques they feel have been or would be helpful. These interviews were transcribed and separated into themes in hopes that they would aid us in discovering and developing techniques to support those students and sociocultural strategies. Sociocultural strategies are techniques useful for sympathizing and communicating with people of other cultures and can have great effects on the academic and overall wellness of student's whose primary language is not English.

Caitlyn Connolly Personal Statement

Being a par of MUSE and Stuart Roe's Research has been an amazing experience. MUSE provided me with an opportunity to meet students in other fields of study, network, and be able to briefly and effectively explain research to others outside our department. Working with Stuart Roe, I was treated as a vital part of the research, I was able to be trained in NVivo, a program for analyzing and organizing data and sources, and I learned a lot about conducting research using phenomenology. I was also trained to use DragonSpeak software which helps with the transcribing process. The overall experience is one that has had a great impact on my life and will help me to thrive and succeed in my future at graduate school and in my future career.

Living World History for Secondary Social Studies Classrooms
Matthew Ritsko, Education Administration
Faculty Mentor: Dr. Brian Girard

MUSE 2013 Project

As the world rapidly accelerates into the future, the importance of the past is often forgotten. Modern developmental energies have crafted a globalized world which is rewriting the status-quo in political, economic and sociocultural terms. Young people are being thrust into a sparkling new global world brimming with new developments - all of which builds upon a long-standing developmental history that has been shaping the entirety of humanity for eons. Thus, it is imperative that our educational system imparts a stronger conceptual understanding of humanity's development via a more focused World History curriculum. This summer, Matthew Ritsko, under the direction or Dr. Brian Girard, created a MUSE project that seeks to design a classroom-centered, longitudinal simulation that highlights humanity's universal development from the dawning of our species to the present - all in harmony with the state and national educational standards. To present these profound and abstract concepts to students, this project draws directly from a burgeoning body of research, including game theory, ethnographic methodologies and sociocultural learning theories to put students in greater command of their educational experience by applying their growing content literacy towards the development of their own unique civilizations. Designed to harness students' inherent creative energies, this game-centered world history curriculum cultivates a holistic understanding of humanity's development through a blended application of the arts, sciences and humanities. Furthermore, this project endeavors to actively merge content literacy with 21st century skill development by imbuing students with the capacity to actively write and theorize, innovate, problem solve, critique, collaborate and adapt in concert with an evolving simulation - thereby providing them with the expertise and skills to interact with our rapidly developing world

Matthew Ritsko Personal Statement

The 2013 MUSE Program provided me the unique opportunity to hone my research skills in a tangible effort to further develop my understanding and appreciation for the immense amount of thought and effort that goes into developing a middle school curriculum. This experience furthered my interest in a field in which I already had a great amount of interest in and provided me the tools to become an active member in the field of curricular development. Most importantly, working with Dr. Brain Girard strengthened my understanding of research processes and gave me a realistic introduction to the world of academia. With Dr. Girard's valuable support, insight and encouragement, I had the priceless opportunity to further myself as a budding professional.

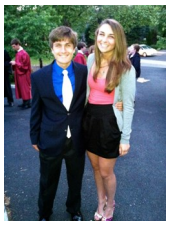
Mechanically Induced Mesenchymal Stem Cell Differentiation

Christina Rabolli, Biomedical Engineering
Faculty Mentors: Dr. Christopher Wagner

2013 MUSE Project

Mesenchymal stem cells (MSCs) are adult progenitor cells that can differentiate into a variety of cells types, including bone, tendon, ligament, cartilage, and adipose cells and are commonly used for tissue engineering approaches to tissue replacement. It has been shown that MSCs can be induced to differentiate through the application of specific chemical signals. More recently, studies have demonstrated that MSCs embedded in a collagen-based gel can also be induced to differentiate into tenocytes (tendon cells) through the application of specific mechanical stimulation. However, the resulting constructs fail to achieve mechanical properties suitable for tendon/ligament replacement. In this study we will use a porcine-derived acellular intact extracellular matrix (ECM) scaffold that has been used clinically to replace tissue deficits instead of traditional scaffolds having non-native composition and organization. The objectives of this work are to demonstrate MSC cultured on this intact ECM will differentiate in response to mechanical stimulation and exhibit tenocyte biological markers and to characterize the rate and degree of differentiation compared to purified collagen scaffolds. The ultimate goal of this work would be to apply tissue engineering approaches and specific bioreactor conditions to produce therapeutic grafts for tendon/ligament injuries, especially the anterior cruciate ligament that does not heal after being injured.

Christina Rabolli Personal Statement



This project had such a huge impact on me because it showed me how to actually apply all the knowledge I've gained in 2 years of classes. I enjoyed this research so much that I actually changed my career goals and am gearing them more towards tissue engineering, which is what we've been doing this summer, instead of prosthetic design, which is a HUGE change.

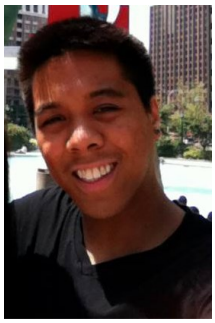
Flow Patterns at Low Reynolds Numbers

Christopher Atanacio, Mechanical Engineering
Faculty Mentor: Dr. Lisa Grega

2013 MUSE Project

Christopher Atanacio worked under Dr. Lisa Grega this summer in the Mentored Undergraduate Summer Experience. They both performed research on flow patterns at low Reynolds numbers. They did so by way of low velocity flow as well as flow around small particles. In particular, the students were modeling and testing the flow patterns around pollen. Those flow patterns were then modeled using ANSYS Fluent. Subsequent to that, the flow patterns were then tested in a flow tank which they also were responsible for modeling and building.

Christopher Atanacio Personal Statement



My research, advised by Dr. Lisa Grega, was on the study of laminar fluid flow at really low Reynolds numbers, specifically around pollen particles. I, particularly, worked on building the apparatus to test the fluid flow. It consisted of two moving walls that were parallel to each other and move in the same direction in order to get a more uniform velocity profile. The moving walls were achieved by wrapping each wall around two rods and having an electric motor spin one of the rods to make the wall move. I also worked on modeling the 3D fluid flow around a cylinder in ANSYS Fluent. The meshing method used to model the 3D fluid flow will later be used to model the fluid flow around a pollen particle.

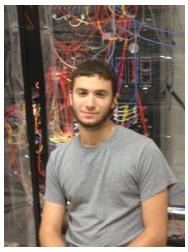
Phasor Measurement Units

Timothy Daniel Nugent, Electrical Engineering
Stephen Coppi, Electrical Engineering
Faculty Mentor: Dr. Anthony Deese

2013 MUSE Project

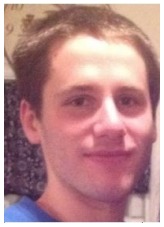
Power distribution networks can see serious issues due to lack of real-time information. Phasor measurement units are used to observe and collect voltage, frequency, and phase data for analysis. Based on the data, the operator can make adjustments to the power grids such as increasing/decreasing the power output. The data can also be used to determine where any problem has occurred, which allows for the problem to be isolated. An increase in the number of PMUs will result in a more efficient and stable power grid. During MUSE, Stephen Coppi and Timothy Nugent worked with Dr. Deese to research and develop a phasor measurement unit. A PMU is used to measure voltage, frequency, and phase at a particular point in the power grid. When multiple PMUs are implemented, an estimation of the overall quality of the grid can be determined so that actions can be taken to both improve efficiency and prevent problems.

Timothy Nugent Personal Statement



The MUSE program has provided me with the opportunity to perform research within the advancing field of power systems. The research conducted increased my ability to critically analyze data and processes and draw conclusions based on these results. It was excellent to have gained necessary background knowledge and experience in this field and in the Smart Electric Power Systems Lab as I move forward towards developing my senior project. It was a privilege to be able to work under Dr. Deese, an expert in the field and an outstanding mentor. I look forward to using the skills attained through this experience in my future endeavors in graduate school and/or industry.

Stephen Coppi Personal Statement



The MUSE program was a great experience. It allowed me to not only conduct research in a field I am interested in, but also gave me valuable knowledge to further my college education. Working with Dr. Deese was a privilege and being advised by someone with experience in the field was invaluable. The MUSE program was great for both furthering my college experience as well as preparing me for work in the field.

Nanofibrous Networks for Water Remediation

Allyson Salmon, Technological Studies
Joanna Papadopoulos, Technological Studies
Faculty Mentor: Dr. Matthew Cathell

2013 MUSE Project

For this MUSE research project, Joanna Papadopoulos and Allyson Salmon are creating and characterizing nanofibers, which are made from biopolymers that bind to toxic metals dissolved in water. The nanofibers membranes under investigation are formed from alginate, a water-soluble polymer found in algae and known for its ability to bind to heavy metals. The nanofibers are formed through a process called electrospinning, in which nanoscale fibers are fabricated from polymer solutions using a high voltage electric field. In previous summer's research, fibers with diameter ranging from 100–500 nm (100–500 billionths of a meter) were successfully electrospun and imaged using scanning electron microscopy (SEM). These nanofibers were then treated with calcium chloride and glutaradehyde vapor to strengthen their structure making them suitable for water filtration. Results from the past two years of MUSE research indicate that the nanofibers can bind to to dissolved ions of lead ions, thus removing the ions water. This year, they will continue to test the sorption capacity of the nanofibers with other heavy metals such as mercury and cadmium. We are also investigating alternative means of making the nanofiber membranes water-insoluble, including photo-crosslinking with ultraviolet light.

Allyson Salmon Personal Statement

As an elementary education major I felt that my degree did not fully encompass my interests and capabilities. I have always had a passion for science and research, two fields which would have been mostly neglected had I stuck to the usual rout. As life would have it, I took the road less traveled and decided to pursue integrative science, technology, engineering, and math (iSTEM) as my second major and to focus in the field of biology (only about 2% of iSTEM students choose this focus). My passion for science lead me to take additional courses which will allow me to teach kindergarten through twelfth grade. Yet I still had the desire to engage in genuine research, where the results could not be found by examining another's work. In partnership with assistant professor, Dr. Mathew Cathell and student, Joanna Papadopoulos, I was able to delve into the field of research. Lead by Dr. Cathell and the previous work done by TCNJ graduate, Melissa Bradley, Ms. Papadopoulos and I established a method to produce consistent nanofibrous mats of alginate biopolymer and began testing them for their ability to remediate heavy-metal contaminated water. We hope to continue our research throughout the school year in order to verify what the preliminary data has shown. Through this experience I gained many skills and challenged the limits of my capabilities. Not only did I learn how to used new equipment (such as a scanning electron microscope and an inferred spectrometer), I gained an appreciation for the persistence and determination that research requires. In addition, I have gained confidence in my ability to engage in academic pursuits beyond those for my undergraduate degree. The road ahead of me is uncertain but I can now continue down the path more confident in my ability to pursue any path I choose.

