The College of New Jersey

Mentored Undergraduate Summer Experience

2011 Abstracts

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2011

The College of New Jersey

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Mentored Undergraduate Summer Experience – 2011

The student and faculty participants in TCNJ's Mentored Undergraduate Summer Experience (MUSE) created a vibrant scholarly community of faculty-student collaboration for eight weeks this summer. Our community was truly multi-disciplinary, with 76 students and 52 faculty members representing 23 Departments or Programs from all seven Schools and the Library.

The students engaged in authentic research or creative projects full-time, as junior collaborators with their faculty mentors. In addition, we gathered twice weekly as the MUSE community for food and conversation across the disciplines. Faculty mentors and TCNJ staff led participatory workshops at Monday lunches on *Ethics in Research, Winning Fellowships and Awards, Career Pathways, Preparing for Graduate School, Communicating About Research,* and *Using Web Resources in Research.* On Thursday afternoons we enjoyed refreshments while hearing from students about their ongoing projects. Social activities and weekly athletic games also encouraged MUSE participants to build community outside of work. Forty-three students were housed together, providing unlimited opportunity for making new friends and interacting informally with fellow scholars of widely varying interests.

This wonderful program was possible because of the generous support and dedication of many people and organizations. The Director and all of the students and faculty of MUSE extend our deepest thanks to the Office of Academic Affairs, with leadership from Provost Carol Bresnahan and Vice Provost Mark Kiselica and invaluable administrative support from Janice Huang; student program assistant Sadia Tahir; the Offices of Residential Education and Housing, Conference and Meeting Services, Catering Services, Finance and Business Services, and every School and Department office and Chair with MUSE students, for administrative support. We also thank the Faculty-Student Collaboration Committee for guiding the vision of MUSE, reviewing proposals, and recommending funding: Matthew Bender, Benny Chan, Paul D'Angelo, Andrew Leynes, Donka Mirtcheva, Nick Ratamess, Ralph Reed, Greg Seaton, and Karen Yang. The program is possible due to major financial support from Academic Affairs, with supplemental funding from the School of Business (Dean William Keep) and the School of Culture and Society (Dean Ben Rifkin). We also are very grateful to our generous external funders, the American Chemical Society Petroleum Research Fund, Bristol Myers Squibb, NASA, the Pennsylvania Fish and Boat Commission, the National Science Foundation, and Research Corporation.

Janet Morrison, Ph.D.

Director of Faculty-Student Scholarly and Creative Collaborative Activity and MUSE

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Emotions in Teaching and Learning History: Transforming Pedagogy and Practice for Adolescent Learners

Danielle Steward, History/Secondary Education
Faculty Mentor: Dr. Ruth Palmer, Secondary Education
Faculty Mentor: Dr. Michael Marino, History/Secondary Education

MUSE 2011 Project

My study is part of an interdisciplinary team investigation addressing the question: *How does Metacognitive, Motivational and Emotional Self Regulation Influence Secondary Education Teacher Development and Student Learning?* My study focuses on the influences of teacher-enhanced and research-based integrated practices on the teaching and learning of secondary history. Its primary purpose is to develop a framework for teaching history that integrates the interrelated constructs of emotion, cognition, and motivation, adopting Schultz et al's (2006)., definition of these as interconnected social-historical constructs. The secondary purpose is to test the validity of the framework for teaching history.

Thus, using an exploratory mixed method research design, the study will be conducted in two phases. Phase 1, using qualitative research approaches, includes four steps: (a) the initial design of the framework through the identification and classification of research-based and practice-informed elements of emotions, cognitions, and motivation; (b) integrating that framework into the wider context of teaching and learning using Charlotte Danielson's (1996) framework for teaching; (c) establishing focus groups of history teachers, and teacher educators to provide continuous critical feedback on the framework and its application to the teaching of history; and (d) have selected secondary school history teachers apply the framework to design units of consistently positive emotional learning experiences for 9th grade history students. Phase 2, using a multiple case study approach, aims to test the validity of the framework and includes the implementation of the history teaching units and their evaluation using detailed documentation which includes photographic data, videotaping, classroom observations, teacher interviews and student work.

The results of both phases of this investigation will extend existing research on emotions in the classroom and help teachers and teacher educators to understand how emotions are connected to teaching goals and classroom engagement.