Joanna Papadopoulos Personal Statement

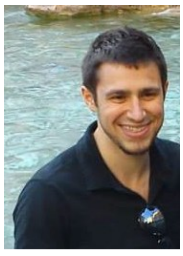
This summer I had the privilege of working with Dr. Matthew Cathell from the School of Engineering and iSTEM major, Allyson Salmon on a research project that investigated ways in which we could create a nanofiberous network to be used in the remediation of contaminated water from heavy metals such as Mercury. We investigated various ways to which we could create such a network using a natural biopolymer called Alginate, which originates from brown algae. Through this research experience, I was able to obtain a greater perspective of the roles of a researcher and gain a better understanding of this environmental issue. I was also able to meet new people and make many memorable memories through the social gatherings our MUSE coordinators planned. I would like to thank all the MUSE coordinators, Faculty, Staff, students and contributors that helped make this MUSE 2013 a great success. Thank you!

Temporal Analysis of a Stochastic and Integrative Model of the Cardiorespiratory System
George Banis, Biomedical Engineering
Faculty Mentor: Dr. Brett Busha

2013 MUSE Project

Under the direction of Dr. Bret Busha, George Banis expanded on their research from last year of designing and implementing a stochastic and integrative model of the cardiorespiratory system. The new model will be able to quantify the ability of short-term data to be used to predict longer-term system behavior. The experimental plan is to optimize the model with data from a fixed short span and model behaviors at significantly longer time spans. With the end goal of determining the relationship between model data length and the maximum predictive length. In addition, George Banis and Dr. Busha will be drafting a manuscript resulting from last year's project.

George Banis Personal Statement



During MUSE, the objective of my research was to design, implement, and optimize a stochastic and integrative computational model of cardiorespiratory control by modeling the distribution of previously recorded respiratory and cardiovascular data. Sequences of data were used to construct probability density functions (PDFs) to describe the variability of breathing and heart function for each subject. Using MATLAB, polynomial curves were fit to the PDFs of breath-to-breath and heartbeat-to-heartbeat data. The model curves were used to generate random sequences of breathing and heartbeat data, which were then passed through an memory-based function that used information from the second and third lag of the autocorrelation of each original data set.

Determination of the Mechanical Properties of Fiber Reinforced Polymer Composites Fabricated by Hand Lay-Up from Companion Coupons

Casey Fontana, Civil Engineering
Noel Gorab, Civil Engineering
Faculty Mentor: Dr. Andrew Bechtel

2013 MUSE Project

Fiber reinforced polymer composites have many desirable properties that make them ideal for the external repair of aging civil engineering structures. However, the existing method (ASTM D3039)of determining their engineering properties was designed for shop-manufactured composite, and civil engineering applications require field-manufactured composite which has a more variable thickness. The objective of our research was to analyze the accuracy of ASTM D3039 in determining the properties of field-manufactured composite. In order to execute this, we first created a mock civil engineering structure and laid up composite onto the floor, wall, and ceiling of the structure. The cured composite was removed and thickness measurements were taken throughout. Thirty coupons of each sheet were then tested in tension to failure per ASTM D3039, and resulting elastic modulus and ultimate strength data were collected. The values of these properties were determined using only three measurements of thickness along the length of the coupon. Data for each of these properties were also simulated from the extensive thickness measurements using Monte Carlo simulations. These simulations represented the true values for each property. The distributions of each data set were determined, and the experimentally determined data sets were statistically compared to the simulated data sets for each property of each surface. Based on these comparisons, it was concluded that ASTM D3039 was adequate in determining the engineering properties of field-manufactured composite.

Statistical comparisons were also performed among surfaces for each property. Results of these tests showed that the surfaces were not all comparable, and that variability increased as the surface orientation became more difficult to work on (i.e. the roof was more variable than the floor, and the two were not statistically comparable). These conclusions will contribute to the use of fiber reinforced polymer composite in civil engineering field applications.

Casey Fontana Personal Statement

MUSE has been an incredible summer experience that has expanded my horizons behind normal classroom limits. It has been extremely valuable to me in multiple ways, one of them being that I am significantly more proficient with the computer programs and lab equipment we used over the course of this research. My mentor was a wealth of knowledge, both helping me to fully understand the importance of research and offering me guidance about my future in the field of civil engineering. By encouraging me to work independently, Dr. Bechtel has helped me to sharpen my analytical and problem-solving skills, assets which will aid me in my future graduate studies and job responsibilities. My involvement in this research has truly made me gain invaluable perspective on the entire process of research, from outlining the project goals all the way to the presenting the conclusions.

Noel Gorab Personal Statement

During the MUSE program I was able to learn a lot about our specific subject matter, gain more experience with computer software, and get hands on experience with research that I could not have had any other way. It was a fun and rewarding experience that will definitely help me as I continue my education.

Cardiorespiratory and Muscular Performance Adaptations to Concurrent Aerobic and Low-Intensity Resistance Training

Matthew Wells, Health & Exercise Science
Megan Flynn, Health & Exercise Science
Faculty Mentor: Dr. Nicholas Ratamess

2013 MUSE Project

The Department of Health and Exercise Science's 2013 MUSE research is titled, "Cardiorespiratory and Muscular Performance Adaptations to Concurrent Aerobic and Low-Intensity Resistance Training ." The purpose of this study is to compare the physiological benefits of a standard aerobic training program to a combined aerobic/resistance training program. Subjects undergo a rigorous week of testing, after which they are randomly placed into a running group, running/lifting combined group or a control group. The non-control groups undergo six weeks of training, which includes three 20-minute sessions each week. At the end of the training program, subjects will be evaluated for changes in their maximal oxygen uptake, exercise economy, body composition, and muscular strength.

Matthew Wells Personal Statement

The Mentored Undergraduate Summer Experience (MUSE) research program provided me with an unforgettable summer with my mentor, Dr. Ratamess, as well as the other laboratory assistant, Megan Flynn. Our research project involved human subjects, which required a collaborative effort on the part of the subjects and the supervision of our team. Our subjects underwent a grueling eight-week workout regimen that ultimately led to physiological adaptations prompting an overall average increase in maximal oxygen uptake, aerobic economy, and muscular strength. Through the MUSE program I learned how to properly execute different testing protocols, apply what I have learned from my courses in a controlled environment, statistically analyze the data gathered, and present the justifications for our findings. These skills will provide the essential foundation needed in the graduate schools that I will apply to in the upcoming year. MUSE is titled appropriately as it is not just a program, but also a truly valuable experience of which I am grateful for.

Megan Flynn Personal Statement

Our project involved determining the effects of an exercise training program consisting of aerobic and resistance exercise and comparing the results with a training program consisting of solely aerobic training--running on a treadmill. I enhanced my knowledge throughout this research program, by applying a majority of the information that I have learned in the classroom over the past few years that I have been a student at TCNJ. I was also able to learn the protocol of working in the lab, which will be of use to me in the future. In addition, the activities set up throughout the research program made the experience even more enjoyable. Overall, I learned a lot in this research program that will help me in my future endeavors.

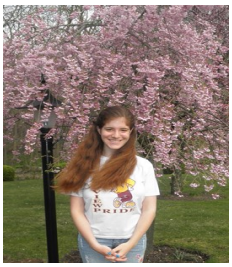
Systematics: Study of Evolutionary Relationships Among Organisms

Syndi Barish, Biology
Amanda Goble, Biology
Alanna Cohen, Biology
Faculty Member: Dr. Wendy Clement

2013 MUSE Project

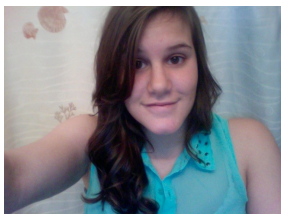
Systematics is the study of evolutionary relationships among organisms. To study this branch of science, phylogenetic trees, a branching diagram that helps us see evolutionary relatedness, are reconstructed using the organism's structural characteristics and DNA sequences. Phylogenetic trees are hypotheses about the evolutionary past of a group of organisms and help us, for example, describe how certain morphological traits evolved and where plant groups originated. This project focuses on a group of plants called Viburnum. There are 160 species of Viburnum that are common to temperate forests of the Northern Hemisphere. Currently, the Viburnum phylogeny includes over 100 of the 160 species that exist. However, due to lack of resolution, they are uncertain about some of the evolutionary relationships among Viburnum species. My goal is to improve our phylogenetic hypothesis to resolve these relationships by sampling more regions of DNA. All researchers will be testing new molecular markers to identify more variable regions of DNA that will help us separate closely related species on the phylogeny. These data will be analyzed using phylogenetic methods. Ultimately, the goal is to better describe the relationships among Viburnum in order to provide an improved classification of the group and identify their geographic origins

Syndi Barish Personal Statement



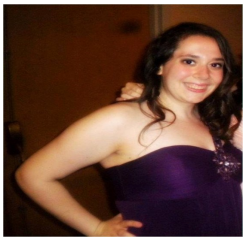
Being a part of MUSE has enabled me to dedicate forty hours a week to doing research without having to worry about classes. In doing so, I have made significant progress on my two projects. In addition to getting more data, I have acquired skills to become a better scientist such as independence and problem-solving skills. One project I was working on involved trouble-shooting protocols. Rather than asking for help every time it did not work, I thought through the problem and came up with possible solutions to discuss with my mentor. I changed one thing at a time, until it finally worked. It felt really satisfying each time I got a protocol to work. This experience showed me that if you persevere, you can accomplish a lot. Even if it seems trivial at the time, a lot of small steps add up to major accomplishments.

Amanda Goble Statement



Being in the MUSE program has certainly been a challenge, but it has been an exciting and stimulating experience that I will never forget. I've become a more independent person, able to successfully organize and perform multiple scientific processes confidently. I originally planned on using this summer to perfect my lab techniques, but I've gotten so much more out of the program than just that. I was able to get a grasp of the workings of plant systematics and evolution, branches of science that were new to me. I have learned (and am continuing to learn) many computer analysis techniques, and will be able to analyze my own data, which is a very satisfying feeling. I'm looking forward to continuing the Viburnum project that I got to begin this summer!

Alanna Cohen Personal Statement



My experience with MUSE has given me insight to a career as a scientist. Rather than coming into the lab to run a PCR between classes as I do during the semester, I've had the chance to make research a full-time job. Also, I'm not only conducting experiments, but also developing my skill set as well as a new way of thinking and approaching problems. My MUSE experience has helped me become even more comfortable with familiar techniques and learn completely new ones that I never imagined I would be doing. The best part of this experience, and for what I am most thankful for, is my newfound sense of independence. When encountering a problem, rather than immediately asking for help, I now begin to think more critically about the problem, what might have caused it, and how I might be able to fix it. As rewarding as it is to have collected, analyzed, and presented my own data, the ability to think like a scientist and develop my problem solving skills makes me thankful I had this amazing experience and all the opportunities it offers.

Effects of Prenatal Nicotine Exposure on Cardiorespiratory Function in Neonatal Serotonin-Deficient Mice

Renuka Reddy, Biology
Jessica Nardone
Shota Kikozashvili
Faculty Mentor: Dr. Jeffrey Erickson

MUSE 2013 Project

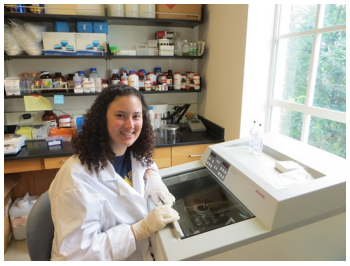
The brainstem serotonergic system is a key regulator of autonomic respiratory function and is particularly important in the proper development of early postnatal respiratory control. In fact, deletion of the Pet-1 gene, which codes for a transcription factor needed for the development of a full complement of brainstem serotonin neurons, results in several respiratory deficits in neonatal mice. Specifically, serotonin-deficient Pet-1 knockout mice exhibit a depressed breathing frequency, a higher incidence of spontaneous respiratory pauses, and an impaired autoresuscitation response to anoxia-induced apnea, relative to genetically intact littermates. These respiratory deficits are similar to those observed in victims of Sudden Infant Death Syndrome (SIDS), which has been associated with brainstem serotonin deficiencies. Among the many risk factors for SIDS, one that has garnered recent interest is pre- and postnatal exposure to nicotine, a neuroteratogen present in cigarette smoke.

Surprisingly, previous studies in our lab, utilizing whole-animal in vivo techniques, have demonstrated that pre - and postnatal nicotine exposure reverses the respiratory deficits observed in neonatal Pet-1 knockout mice. However, the neural mechanisms responsible for the respiratory abnormalities in the Pet-1 knockouts and the role of nicotine in reversing these abnormalities remain unknown. To begin to address this issue, we have developed an in vitro neurophysiological recording system that allows neural impulses from breathing control centers in the isolated neonatal mouse brainstem-spinal cord to be studied under controlled experimental conditions. This system will be used extensively throughout the summer, in addition to continued whole-animal cardiorespiratory studies, in an attempt to better understand how loss of Pet-1 gene function produces abnormal breathing behavior and how prenatal exposure to nicotine reverses the respiratory deficits in the serotonin-deficient Pet-1 knockouts.

Renuka Reddy Personal Statement

Although I have conducted research projects during the academic year as a member of the Erickson lab, the MUSE program provided me with the unique opportunity to partake in full-time research. Developing a system for isolating live tissue and obtaining neural recordings is no easy task, but under the guidance of Dr. Erickson, our team was able to set up a working system for data collection. I learned that through dedication it was possible to arrive at that marvelous moment when the days spent troubleshooting culminate in success, be it a clear recording or simply a discovery that brings us one step forward in perfecting the system. Through MUSE I have also become more independent in the lab. I have refined and taught others a technique for simultaneously recording mouse heart rate and ventilator movements. As the program draws to an end, I look back – proud of what we have accomplished and eager to continue working in the lab during the upcoming semester.

Jessica Nardone Personal Statement



The MUSE summer research program provided me with the opportunity to do full time independent laboratory research. I was able to dedicate my time to continuing my project from the past semester. I developed many new techniques and skills that are important to my research project and became the first student in the school to learn how to do unbiased stereology. I learned how to overcome the problems I faced and further educate myself with the research. The experience that I acquired during the MUSE program has given me a positive insight on what it would be like to attend graduate school, pursuing a future career as a scientist.

Shota Kikozashvili Personal Statement

Participating in MUSE program was an eye opening experience. It allowed me valuable insight to the day to day workings of research as well as the many challenges that one must face and have the tenacity to overcome. This summer was very valuable to me as I learned a great deal about the neurobiology of respiratory behavior as well as other important life skills, for instance, creativity and consistency in tackling the issues at hand. My participation in this program was one of the most interesting and satisfying periods of time I have spent and I greatly look forward it again.

Characterizing genetic variation among native/non-native and infected/uninfected populations of Andropogon virginicus; Impact of Invasive Species and Deer Herbivory on Metropolitan NJ Forests

Megan Wyles, Biology
Angel Lugo, Biology
John Speigel, Biology
Alison Ball, Biology
Nicole Malotides, Biology
Faculty Mentor: Dr. Janet Morrison

2013 MUSE Project

Dr. Morrison had not only one research study, but two. The first study is focused on characterizing the genetic variation among native and non-native, as well as infected and uninfected populations of Andropogon virginicus. Andropogon virginicus is a perennial bunch grass that is native to the East Coast, but it is also invasive in Hawaii and naturalized in California. In Hawaii, where it is invasive, it alters the existing fire regimes and occupies niche-space that could be otherwise occupied by native species. This makes it an important study species for conservation purposes. In addition to these non-native populations, there are also populations of this species in the east coast range that are infected by a smut-fungus pathogen, Sporisorium ellisii, which significantly lowers the reproductive ability and increases mortality of infected plants. For these reasons, Andropogon virginicus is a convenient model species to study the more general implications that population-level genetic variation may have in cases of biological invasion, as well as plant-pathogen interactions. In order to assess this genetic variation, Megan and Angel implemented the use of PCR and ISSR analysis. ISSR markers are hyper-variable, dominant markers that allow for the detection of genetic variation both within and among populations. Throughout the course of MUSE, they both performed many series of PCR reactions with several different ISSR markers. To date since the beginning of this project, they have characterized 16 populations, each composed of 20 individuals, and each with three different ISSR primers, yielding numerous unique molecular markers. The characterization of these samples with ISSR primer #23 was completed fully over the course of MUSE, in addition to the optimization of three additional primers for future use in characterization of these populations. In addition to completing this molecular work, they performed and harvested a greenhouse experiment that investigated the link between population-level genetic variation and the community-level ability to adapt to differing environments.

As for Dr. Morrison's second study, student researchers are studying the effects of two invasive plant species- Alliaria petiolata (garlic mustard) and Microstegium vimineum (Japanese stilt-grass) - in six metropolitan New Jersey forests that represent the effects of increasing urbanization on forests across the country. By out-competing native species, invasive plants are capable of displacing natives and altering the overall forest biodiversity. Each study forest is split into 40 plots with different treatments that add either one, both, or neither of the two invasive plants. Data collected over multiple plant generations will allow us to see how single-species invasion and co-invasion vary in their effects on the plant community. Furthermore, half of the plots are fenced off to exclude white-tailed deer, which are overabundant in metropolitan regions; this will allow us to also understand the effects of deer herbivory on plant diversity, growth, and invasive spread, by comparing the communities in fenced and unfenced plots.

Megan Wyles Personal Statement

MUSE gives students the opportunity to fully immerse themselves in lab-work in a way that is just not possible during the semester. Working in the lab full-time during MUSE allowed me to hone my laboratory technique and my efficiency in the lab in ways that I could not have anticipated prior to this experience. The amount of work we have been able to complete over the past two months has truly amazed me. I am excited to resume my lab-work in the fall knowing that I will be able to implement the new skills and perspectives I have gained from MUSE this summer. Additionally, working closely with my faculty mentor has been and continues to be one of the most formative experiences of my career as an undergraduate scientist. Dr. Morrison has a wealth of experience and knowledge that she is always looking to share with her research students and I am excited to see what the next two semesters of research in her lab will bring.

Angel Lugo Personal Statement

As an undergraduate, it may be tough to find the time to gain research experience while managing classes and campus responsibilities. Likewise, with summer classes and personal responsibilities, adding on research experience may be difficult. The two-month long MUSE program allows for such and more. In previous semesters, I have taken research courses and was only allotted a certain amount of hours in the lab in order to pay necessary attention to my other non-research courses. This becomes a set-back in the amount of experience and skills someone can gain. However, through the MUSE program I was allowed the time and mentor-experience to acquire a multitude of various lab skills. From not knowing as much in the beginning to where I am at now, my lab partner and I managed to complete a data set that started many years back, continue to grow and harvest plants for our upcoming project while successfully finishing PCR and gel electrophoreses for 16 populations of an entire ISSR. This newly acquired familiarity in the lab gives me the confidence to take on further research courses in a new outlook.

John Speigel Personal Statement

My participation in MUSE has a tiring but extremely rewarding experience. Throughout the course of this intensive research experience I have massively expanded my ecological knowledge and techniques and gained invaluable experience with the process of experimental design and execution. Working on a research project so intensely and for such a period of time provides insight into the issues, questions, and decisions, both large and mundane, that come up in the course of actual research in a way that you just can't get out of a classroom course. Within the past 7 weeks I have gained proficiency in plant identification and collected a large volume of information on the many effects of multiple invasive species and deer herbivory on NJ metropolitan forests. I'd like to thank my faculty mentor, Dr. Janet Morrison, for her support and guidance throughout the program, and Dr. Chan, the MUSE program director, for his role in providing myself and the other MUSE participants with this incredible opportunity. I am certain that what I have learned this Summer will prove valuable as I continue to work on this project as a part of the Morrison lab throughout my senior year and as I move on to graduate school following my graduation from TCNJ.

Alison Ball Personal Statement

As a field researcher within Dr. Morrison's lab for the 2013 MUSE program, my summer was not only mentally stimulating, but physically exhausting as well! Despite the heat, bugs, and long hikes, these past 8 weeks have only made me more sure of the fact that field research is what I want to do with my life. I was able to conduct research protocols that many articles I've read have themselves referenced, such as leaf litter collection, deer browse analysis, and the use of an accuPAR reader to measure the amount of photosynthetic active radiation within our forest study sites. My personal runs around the loop will forever be a chance for me to refresh my plant identification skills. I'm very grateful that I had the opportunity to participate in this program, and the skills I've learned in the lab, field, and my personal life will stay with me throughout my life and career.

Nicole Mallotides Personal Statement

Throughout the summer, the MUSE program has taught me numerous valuable lessons, in addition to challenging me in novel ways. For the first time ever, I was able to work full time in the field, which facilitated learning and implementing new skills and techniques. The complete immersion of our team in the forests we are studying has prepared me for the real world, in regards to what my career will be like, what is expected of researchers, and how team collaboration works. This complete immersion, however, also yielded many ticks, mosquito bites, poison ivy scares, and humidity induced sweat, but I quickly learned that is all part of the fun of working in the field. Overall, I have gained much more confidence and independence and reaffirmed my plan of pursuing a career in field research.