Danielle Steward Personal Statement

The MUSE program has helped to extend my disciplinary and professional research abilities and to appreciate and strengthen my capacities to collaborate in interdisciplinary research. While Dr. Palmer had been mentoring me in my research since the fall of 2010, this summer in the MUSE program helped to move our research collaboration from a review of the literature to a proposal for a long term study. Our study aims to extend previous research and take an interdisciplinary approach that brings together both educational psychology and the teaching of the content area of history. Taking this interdisciplinary approach has challenged me to think about researching in an entirely different way and to learn how to synthesize information across disciplines to develop new ideas. MUSE has pushed our research forward and has prepared us to put our study into action in the fall of 2011 and spring of 2012.

Contribution of Motivational Beliefs and Metacognitive Learning Approaches to 9th grade Students' Classroom Engagement and Historical Thinking

Hayang Lee, History/Secondary Education
Faculty Mentors: Dr. Ruth Palmer & Dr. Michael Marino

MUSE 2011 Project

This study investigates the contribution of motivational beliefs and metacognitive approaches to classroom engagement and historical thinking of secondary education students. More specifically this study sets out to analyze the impact of teachers' use of specific motivational and metacognitive approaches on 9th grade students' classroom engagement and their chronological thinking in history. Participants consist of one 9th grade world history teacher, two teacher-recommended 9th grade world history students and the researcher as a participant observer. This multiple case study using a Times Series Research Design with the continuous intervention of a 10-week tutoring program allows for multiple units of analyses and for measures to be taken continuously before, during, and after the tutoring intervention. The world history learning intervention consists of 12 motivational and metacognitive strategies that fall under two categories: (1) educator specific strategies (2) student specific strategies. These strategies range from basic to more complex skills focused on moving the students from simple to more complex thinking for learning content. These skills will be

introduced two at a time weekly and then cumulatively over the 10 weeks, with students eventually taking ownership of all strategies and participating in more complex thinking within their learning of historical content and of chronological thinking. Data collection across multiple data points will use three types of instruments: (1) researcher completed measures; (2) student completed measures; and (3) teacher completed measures. Each data set will be analyzed using descriptive statistics and qualitative analyses, including member checking. Then triangulation of these data will be conducted to enhance the accuracy and credibility of the findings, which have potential for contributing to teacher design of creative learning experiences for adolescent learners, to student learning, and to elevating the role of tutoring in the learning process.

Hayang Lee Personal Statement

Working with Dr. Ruth Palmer and Dr. Michael Marino this summer taught me lessons about collaboration and communication. It was an opportunity to learn about the research process educators undergo and the meticulous work necessary for creating a rigorous investigation which contributes to the knowledge base. This summer revealed to me that research is a skill requiring investments in patient study, iterative tasks, and clear/ effective writing, while reminding me that errors are stepping stones toward accomplishments. Working with two great mentors provided me with the ability to develop my understanding of education psychology and history education literature that will surely enrich my future as a prospective history teacher.

Design, Construction, and Testing of a Wearable Expression Monitoring System for Musicians

Melissa Mastro, Biomedical Engineering
Nima Rahimi, Biomedical Engineering
Faculty Mentors: Dr. Brett BuSha and Dr. Teresa Nakra

MUSE 2011 Project

Musicians and music conductors are often emotionally connected to their performances. These emotional connections result in changes in heart rate and breathing not associated with the physical movement related to the performances. In this study, we designed a wearable expression monitoring system to continuously evaluate heart rate, breathing, muscle movement, as well as a measure of emotional state. Heart rate was measured through the recording of the electrical activity of the heart. Similarly, muscle movement was quantified through the recording of the electrical signals generated during muscle movement. Breathing was measured by tracking the expansion of the chest wall during breathing efforts. Emotional state was assessed using a locally designed and fabricated galvanic skin response (GSR) sensor. The GSR sensor detected microscopic changes in the sweat production of the skin, a marker for emotional state (any shift from a relative calm state, i.e. scared or happy, results in an increase in sweat production). Each of these sensors were integrated into a wearable garment and the sensor data were wirelessly transmitted to a laptop. A pilot study was then conducted with several subjects of varying musical expertise. Preliminary results show increased levels of emotional arousal during music performance, not related to increases in heart rate, breathing or muscle activity. Overall, the development of the wearable expression monitoring system provides a solution for long-term unobtrusive separation of emotional state independent from physical activity.