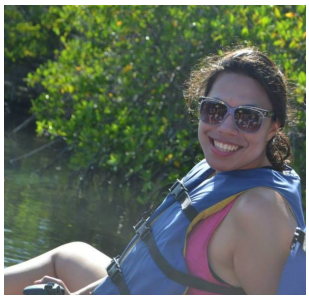
The Expression of GLD-1 in the C. elegans germline

Jennifer Aleman, Biology
Ariel Omiunu, Biology
Faculty Mentor: Dr. Sudhir Nayak

2013 MUSE Project

My project focused on characterizing a subset of GLD-1 seemingly localizes to the nuclear periphery in the adult C. elegans germline. Caenorhabditis elegans (C. elegans) GLD-1 (defective in Germ Line Development) is an RNA-binding protein that acts as a translational repressor for multiple mRNA targets in the germline preventing inappropriate expression of their protein products. The mRNAs targeted for repression are responsible for various aspects of germline development such as oocyte development and cell proliferation. Mutations in gld-1 can lead to aberrant progression through the cell cycle during oogenesis and the formation of germline tumors. Throughout development, expression of GLD-1 protein is tightly controlled in the germline of hermaphrodites. In wild type adult hermaphrodites, GLD-1 levels are low at the distal tip of germline, increase to maximum levels in the transition zone where germ cells are in meiotic prophase, remain high during distal pachytene, and decrease abruptly in diplotene as oocytes begin to differentiate. We took advantage of a transgenic strain which contained GLD-1 fused to GFP (green fluorescent protein) to visualize the expression of GLD-1 in real-time as animals age. We found that GLD-1 levels change as animals age and that GLD-1 localization to the nuclear periphery becomes more evident. Since oocyte quality decline limits reproductive span, we hypothesize that changes in GLD-1 protein expression as animals age may govern reproductive potential.

Jennifer Aleman Personal Statement



The MUSE program was a very positive experience for me. It allowed me to make huge progress on my project, leaving me with a good starting place for research during the semester. During the first half of MUSE I was able to finish a portion of my project that I had been working on for a full year in preparation for the International C. elegans meeting. Coming back from the conference for the second half of MUSE provided me with ample time to start the second phase of my project involving antibody staining and germline dissection. I was able to master these two techniques having so much time to practice. Experiencing what it's like to do full time research this summer ultimately helped me to make informed decisions about my future career.

Cryptic Genetic Variation: How environmental effects on developmental alter the expression of genetic variation

Krishna Parekh, Biology
Sadia Tahir, Biology
Gabrielle Haak, Biology
Faculty Mentor: Dr. Matthew Wund

2013 MUSE Project

Natural selection acts upon heritable variation in traits, favoring individuals who best compete for limited resources. Environmental effects on trait expression can induce a change in heritable traits, thereby altering the variation upon which natural selection acts. All three students, Krishna, Sadia, and Gabrielle, are testing the hypothesis that these environmental effects influence evolution in natural populations. The model organism considered is the threespine stickleback fish (Gasterosteus aculeatus), for which the ancestral population inhabits the marine environment. In the marine saltwater environment, stickleback fish are morphologically uniform but genetically diverse. When the fish invade a freshwater environment, they rapidly adapt to new salinity, food, predators, and habitat. We will be studying how such a uniform ancestral population evolves and diversifies so quickly. The change in the environment may act directly upon the phenotype and presents itself in the form of heritable variation, allowing natural selection to act. To test this hypothesis, marine fish were raised in controlled saltwater and freshwater environments, and then preserved. Lateral and ventral photographs of 2,050 fish will be taken and then analyzed through ImageJ software. Various phenotypes will be measured upon the fish to observe whether heritable phenotypic variation is higher in fish raised in freshwater relative to saltwater.

Krishna Parekh Personal Statement

Spending 2 months doing research at The College of New Jersey was one of my best summers. Coming to lab every weekday and most weekends to work on a project and to take care of our stickleback fish felt meaningful, especially because I felt more responsible . In addition, the atmosphere of the living environment was both jovial and stimulating as we discussed our daily musings with each other; this allowed me to learn not only about my colleagues but myself as well.

Sadia Tahir Personal Statement

Being a part of the MUSE program this summer has been an absolutely riveting experience for me. Two months in the laboratory provided for me the experience necessary to thrive in the field of Biology. I learned how to be independent in lab while mutually supporting my lab partner in our project. I also learned to work efficiently and radically during the eight weeks spent in lab. I consider one of the biggest accomplishments to be overcoming challenging faced in the duration of the project. All projects come with those challenges but learning how to deal with those setbacks and bouncing back are important lessons learned.

The knowledge gained and the hands on experience will stick with me for a long while as I continue my career in Biology. I was able to grow as a student and as a human being. Working with my mentor was enriching as Dr. Wund taught me how to write from a scholarly perspective, consolidate information, and work independently. I'm grateful for his guidance during MUSE and throughout the years. Working with my lab partner was wonderful as well as we combined our energies synergistically to progress through our project. It was an absolute blessing and privilege to be a part of the MUSE program and a solid foundation for the rest of my career.

Gabrielle Haak Personal Statement

I had a great time working in the lab in MUSE this past summer. It was nice to be able to be fully immersed in research while part of such a friendly community. I was glad to see the preliminary results of my data after all that work.

Creation of a double mutant worm strain to analyze the function of tubulin glutamylation

Jessica Lee, Biology
Ruchi Shah, Biology
Adrian Breckheimer, Biology
Faculty Mentor: Dr. Nina Peel

2013 MUSE project

Both Ruchi Shah and Jessica Lee under the direction of Dr. Peel performed research on a project titled "Creation of a double mutant worm strain to analyze the function of tubulin glutamylation". On a broad scale, both students will be researching the process of cell division. More specifically, they will be investigating the role of microtubules, which are fibers made of tubulin protein that pull the chromosomes apart during this process. The amino acid glutamate is attached to specific sites on the microtubules; this is known as tubulin glutamylation. Both students are trying to determine whether this glutamylation is necessary for proper microtubulue function using C. elegans. These microscopic worms only have 5 enzymes that are responsible for glutamylation, making them ideal for this study. We will be genetically combining mutations in genes that cause different enzyme deletions. Over the course of MUSE, their goal is to specifically combine mutations in 2 particular genes that are located very close together which makes such combination challenging. This will bring them closer to our ultimate goal of generating worms that have all 5 enzymes deleted, so that the microtubules are not glutamylated. By comparing these mutant worms to 'normal' worms, they will be able to determine whether tubulin glutamylation is necessary for proper microtubule function during cell division.

Ruchi Shah Personal Statement

Participating in MUSE this summer was an unparalleled, enriching experience for me as it pertained to both my academic and career goals. The opportunity to do research under my professor full time this summer allowed me to hone the techniques I had learned during the previous semesters, in addition to attaining new techniques that will enable me to increase my contribution in the lab during the upcoming semesters. We were able to achieve our goal of obtaining a ttll-15, ttll-5 double mutant C. elegans strain. This of course made MUSE all the more rewarding as this had a 3/1000 chance of occurring. Now we will be able to progress further towards our goal of ultimately obtaining at quint mutant that lacks all 5 TTLL enzymes. In summary, MUSE was a fantastic opportunity that allowed me to gain more confidence in myself as a researcher.

Jessica Lee Personal Statement

MUSE offered me a special opportunity for me to work solely on a research project during the summer without other worries such as classes. By working on a project full time for two months, I was able to acquire valuable skills such as laboratory techniques and collaborative teamwork that are necessary for upcoming years at TCNJ and also possible research career in the future. In addition, MUSE helped to broaden my knowledge on other academic disciplines and research projects very different and similar from my own. MUSE has allowed me to fully immerse in the project I absolutely enjoyed and accomplish results that needed a great time and effort!

Adrian Breckheimer Personal Statement

The Mentored Undergraduate Summer Experience (MUSE) introduced me to an array of valuable skills, which include applying research methods, conducting experiments, and devising effective assays. In addition, MUSE has allowed me to connect and collaborate with professors and my fellow peers on an academic level that differentiates itself from the professor-student relationship commonly found in the classroom. The low student-faculty ratio present in the lab granted me the opportunity to be my by inquisitive self, aiding me in the process of learning about unfamiliar biological concepts. Lastly, I would like to note that I had the chance to refine my ability to present, as I had to give a talk about my experiments and be prepared to answer the audience's questions.

Structural Analysis of CYP72A enzymes that regulate plant growth and metabolism

Oliver Hendy, Biology
Tiffany Piatt, Biology
Will Prall, Biology
Faculty Mentor: Dr. Leeann Thornton

2013 MUSE Project

Plants deal with various biotic and abiotic stresses through an array of enzymes that fuel an elaborate biochemical response system. The Thornton Lab currently studies three plant genes, CYP72A9, CYP72A11, & CYP72A13, which encode for three Cytochrome p450s (CYPs) suspected to play a role in seedling development and plant defense. This summer, all three students are adopting a new strategy in trying to express our genes of interest from the model plant Arabidopsis thaliana in yeast. In their previous approach, they produced protein, however, it was not functional; since the protein is membrane bound, they suspect that the membrane-binding domain of the plant CYPs is not compatible with the yeast membrane. Their aim this summer is to replace the membrane-binding domain of the Arabidopsis CYPs with a similar membrane-binding domain from a yeast CYP so that the resultant protein is more "yeast friendly". If this new protein is functional, all three students hope to test the respective function of each CYP and determine what specific roles they play in plant development and defense. In addition to our main project, some students will be working on creating models of CYPs using software that uses crystal structures of other CYPs as templates for predicting the structure of our unknown CYPs. This will hopefully allow them to analyze the receptor site of the Arabidopsis CYPs and test possible substrate interactions in silico.

Oliver Hendy Personal Statement

This summer I was part of a project investigating three Cytochrome P450 (CYP) enzymes that regulate plant growth and metabolism. We have several different angles in this analysis, the two of mine being a biochemical approach and an in silico approach. I worked with my lab partner Wil to express a "hybrid" CYP in Yeast that combined the plant active domain and the yeast membrane domain. We have been slowed down by several problems that have come up in cloning, however, we hope to continue this during the upcoming semester. In addition, using a computer-simulated environment, I modeled CYP72A9 to a similar CYP whose structure is known, and was able to visualize and analyze the substrate site from this work. Being immersed in a full time research experience has certainly been a learning experience for me; Not only do I feel more confident and independent around the laboratory, but I have learned the necessity of patience and careful planning for good science. Moreover, it has helped me understand what aspects of research I enjoy and how I see this type of work fitting into a future career. Finally, I'm glad to have built a stronger relationship with my lab partners, mentor, and other students in the program.

Tiffany Piatt Personal Statement

The Cytochrome P450s (CYPs) are a group of enzymes that catayze biochemical reactions in all organisms, and they are grouped into subfamilies based on genetic similarity. The CYP72A subfamily appears to contribute to producing defensive secondary metabolites in response to stress and herbivory. We are examining double and triple mutants to determine the role the enzymes play in maintaining optimal plant growth in our model system, the Arabidopsis. Personally, MUSE has been a real life glimpse into all the work and ups-and-downs that come with being a scientist. It was an incredible learning experience and made me feel much more confident in my abilities.

Will Prall Personal Statement

This summer the Thornton Lab group worked towards isolating and functionally characterizing three enzymes in Arabidopsis thaliana belonging to the super class of enzymes, Cytochrome P450s. The molecular side of our lab is where I worked with a partner to genetically engineer a modified version of each gene in hopes that they will be expressed once inserted into yeast. By expressing each enzyme at high levels using yeast, we will be able to functionally characterize and understand them. I worked towards creating chimeras this summer, taking a portion of a known P450 that is expressed in yeast, and inserting it in place of each membrane binding portion of the genes we are investigating. The new region should aid in enzyme folding while in yeast. Through my work I gained a great deal of independence as a young scientist. I learned new techniques and skills while developing a scientific work ethic, which was so different from any other type of full time work I have done. I was able to experience what it is like to be a real scientist and enjoyed delving into my project. Furthermore, my research experience has taught me more than any class I have ever taken; full time research as a student collaborator is invaluable.

Evolution of Amplification at a Low-Copy Number Chromosomal Locus in Acinetobacter baylyi

Abigail Calixto, Biology
Kaitlyn Remde, Biology
Faculty Mentor: Dr. Kathryn Elliot

2013 MUSE Project

DNA rearrangements are mutations that occur in all living organisms. In humans they can lead to life threatening diseases and in bacteria they can result in antibiotic resistance and increased virulence. In bacteria, genetic variation can arise can arise through genetic recombination. Resolvases cut knots in the DNA that are generated through DNA recombination. This summer I will focus on a predicted, but unstudied resolvase that is coded by the gene yqgF. I will study the structure and function of the resolvase by altering its sequence. in doing so, I will observe how the resolvase functions in response to these changes.

Abigail Calixto Personal Statement

To be honest, I was a little bit anxious to start MUSE. I was going to be in a lab for the next two months and wondered if I was prepared to be fully engaged in research. On the first day of MUSE, I was introduced to the research that I would be doing for the summer. When 5 o'clock came my brain was exhausted. I was frustrated that I could not understand many of the things that my mentor had explained to me. When I arrived back to the dorms I discovered that my roommates felt the same exact way. It was a huge relief to discover that I was not in this alone, but I knew that I could not let myself feel like this forever. I went to the lab the next day with a different attitude. I wanted to learn and wasn't going to be discouraged by what I didn't know. Soon enough, with the help of my peers and my mentor I reached the point where I was able to do experiments all by myself! Every day there was something new to do and I grew to love being in lab. Throughout this experience I learned what it was like to be in a community of scientists and share ideas. Everyone here is studying something different. And yes, we all use different model organisms and our labs look entirely different, but we all have one common goal: to explore. We ask questions that no one else has asked before and hopefully discover the answers. I have never met more ambitious people and because of this summer I can now truly call myself a scientist.

Kaitlyn Remde Personal Statement

I am very thankful for the opportunity to be a part of MUSE and to perform research this summer under the guidance of my mentor, Dr. K.T. Elliott. Throughout this summer's research, I have developed valuable professional skills. I learned to methodically plan and troubleshoot procedures, perform new molecular techniques, and analyze genomic data. I also mentored a starting lab student, assisting with her experiments and teaching her essential molecular and microbiology techniques. Finally, at a microbiology symposium and lab meetings, I gained experience networking and presenting my research among fellow students and microbiologists. These experiences, along with MUSE networking and career-building events, have transformed my career aspirations. Originally, coming into MUSE, I aimed to become a Ph.D or M.D./Ph.D, specializing on human disease. Since focusing my talents and identifying new interests, I have opened my eyes to new possibilities for future career paths that I had not previously considered.

Risk Allocation in Virile Crayfish
Kristen Batko, Biology
Faculty Mentor: Dr. Keith Pecor

Kristen Batko Personal Statement

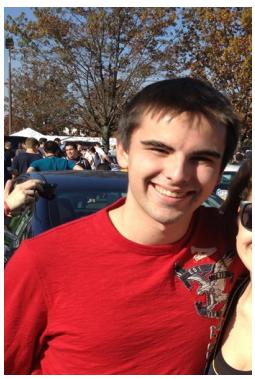
This summer has been a combination of field work and lab work. The field world consisted of surveying streams and lakes in New Jersey to document crayfish distributions and collect crayfish for lab work. Without classes, we were able to spend a lot of time in the field, which allowed us to travel to further sites than we would during the semester. In the lab, I conducted trials to assess responses to chemical stimuli in the virile crayfish (Orconectes virilis) and rusty crayfish (O. rusticus) in both aquarium and Y-maze arenas. These results have been inconclusive, so I will spend the next year readjusting the experiment to obtain conclusive data. Despite this, MUSE has been a great experience and nice transition into applying to graduate school. Conducting research full-time was more fun than I could have ever expected and I look forward to attending graduate school.

Exploring the Regulation of Gene Expression; Investigating Novel Links between Histone Modification and Splicing Machinery
Daniel Sprague, Biology
Ryan Moazamian, Biology
Stefanie Ucles, Biology
Danielle Flood, Biology
Mentor: Dr. Tracy Kress

2013 MUSE Project

All three students, Ryan, Daniel, and Stefanie, will be working with Dr. Kress on the regulation of gene expression in yeast. The expression of genes starts with our DNA, which goes through many different processes to end up with a functional protein. These processes are often coupled together to increase efficiency, so when one of these processes gets damaged, this can result in unhealthy cells, potentially even oncogenic cells. In their lab they are interested in understanding how transcription, a process that makes a messenger RNA (mRNA) copy of the DNA, is coordinated with other processing steps. Specifically, they are looking at two proteins, Vps72 and Swr1, which function to exchange the H2A histone for the variant Htz1p histone, loosening the DNA in chromatin into an accessible state for transcription machinery. These two proteins are subunits of the Swr1-complex, which coordinates with the NuA4-complex to promote transcription at the desired gene. The NuA4-complex, a histone acetyl-transferase, recruits the Swr1-complex by acetylating the desired histones. Previous data from our lab suggest that these two protein complexes might affect splicing, another RNA process important in creating functional mRNAs. What they plan to do is uncover novel mechanisms that coordinate transcription and splicing, two vital steps necessary to create functional proteins. In doing so, it will further our understanding of higher eukaryotic cells, and can also shed light on the inner workings of cancerous cells.

Daniel Sprague Personal Statement



This summer I worked with Dr. Kress to further our understanding of the coordination of two critical steps in gene expression, transcription and RNA splicing. To identify novel proteins that coordinate these two steps, we utilized genetic interaction studies. Our preliminary work has revealed several proteins that might work together to coordinate gene expression. Working in a biology lab is completely removed from anything I had previously done. Coming from computation work in physics, the amount of time required to setup and perform experiments is on a whole different scale from what I expected. Furthermore, it is not unusual for a procedure to not go as well as expected, possibly due to a large variety of causes unique to biology. Because of this experience, MUSE has been a valuable way to become more confident in a biological setting. Perhaps the part of the project I enjoyed the most was something that I am the most familiar with, and that was working with computer code to perform the statistical analysis of the data gathered from our genetic interaction experiments.. The experimental method itself is a novel approach to what we are looking to

measure, so most of the data analysis has been built from the ground up. Overall, MUSE has been a valuable experience and I look forward to continuing the projects throughout the academic year.

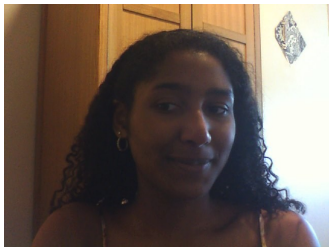
Ryan Moazamian Personal Statement

Our project during MUSE was to investigate novel mechanisms for the regulation of gene expression. During all stages of life, different genes need to be expressed at very specific times in order to allow a functional organism. Thus, the expression of an organism's genes must be finely regulated. What mechanistic steps are there to ensure the proper genes are expressed at the proper time? Recent scientific studies suggest that gene expression can be finely regulated by coordinating different stages in gene expression, yet the mechanisms that underlie this coordination are largely unknown. With genetics being the stepping stones of our research, we explored two different stages of gene expression, transcription and splicing. After a number of experiments, we illuminated genetic interactions occurring between proteins involved in transcription and splicing, furthering the postulate that gene expression is an interconnected web of regulation and coordination. The MUSE program at TCNJ was a fulfilling and rewarding experience that I am very grateful to have been a part of. In addition to the knowledge of what a life in research is all about, MUSE taught me additional skills such as personal interactions, networking, and interdisciplinary collaboration. Skills such as these can be carried through life, aiding each and every one of us through whatever life choices we may make. MUSE also gave a glimpse of what a life in research/academics would be like, allowing students to experience first-hand what this entails. This was truly a gratifying experience that allowed me to explore the various outlets of science, and retain useful life-lessons.

Stefanie Ucles Personal Statement

Our cells store information in the form of DNA, which is then read and made to RNA, and then is translated into useful proteins that are needed in order to run important cellular functions that keep us alive and well. This highly regulated process, known as gene expression, consists of many steps that are coordinated and coregulated in order to keep cell functions at the highest efficiency. Using the model organism Saccharomyces cervisiae, in the Kress Lab we are interested in ways that two steps of this process, transcription and splicing, are coordinated and coregulated. Over the summer my labmate and I will be doing a genetic interaction study to see if there are any significant links between two histone modifiers JHD1 and Set2, which regulate transcription by modulating histone methylation, and various splicing factors involved in RNA splicing. If we uncover genetic interactions that suggest a link, we will then use biochemical techniques will be used to assess how Jhd1 and Set2 work to connect these two crucial steps in gene expression. Over MUSE, my partner and I are confident that we are seeing some early signs of positive genetic interactions with JHD1 and the splicing factors, and negative genetic interactions with SET2 and the splicing factors. These interactions support a role for these factors in the coordination of transcription and RNA splicing. During MUSEas well, we prepared the necessary components needed to further our study that will test whether the perturbation of JHD1 or SET2 affects RNA splicing. MUSE for me was a great experience! After being in the lab consistently for full days, I feel more confident and comfortable with my previously acquired lab skills. I also learned a number of new lab skills and techniques for our lab including qPCR and the steps to needed to perform a ChIP assay. Outside of the lab, I met a lot of new people and made new friends!

Danielle Flood Personal Statement



This summer I learned a lot of great skills and met some of the most amazing people in MUSE. I learned how to run my own PCR reactions and check gels, isolate genomic DNA, transform yeast, do colony sizing assays, then analyze the data I got from each of these experiments and plan accordingly in my research. After research I looked forward to the group activities and always the weekly breakfasts! I'm truly grateful to have had this experience and I'd like to thank everyone in the MUSE program, especially Dr. Kress for being my faculty mentor.

Genetics of the osmoregulation of the crab

Santaigo Pulido, Biology
Maya Williams, Biology
Andrew Goldfarb
Faculty Mentor: Dr. Don Lovett

2013 MUSE Project

Sequencing and qPCR primer design in the Methyl farnesoate pathway of green crab, Carcinus maenas: The Lovett lab is examining how changes in the expression of certain genes in crabs allow them to maintain an optimal level of salt in their blood (i.e., osmoregulate) when they are exposed to changes in the salt content of the seawater (salinity). Since organisms, such as the green crab Carcinus maenas, that live in estuaries are exposed to fluctuating salinity, these organisms typically are strong osmoregulators. Previous studies have suggested that methyl farnesoate (MF), a substance produced by the crab, may play a role in green crab osmoregulation. This summer they seek to measure changes in the levels of expression of genes for enzymes in the MF synthesis pathway when organisms are exposed the changes in seawater salinity. They will be comparing the response to salinity change in the green crab (a strong osmoregulator) with that of the lobster Homarus americanus (a weak osmoregulator). To accomplish this, we first will sequence the genes for enzymes in the MF synthesis pathway from both crabs and lobsters. The gene sequences will be used to design qPCR primers (short sequences of DNA that can be used to quantify the amount of messenger RNA (mRNA) for each enzyme). The relative amount of mRNA can be used to estimate the relative amount of each enzyme that is present in the organism. They also will be developing a gas chromatography technique to measure MF levels in the blood of crabs and lobsters.