Melissa Mastro Personal Statement

The MUSE program offered me a fantastic opportunity to glimpse into the day to day functioning of a graduate level research laboratory. Not only did I gain experience with computer programs common in engineering research, but I also enhanced my circuit design and building skills. Through this project, I was able to experience the interdisciplinary nature of human research with the integration of physiological sensors, emotion research, and musical performance. This also helped to illustrate the importance of collaboration, as varying skill sets are necessary for different aspects of biomedical engineering research. My experience in MUSE will directly correlate and aid me in the development of my senior design project as well as prepare me for my future goals in graduate school.

Nima Rahimi Personal Statement

Participation in the MUSE program has equipped me with a distinct vision on collaborative efforts in a biomedical engineering research environment by allowing me to employ a creative approach to examine physiological changes due to emotional stimuli. Our advisors encouraged us to explore various journal articles, gather beneficial knowledge

regarding each step of the design, and think independently to propose plausible solutions for the encountered problems. The MUSE program helped me gain enhanced communication skills through the collective assessment of different viewpoints on problem solving approaches and aided the development of strong relationships with my advisors. Contribution to data analysis across multiple subjects enabled me to implement an objective method to evaluate the experimental results and identify logical explanations for the observed trends. The interdisciplinary nature of my project allowed me to connect with faculty from the Department of Music at TCNJ and recognize additional fields of research associated with biomedical engineering. The community activities of the program provided me with a wonderful opportunity to meet students from other disciplines and become familiar with their research. Overall, I have acquired an important set of skills to successfully conduct meaningful research and I'm hoping to apply these skills to future graduate work.

Implementing an Institutional Repository for The College of New Jersey

Michael Glinski, Computer Science
Ross Holley, Computer Science
Faculty Mentors: Yuji Tosaka, Library; Cathy Weng, Library; Sharon Whitfield, Library

MUSE 2011 Project

The Library MUSE project is aimed at implementing an Institutional Repository (IR) for The College of New Jersey. Its purpose is to archive, preserve, and disseminate TCNJ's scholarly assets and promote open access across all disciplines. With two computer science students, we have sought to apply current IR theories and models and collaborate to design, develop, test, and deliver an operational IR prototype. Michael Glinski and Ross Holley were selected to work on this project.

The MUSE faculty selected IR+, an open source software developed by University of Rochester, as TCNJ's IR platform. The IR+ system is fairly new (first released in December 2009) with many good features, including faceted filtering and researcher's profile pages. Mike and Ross worked very closely with the three library faculty including daily individual consultations and weekly team meetings. We also received a great deal of help from the original software developer, Nate Sarr of the University of Rochester.

Mike and Ross performed local installation and server administration in their first week. They then began to explore the areas that needed to be enhanced and learn strategies to find target files where codes could be changed. This turned out to be a challenge and quite a learning experience. To gain more knowledge of the IR+ user interface, Ross learned how to perform usability studies and practiced conducting informal software usability tests. His recommendations on enhancing the system administration menu were well received. Mike explored enhancements of two major functionalities: modifying faceted navigating and batch-loading metadata. He self-learned several new programming languages and familiarized himself with MARC formats (a library metadata standard). He has acquired a grasp of faceted filtering functionality and metadata schemes. The team also learned the importance of building an open source software development community so that the software can be continuously and collaboratively developed.

Michael Glinski Personal Statement

My time spent at TCNJ for the MUSE summer research program has been an invaluable experience. For this project, I worked alongside Computer Science peer, Ross Holley, and mentors Sharon Whitfield, Yuji Tosaka, and Cathy Weng to implement an institutional repository for the school. I was given several opportunities while working on this project that I believe are not offered in the classroom. Included in these opportunities is the chance to perform the duties of a server administrator, as well as the liberty to be a part of and contribute to an open source community. The open source software we were implementing and developing upon, IR+, was primarily created by Nathan Sarr, Senior Software Engineer at University of Rochester. At several times throughout my research here at TCNJ, I conversed with Nate via discussion board, email, and even Skype about the progress of my research and received guidance from him when needed. Simply put, my time here gave me valuable skills and opportunities that I hope will benefit me in my future endeavors.