Santiago Pulido Personal Statement

Although I had been working in Dr. Lovett's lab for the past year, MUSE was an experience unlike the Independent Research course. Working full time in the lab gave me the opportunity to improve my lab techniques and the way troubleshooting was approached. We advanced significantly on our project this summer. This amount of progress only set us up for more progression in the future. I am looking forward to coming back during the academic year and continuing this project.

Maya Williams Personal Statement

The possibility of doing research in Biology was first presented to me as a freshman at The College of New Jersey. A Research lab? I had only seen those on TV shows like CSI or Dexter's Lab. I had no idea that there are doctors, post-docs, grad students and undergraduate student conducting research on an unimaginable amount of project across the world! During the academic year, I have conducted research with Dr. Lovett. Juggling research and extra curricular activities, while maintaining my own academic standards meant that research did not always receive my full attention. For 8 weeks, MUSE allowed me to devote all my attention and mental energy to answer my research question. In this time, we have made real progress in designing primers for our next set of experiments using qrtPRC. We also have learned new methods of RNA extraction and improved our dissection skills. The most important lesson that I have learned is that it takes patients, perseverance, and humility to be a researcher. One needs patients for the time that a project may take to reach a breakthrough. Perseverance and hard work should be driven by the will to succeed and a passion for the subject. Humility is the most important lesson that I learned this summer, for there are times when the answer is not what is wanted or expected it to be. Still, a good student of science does not let pride interfere with the acquisition of true knowledge; that is a lesson I will never forget.

Andrew Goldfard Personal Statement

This summer in MUSE I worked with Dr. Lovett in the Biology Department. Entering the lab as a rising sophomore, I learned everything I know this summer when it comes to being in a laboratory setting. From procedures to techniques, there really was no better way for me to learn these vital skills as an emerging biologist than to be in a lab 40 hours a week. MUSE was such a great experience for me, and taught me so much more than I would have ever gained in a simple classroom setting.

Amphibalanus amphitrite cement protein analysis in the context of molting cycles ; The Effects of Ocean Acidification (OA) on Biomineralization In Blue King Crabs (BKC) and Red King Crabs (RKC)

William Coffey, Biology
Julian Sison, Biology
Faculty Mentor: Dr. Gary Dickinson

2013 MUSE Project

Both Julian and William's work in the lab focuses on barnacle cement secretions and the biochemistry behind such secretions that enables barnacles to adhere so successfully to underwater surfaces. Since barnacle cement has been found to be mainly proteinaceous, their work involves running several gels, which includes techniques such as SDS-PAGE, phosphoprotein staining, and isoelectric focusing. Each of these methods yields a unique analysis of the proteins present in barnacle glue; SDS-PAGE allows me to analyze molecular weights of proteins present, phosphoprotein stains enable the detection of phosphorylated proteins, and isoelectric focusing helps in determining the charge of proteins present. Their work also analyzes these cement proteins in the context of barnacle molting cycles, in order to determine whether casting off a molt has any impact on barnacle secretions. In gaining a greater knowledge of the proteins present in barnacle cement, it becomes possible to develop substances to prevent and/or resolve the issue of barnacle accumulation on boat surfaces underwater (dubbed "biofouling"), and to synthesize artificial glues for biomedical purposes with the adhesive tenacity of barnacle glue. Consequently, barnacle cement is presently a hot topic for biological research and merits further study.

William Coffey Personal Statement

Ocean Acidification is an ongoing phenomenon where increasing atmospheric CO2 results in decreasing ocean pH. As more CO2 dissolves in water and drives down the pH, CaCO3 saturation states are lowered and calcifying organisms are affected in their ability to create mineralized tissue using CaCO3. As a result, species such as the Blue and Red King Crabs, two commercially and ecologically important animals, may have altered exoskeleton mechanical properties and material composition. We tested the hypothesis that elevated PCO2 affects the mechanical properties of mineralized tissue in BKC and RKC. Further, we related exoskeleton chemical and structural properties at the molecular level to the observed mechanical properties at the macro scale. Diminished microhardness was observed in King Crabs (Paralithodes) with increasing PCO2. Changing seawater chemistry decreases CaCO3 saturation states adversely affecting crustacean ability to incorporate CaCO3 in a hard form when calcifying. Crabs with impaired mechanical properties are likely to be more susceptible to breakage by predators and physical factors, compromising survival. Infrared Spectroscopy did not explain the observed differences in microhardness because calcite was the predominate molecular phase of CaCO3 in all samples. Thermogravimetric Analysis failed to explain microhardness trends because the organic composition was similar among all samples. Further testing will be geared toward determining what causes these observed alterations in mechanical properties.

Julian Sison Personal Statement

MUSE has allowed me to venture into a large research commitment at an early stage of my college education, thus exposing me to the world of academia and enabling me to evaluate my career choices more effectively. In addition, MUSE has awarded me valuable networking skills, as well as opportunities for honing those skills, and as a result I have developed massively valuable relationships with students who share my career interests. Therefore, I am grateful for the opportunity to spend the summer doing MUSE as it has resulted in tremendous personal progress.

Population Genetics of the Freshwater mussel Lampsilis cariosa

Yessie Werner, Biology
Ariel Long, Biology
Meaghan Ly
Emily Van Malden
Faculty Mentor: Dr. Curt Elderkin

2013 MUSE Project

Freshwater mussels are a diverse group of organisms found living in a variety of aquatic habitats. North America, which is home to the most abundant freshwater mussel diversity worldwide, has 250 different species alone ("Freshwater Mussels"). These organisms are sedentary filter feeders and are found burrowing within the sediment at the bottom of the waterbed. By feeding via water filtration, they cleanse the environment of particles suspended in the water column. These qualities of freshwater mussels make them critical for maintaining healthy freshwater ecosystems. Many species of freshwater mussels are at risk due to a variety of factors, the most prominent of which includes human intervention. These influences may lead to genetic drift, which may cause some genes to be more frequent in some populations of mussels than in others at different locations within the same river system. By studying the population genetics of Lampsilis cariosa (L.cariosa) throughout the Delaware and Susquehanna rivers, we will be able to observe the effect of genetic drift on individuals in the populations. In order to observe the effects of genetic drift on populations of L.cariosa, neutral molecular markers at seven nuclear loci are used. These genetic markers, known as microsatellites, are variable number tandem repeats (VNTRs) which are segments of non-coding DNA. Due to the non-coding nature of VNTRs, natural selection therefore cannot act upon the marker allele frequencies. L.cariosa DNA was extracted from collected mantle tissue samples and then amplified. Fragment analysis was performed for individuals of several different populations and the genotype was then derived for each individual. Using the genotypes, the allelic frequencies of each population will be determined. If upon analysis the allelic frequencies between differing populations are vastly different, then we can conclude that the populations have been isolated from each other in recent time. If the allelic frequencies are much closer together, then migration will have occurred between populations in recent evolutionary time. This research may be continued using different organisms with similar life history traits.

Meaghan Ly Personal Statement

This summer, my lab investigated the population genetics of different populations of the freshwater mussel Lampsilis cariosa. We examined historical patterns of gene flow using mitochondrial DNA and recent patterns of gene flow using seven microsatellite loci. Knowing how genetically diverse and how isolated populations are is important for conservation of this species. During MUSE I primarily worked with the microsatellite markers and learned how to isolate, dilute, and amplify DNA, and how to use a sequencer to analyze DNA fragment lengths. I also learned how to write a formal report, run gels, identify mussels in the wild, use freeware for genetic analysis and troubleshoot when the programs wouldn't work, how to work in a lab setting independently, and how to cooperate and collaborate with people within and outside of my lab. Some experiences were obviously more fun than others, and some were more grueling and exhausting than others, but all in all I gained a lot of valuable knowledge and experience doing research this summer with MUSE.

An Unexpected Aromatization Reaction of Cyclohexanedione Ethers ; New Methods for the Construction of Complex Ring Systems

Ryan DeAngelis, Chemistry
Marissa Rubenstien, Chemistry
Tyler Higgins, Chemistry
Faculty Mentor: Dr. David Hunt

2013 MUSE Project

Three students worked under the direction of Dr. Hunt: Marissa Rubenstein, Tyler Higgins, and Ryan DeAngelis. Marissa Rubenstein primarily worked with Dr. Hunt in the chemistry department researching new methods for the

construction of complex ring systems. Their main goal aimed towards finding the most efficient way to cary out a Knoevenagel condensation reaction. To do that they experimented with different bases and catalysts. Tyler Higgins worked with Dr. Hunt on creating new heterocyclic ring structures through a Michael addition reaction. Not only that, but Tyler also worked on altering the compound resveratrol to see if it can become more biologically active. Dr. Hunt's final research student, Ryan DeAngelis worked on studying the cyclization of alpha,beta-unsaturated orthobenzyloxy ketones.

Ryan DeAngelis Personal Statement

Initially, my project focused on the reactivity patterns of 1,2-cyclohexanedione with bromoaryl alcohols. At the very beginning of MUSE, we struggled to create the starting material, and thus, decided to pursue an alternate synthetic route. In pursuing this route, we observed unexpected reactivity, which then shifted the focus of my project to the reactivity patterns of 1,2-cyclohexanedione with arylalkyl alcohols. Throughout the summer, I was able to study multiple reactions and the data collected showed a consistent pattern. Participating in MUSE this summer allowed me to further develop my skills as an organic chemist by fully submerging myself in the laboratory. With the help of my mentor and other chemistry students, I was able to accomplish more in these past eight weeks than I could ever accomplish during a semester. With an extensive array of extracurricular activities, such as bowling, Grounds for Sculpture, and laser tag, I was able to meet students across all disciplines and learn about their research as well.

Synthesis, Characterization, and Reactivity of (π-allyl)Nickel Complexes Containing Dialkylbiaryl Phosphines
Michael McDaniel, Chemistry
James O'Connor, Chemsitry
Faculty Mentor: Dr. Abby R. O'Connor

2013 MUSE Project

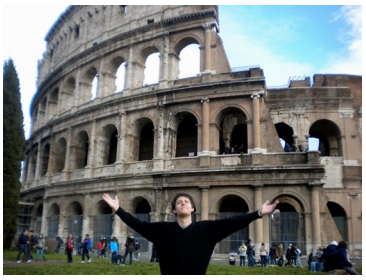
Michael McDaniel worked hand in hand with James O'Connor. Both student researches worked under the direction of Dr. Abby O'Connor. The polymerization of alkenes and dienes has been previously investigated using nickel complexes. However, the polymerization of non-polar and polar monomers and living polymerization has remained challenges. The goal of this project is to develop new nickel complexes containing an array of dialkylbiaryl phosphine ligands in order to function as catalysts to polymerize norbornene and functionalized norbornenes. The synthesis and characterization of various nickel phosphine complexes has been achieved. The complexes have been isolated in good yield and purity and were characterized via NMR spectroscopy and X-ray crystallography. Preliminary reactivity studies have been conducted evaluating the polymerization of norbornene. Polymerization of norbornene has been seen with some of the nickel complexes. An interesting side-reaction was also discovered that opens up several new areas to study. The mechanism of this side-reaction will be evaluated in the future.

Michael McDaniel Personal Statement

Overall MUSE has been a great experience and really helped me to grow as an aspiring chemist. Having conducted research during the previous semester, MUSE makes for a much easier, work intensive time that is not achievable during the school semesters. The experience gained during this 8 weeks proved invaluable in teaching work ethic, as well as allowing myself to get a feel for working full time as a chemist. The personal time spent with the professors allowed me to a see the side of chemistry that not many are fortunate to see. I ate and laughed with the professors and this allowed me to see the human side of the chemistry department here at TCNJ. Overall the experience was very positive and I would do it again in a heartbeat.

James O'Connor Personal Statement

The goal of this project is to synthesize and characterize iridium complexes that will be used for catalytic applications. The synthesis and characterization of new transition metal complexes is of value to examine because these com-



plexes have the likelihood of being catalytically relevant, which has the potential to impact industrial areas. Further understanding of catalytic properties of iridium complexes should lead to the production of more reactive, selective and safer catalysts. This work will be done in collaboration with students and faculty member Dr. Danielle Jacobs from Rider University. The Jacobs group has prepared pyridine sulfonamide ligands using a novel microwave synthesis. Our group will make different iridium and rhodium complexes and characterize them using X-ray crystallography and NMR spectroscopy. In future directions for this project, the catalytic properties of the complexes will be explored.

Studying the Chemical and Electrical Properties of Graphene Oxide
Serge Zemerov, Chemistry
Lyle Nolasco, Chemistry
Faculty Mentor: Dr. Donald Hirsh

2013 MUSE Project:

Suppose that you have two proteins that you know interact with each other but you are unsure about how this interaction is achieved; that is, which surfaces come in contact with each other, for example. This can be elucidated by placing paramagnetic species (such as ions or radicals) on known surfaces of the proteins and then measuring the distance between the two species to see if those surfaces interact. This is one of the many applications that my research this summer will have. Serge will be working with Dr. Hirsh in the chemistry department on two separate but related projects. The first is a continuation of work from the previous semester; he will be using Pf1 bacteriophage to orient DNA molecules in the magnetic field found inside a 400 MHz NMR spectrometer. The DNA duplexes will have an EDTA moiety on one strand to which dysprosium ions can bind and a nitroxide radical on the complementary strand. Both the dysprosium ion and the radical have unpaired electrons whose positions are fixed with respect to the DNA helix. Analysis of the spin-spin interactions between these electrons will allow us to determine the orientation of the vector between them. The second project involves preparing suspensions of the DNA duplexes, but using cobalt ion instead of dysprosium ion. It is hypothesized that cobalt strongly enhances the spin-lattice relaxation of radicals, so continuous wave EPR can be used to compare the microwave progressive power saturation and relaxation behavior between the dysprosium and the cobalt duplexes.

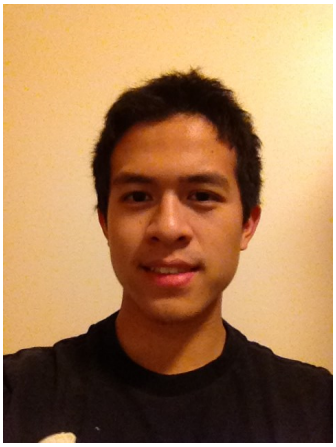
On the other hand, Nyle will be working on graphene. Graphene is a carbon allotrope with very extraordinary properties, such as having a higher electrical conductance than silver and a tensile strength superior to that of steel. These among other properties of graphene give it many technological applications such as in integrated circuits and other electronics. However, there is currently no known method of producing pristine graphene on an industrial scale. Graphene oxide on the other hand, is the closely related oxidized form of graphene, and can be produced on such a scale with relative ease. While graphene oxide doesn't share the same remarkable properties of graphene, considerable research is being done to investigate the possibility of producing graphene from graphene oxide, due to their structural and chemical similarities. Nyle's project with Dr. Hirsh focuses on studying the chemical and electrical properties of graphene oxide. Graphene oxide is produced by oxidizing graphite, the material found in pencils. Structurally, graphite is composed of one-atom-thick sheets of carbon that are stacked on top of each other. By oxidizing them, these carbon sheets exfoliate into mono-layer or few-layer flake-like particles that are dispersible in water, known as graphene oxide. The extraordinary properties of graphene provide motivation for my research in characterizing graphene oxide through various forms of spectroscopy, in order to contribute to the eventual goal of the discovery of a synthetic process to produce pristine graphene from graphene oxide.

Serge Zemerov Personal Statement

As a biology and chemistry double major, I have found MUSE to be a valuable and enriching experience that helped me to combine these fields of study into the kind of interdisciplinary approach that will characterize my work at the graduate level. The open and collaborative atmosphere that MUSE offered was what allowed this synthesis to occur:

throughout my seven weeks of research, I have worked with and learned from not only Dr. Hirsh and Lyle, but also from other students in the chemistry department; as well as from faculty and students from the biology department, who very generously allowed the use of various reagents and lab equipment. Additionally, MUSE has provided me with an edifying viewpoint as to the future structure of my life in graduate school, from which I can now make informed decisions on how to better budget my time both in and out of the laboratory. Perhaps the most valuable lesson that I have learned this summer, however, is the importance of moving forward in the face of adversity. I have experienced firsthand both the uncomfortable truth that there are pitfalls at every step of a project (some of which are incredibly difficult to avoid), and the reassuring fact that there is always a way to surmount any unforeseen disappointment, both of which are key tenets throughout all fields of research.

Lyle Nolasco Personal Statement



I have had a great time at TCNJ's MUSE program over the past 7 weeks. I most enjoyed how the program was very multifaceted in the experience it offers. As a research experience, it allowed me to continue the research project I had been working on for two semesters prior - studying the chemical and electrical properties of graphene oxide. Being able to dedicate 40+ hours a week on this project has allowed me to make significant progress that simply would not have been possible during the academic semester, due to time constraints. I hope to present some of my findings at an upcoming conference, and maybe even in a publication soon! As a career development experience, the MUSE program has been helpful, especially in terms of learning how to network. Some of the new skills I have learned include making and delivering an elevator speech, and being able to tailor the speech to its intended audience. Lastly, as a social experience, I've enjoyed the opportunity to better get to know professors and students within my major and across other disciplines. The barbecues, departmental breakfasts, and trips to attractions such as Grounds for Sculpture and the Triumph Brewery, have been great ways to unwind and break away from the usual 9 to 5 routine. These experiences have also been a great way of getting to know my research mentor, Dr. Hirsh, and my lab-mate, Serge, on a more personal level. In addition I have met many other students and faculty members from the MUSE program.

Examining a Dimorphic Cocrystal of Pyrazinamide and para-nitrobenzoic acid

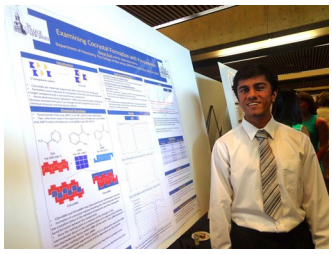
Dhaval Shah, Chemistry
Elizabeth Johnson, Chemistry
Faculty Mentor: Dr. Heba Abourahma

2013 MUSE Project

The objective of this project is to determine the relative thermodynamic stability of pharmaceutical cocrystals. Pharmaceutical cocrystals are multi-component crystalline materials that have at least one active pharmaceutical ingredient. Research has shown some cocrystals to be polymorphic. Polymorphism is a solid-state phenomenon where certain compounds show more than one possible arrangement in the crystal lattice. Each arrangement has different physical properties such as melting point, solubility, and color. In the context of the pharmaceutical industry, it is important to understand the relative thermal stability of different polymorphs because they will have different bioavailability, stability and shelf life. Understanding the thermal stability encompasses determining whether a transition between the different forms is possible and the conditions under which this transition occurs. To determine the transition temperature of the polymorphic cocrystal, it will be suspended in a liquid and allowed to shake for periodic time intervals. Analysis of the cocrystal at the end of mixing will reveal which polymorph is present. The more stable polymorph will form after a set period of time.

Dhaval Shah Personal Statement

The Mentored Undergraduate Summer Experience has allowed me to take away several skills that I will continue to use in my future. Some that immediately come to mind are time management and networking. Time management



was critical because unlike during the school, there is considerable more time each day and each week to perform experiments and it critical how you allot time to get the most of this experience. On the other hand, my netwroking skills have improved because of weekly breakfasts and two majors trips throughout my time during MUSE has helped me to get to know professors and other students better. Finally, having the opportunity to be completely immersed in a project has allowed me to see chemistry from multiple perspectives and it has allowed me to step back and see the big picture.

Elizabeth Johnson Personal Statement

This summer, I accomplished my goal of developing and testing the method for determining the solubility of cocrystals. I was able to apply this procedure to the co-crystals that have been synthesized in the Abourahma lab and thus determine the solubility of each of these. I ran into several trials that had to be overcome to perfect this method, but after some problem-solving, I was able to complete the task. Although none of the cocrystals exhibited better solubility than the active pharmaceutical ingredient (pyrazinamide) alone, as we had hoped, it was great to help develop a method that has never been used by the lab before and will be used by future lab students to, hopefully, find cocrystals that do enhance the solubility of pyrazinamide. Using this summer to adjust to the lab will certainly prove beneficial during the semester, as I can focus on my next project, which will be determining the rate at which the cocrystals dissolve. This is related to my project this summer, so I should have a very smooth transition to further research. Overall, it was a great experience for me that I know will help me both in my future research and my education.

Tutoring System using Microsoft Kinect and Recognition Algorithms
Paul Nathan, Computer Science
Faculty Mentor: Dr. Edward Kim

2013 MUSE Project

Under the direction of Dr. Edward Kim, Paul Nathan will be working in the Computer Science Department. His main focus is to create a system aimed for tutoring. This system will be using visual cues from the Microsoft Kinect. The purpose of using these cues is to better assist the tutoree. Aside from creating the tutoring program, Paul will also be researching facial recognition algorithms. The data concluded from that particular "side research" will be used to help him identify between two main states of the user's face. Those two main states will be frustration and anything that is not frustration. Paul will then use that information to make informed decisions about how well the user understands the material he or she may be viewing. Through these informed decisions, the user will be better prepared to face the material outside of the learning system.

Using Social Computational Systems to Enhance Project Sustainability and Dissemination
Conor Kelton, Computer Science
Joseph Canero, Computer Science
Faculty Mentor: Dr. Monisha Pullimood

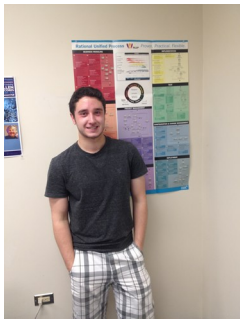
2013 MUSE Project

Under the direction of Dr. Monisha Pullimood, Conor Kelton and Joseph Canero will be investigating social computational concepts that can be applied to promote and sustain research projects as well as disseminate results to interested audiences. We envision accomplishing this task through the design of a self-sustaining, web-based, social computational repository that hosts diverse research projects. A social computational system is one in which an intelligent computing body distributes tasks to a large group of human users in order to gather and distribute information, utilizing the collective intelligence of a community. Such a system will be integrated fully into a web-based application hosted on our repository to ensure all projects are kept-up-to-date with reliable data, even past the period in which the project itself is funded.

Conor Kelton Personal Statement

The eight weeks spent in the MUSE Program 2013 have truly been bountiful. It was amazing to interact with so many bright students as well as their professors on a level not possible during the semester. Only having to focus on our research and one final project goal was something I had never experienced before the MUSE Program. This concept, along with the relevant knowledge I have gathered along the way, will pave the road for all my future work here at the college and in my future career.

Joseph Canero Personal Statement



This summer, I was able to learn a great deal about Human Computation and Social Computational Systems. A large portion of the summer consisted of a literature review, as Luis von Ahn's book, "Human Computation," contained a wealth of useful material. Since our project was to leverage Social Computational concepts for purposes of increasing project accessibility and quality over time, we decided to build an online project repository for research projects. The online repository, known as CABECTPortal, employs Social Computation in the form of a points system. Users of the repository will get points for various actions, which can then be spent to receive a more prominent feature of their project on a main page of the site. The front end of the site was written in HTML, CSS, and Twitter Bootstrap; the site's backend was coded in PHP and used postgresQL to handle dynamic site content and storage. MUSE was an excellent experience, as being surrounded by so many driven researchers was exciting and encouraged me to perform my best as well. Learning many new technologies was daunting at first, but in the end it was definitely worth it, as I have expanded my repertoire of skills considerably. Additionally, MUSE provided so many wonderful experiences for us to take advantage of, like career and resume seminars, leading to this being one of my most well-spent summers.

A Mathematical Model of Cancer: Tumor Growth & Invasion

Jessica Perez, Mathematics & Statistics
Sarah Hirsh, Mathematics & Statistics
Faculty Mentor: Dr. Jana Gevertz

2013 Muse Project

Cancer is a highly complex and multi-faceted disease that is far from being fully understood. Under the guidance of Dr. Gevertz, this summer Jessica and Sarah will try to increase our knowledge of tumor progression by building a mathematical model. This model will aim to illustrate the interaction between tumor vasculature (blood vessels) and invasive cancer cells. Regions with limited vasculature can promote cancer cell invasion, as cancer cells seek to find areas of tissue with more oxygen. On the other hand, blood vessels can provide a track through which cancer cells can be transported to other parts of the body, creating new growths called metastases. My new model will take into consideration these and various other factors that influence the feedback between invading tumor cells and vasculature. Their work will later be tied together with other past and current projects being undertaken in Dr. Gevertz' group. All of our combined efforts will hopefully produce a mathematical model that can more accurately predict the progression of tumor growth and invasion, as well as provide us with new insight on how to more effectively treat cancer. This project is one component of a larger plan to model cancer progression through mathematical and computational means. Because cancer is a complex disease, mathematical models of cancer are intricate and multifaceted. Dr. Gevertz has previously developed and validated a 2-dimensional mathematical model of tumor-vasculature (blood vessel) interactions. The previous model included an oversimplified representation of the blood vessel network. In order to better capture the impact of the vasculature on tumor growth and treatment, a more precise theoretical representation of the vascular structure is required

Jessica Perez Personal Statement

My participation in MUSE this summer has allowed me to explore the field of mathematical biology by researching tumor cell growth and invasion. Using primary biological literature for reference, Dr. Gevertz and I worked to create a system of ordinary differential equations that is designed to predict tumor cell growth and invasion into healthy tissue.

Throughout this process, I developed my skills in the analysis of continuous dynamical systems. Also, I expanded on the computer programming skills I gained in my coursework. At the start of the summer, I created a program that simulates a preexisting model of cancer growth. Later on, I built upon this cellular automaton model program to include cancer cell invasion. I then used results obtained from the cellular automaton model to find optimal parameters for the continuous model, which allowed us to more clearly see the connection between the two different mathematical representations of tumor growth and invasion. In addition to giving me the opportunity to study a real-life topic in an interdisciplinary way, MUSE has allowed me to apply my field of study (mathematics) to the field I would like to someday work in (medicine). MUSE has been a great learning experience and I am grateful for having the chance to participate in it.

Sarah Hirsh Personal Statement

This summer, Dr. Gevertz's research group has been continuing their efforts to build a cancer growth model that depicts the interactions between a growing tumor and its underlying vasculature. With an accurate model of this, and other tumor-host interactions, we aim to direct the pursuit of treatment procedures that may be more effective in combatting tumor progression than currently used therapeutic protocols. The techniques that I employed this summer are atypical for a biology major. Whereas biologists typically use lab-based approaches to study cancer, this has not yet enabled scientists to determine exactly how tumors will grow and respond to treatment. Mathematicians instead use computational tools and models in the hopes that these methods can lend insight where traditional methods have fallen short. After surveying the primary literature, I used tools from computational mathematics to model the de novo formation of vasculature, which will later be integrated into the existing tumor-vasculature model. I acquired and expanded upon many skills this summer, including algorithm development, recursive programming techniques, and the concept of cellular automaton models. From my research experience this summer, I have gained an appreciation for the value of interdisciplinary approaches to healthcare and have been challenged to consider a disease in ways that I would not from typical lecture-based learning, or from my biology classes.

Development of a Photostimulation and Calcium Imaging Microscope

Marianna Caruso-Gilbert, Physics
Faculty Mentor: Dr. Tuan Nguyen

2013 MUSE Project

Under the direction of Dr. Tuan Nguyen, Marianna will be working specifically in the Biophysics field. Their main focus was to create an apparatus that was able to stimulate and measure the activities of neurons simultaneously. Traditionally, researchers look at individual neurons and how they fire. Their goal is to analyze and measure the activity of neurons in a large population using calcium imaging. Their results can then be applied to other biological systems as well as neurons.

Marianna Caruso-Gilbert Personal Statement

This summer I did research with Professor Nguyen through the MUSE program. Our goal was to build an apparatus that can stimulate and record activity from a large population of neurons. Two techniques are used to achieve this: calcium imaging and laser photostimulation. We first created a general layout of all the necessary components that would be added to an existing microscope. These included a highly-sensitive camera for Ca imaging, a uv diode laser for photostimulation, galvo mirrors for steering the laser beam, and various optics and optical filters. I also designed and machined a platform on which we would place our cell samples. Two translation stages were then added to allow precise and stable movement in the x and y direction. In order to test our apparatus, we had to culture and characterized neurons in our laboratory. This process involved using live neurons obtained from a collaborator at Princeton University and "seeding" them onto coverslips in our laboratory. We monitored their growth by counting the

number of neurons daily, and found that after seven days the growth of neurons plateaued. Cell density was then optimized by varying the initial number of seed neurons. In other experiments, we tested the effects of several drugs on a neuronal population. Finally, we performed calcium imaging on the neurons and were able to clearly discern neuronal activity. Being in the MUSE program this year has been a great experience. Before this summer I have had minimal experience in a laboratory. Throughout this summer I have become confident in imaging, machining and preparing solutions. I have learned many mechanical skills and I am not afraid to work with my hands. I have become an independent worker and have learned many useful techniques that I can implement in the biophysics field. I have learned how to use LabView and imaging programs. My love of research has grown, and I have learned that even though research may be tough the rewards you get are worth all the struggles you have endured.

A Further Examination of Quasar Variability Using the Kepler Satellite

Mitchell Revalski Physics
Dawid Nowak, Physics
Faculty Mentor: Dr. Paul Wiita

2013 MUSE Project

During the summer of 2013 Dawid Nowak and Mitchell Revalski conducted research investigating active galactic nuclei under the advisement of Dr. Paul Wiita. The main goal of this project was to continue work begun during MUSE the previous year, and to extend that work with new computational methods. The data used in this project were gathered by the Kepler satellite, a space telescope used to search for planets outside of our solar system. It has the distinct advantage of nearly uninterrupted viewing over long time scales since it is a satellite in an earth trailing orbit. We can use this nearly continuous and high precision data to carefully study how galaxies with active central regions vary in brightness with time. The primary objective this year was to combine individual data sets gathered by the satellite on a quarterly basis for a frequency spectrum analysis that would yield greater information about these active galaxies. Due to the satellites need to change orientation four times per year to point its solar panels at the Sun, the data is spread across four separate cameras. Each camera has its own characteristics, complicating the task of stitching the data together. The combined data may be used to see how these active galaxies vary over the course of years which until now has not been studied in great detail with data of this quality. Through this continued work, we hope to learn more about these extreme astrophysical objects, and the super massive black holes that power them.

Mitchell Revalski Personal Statement:

During this summer I, Mitchell Revalski, together with Dawid Nowak, conducted research investigating active galactic nuclei under the advisement of Dr. Paul Wiita. The main goal of this project was to continue work began during MUSE last year, and to extend that work with new computational methods. The data used in this project were gathered by the Kepler satellite, a space telescope used to search for planets outside of our solar system. It has the distinct advantage of nearly uninterrupted viewing over long time scales since it is a satellite in an earth trailing orbit. We can use this nearly continuous and high precision data to carefully study how galaxies with active central regions vary in brightness with time. The primary objective this year was to combine individual data sets gathered by the satellite on a quarterly basis for a frequency spectrum analysis that would yield greater information about these active galaxies. Due to the satellites need to change orientation four times per year to point its solar panels at the Sun, the data is spread across four separate cameras. Each camera has its own characteristics, complicating the task of stitching the data together. The combined data may be used to see how these active galaxies vary over the course of years which until now has not been studied in great detail with data of this quality. Over the course of the summer I wrote many programs in various computer languages to run a number of investigations on our data. Along the way I have learned both a great deal of programming as well as more of the physics which describe active galaxies. I am now much more confident in my ability to tackle original problems, as well as share my knowledge and excitement for the subject with others. I truly believe MUSE has allowed me to expand my base knowledge, useful skills, and critical thinking ability. As a last note, MUSE would not be half of what it is without the passionate students and faculty who both participate in and organize the program. I extend many thanks to my partner, professor, and the MUSE coordinators for a very fun and educational summer. Our success this summer has led to the production of two great posters which we plan to pre-

sent at a major upcoming conference. In addition, we are working on the beginnings of a paper for submission to a refereed astrophysical journal.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