Ross Holley Personal Statement

This summer I worked with my mentors, Yuji Tosaka, Sharon Whitfield, and Cathy Weng, on improving and modifying the IR+ Institutional Repository, and creating a prototype for future deployment. This project was extremely exciting and successful for me. Throughout the process I felt that I was an equal partner in this endeavor as well as

learning a large amount about programming and the process of system design due to myself and my partner, Michael Glinski, being the computer science experts on the team. I also learned an enormous amount about how computer science can be applied to library systems, and I hope that I am able to apply this newfound knowledge when I continue in my studies in the Fall of 2012 by going to school for Library Science.

Ortler Mountain Range
Kelsey Long, Art
Matthew Pembleton, Art
Faculty Mentor: Elizabeth Mackie, MFA

MUSE 2011 Project

Elizabeth Mackie and her student collaborators, Kelsey Long and Matthew Pembleton, senior Art Education majors, worked on three different projects throughout MUSE. They completed an 8-foot fiber sculpture titled "A String of Little Stories" for Art in the Open in Philadelphia, followed by three Artist books made from handmade paper for an exhibition in Australia. They also created an installation out of large handmade paper, inspired by Glacier kettles from the Ortler Mountain range in Italy.

The first week began with final preparations for and participation in "Art in the Open," a four-day event on the Schuylkill banks. The work invited the public to write stories about women in their lives on strips of fabric sewn into a large skirt. It was included in an exhibition at the Painted Bride.

Next, the group spent five days at Women's Studio Workshop in Rosendale, NY. There, they researched pulp processing, sheet forming, and formulas for coloring paper using various pigments. They made paper for the book projects using Japanese fibers and techniques. They experimented with beating times for Abaca pulp and prepared 40 lbs. for the large installation.

After their return to TCNJ, the group experimented with large scale papermaking using a spraying technique to create 4′ x 7′ sheets. They determined the qualities needed for installation purposes and a method of production. Over the course of four weeks, the group completed eighteen sheets and cut complex patterns into twelve. The work was installed in the art building and photographed for exhibitions.

In addition to the Painted Bride exhibition in July, "A String of Little Stories" will be exhibited in the TCNJ faculty exhibition in September 2011. It is also under consideration for two different exhibitions, Spring 2012. The exhibition of the Books will be at Smith Street Gallery, Victoria, Australia during October/November 2011.

Kelsey Long Personal Statement

My MUSE experience has been a unique opportunity to learn how to work and collaborate as a professional artist. Elizabeth Mackie has exposed Matthew Pembleton and myself to the opportunities available in the art community post-graduation. Working at Women's Studio Workshop gave me a taste of what it would be like to be an artist-in-residence or a studio assistant. Participating in Art in the Open taught me about being in juried art events and exhibitions. Both experiences gave me the chance to network with local artists and graduate school professors.

I have also gained invaluable knowledge and experience in the field of papermaking. I have learned both traditional and large-scale processes, and assisted Elizabeth with several book and sculpture pieces. Our ongoing experiment has been an installation of 4′ x 7′ sheets of handmade paper with cut-outs inspired by global warming patterns in Solda, Italy. It has required problem-solving and critical thinking, and is now nearing completion. It is rewarding to see how our hard work as come full circle as both art and experience.

Matthew Pembleton Personal Statement

I consider myself fortunate to be part of MUSE within a field I am incredibly passionate about- fine arts. To me, one of the most important parts of doing successful work is the process. The process behind the work is where the greatest amount of learning and growing happens. Throughout this collaboration, I have learned a great deal about what goes into building a cohesive team that can achieve goals one person cannot do alone. When a problem arose, my team regrouped and discovered solutions to continue on. The project required a strong sense of independence as well.

The primary research component consisted of testing a variety of fibers and finding out what kind of paper they produced. In addition to learning the varying properties of each fiber, we experimented with several ways of preparing paper from scratch, from traditional Japanese papermaking methods to mechanical means to procure large quantities at one time. I know this experience will benefit my future endeavors as an artist pursuing graduate school and as an art educator who can use these new papermaking methods in the classroom.

The Reception and Rejection of Roman Imperial Portrait Models in the Eastern Provinces of the Empire, 235-270 CE

Hyuna Yong, Art
Faculty Mentor: Lee Ann Riccardi, PhD

MUSE 2011 Project

In a span of a mere 35 years, over 20 emperors ruled the Roman Empire. The period was fraught with wars, rebellions, revolts, plagues and invasions. Emperors reigned for one year, one month, even one week, and none died a natural death during this time: among them, emperors killed themselves, were assassinated by their own soldiers, killed in battle, and captured. Despite – or rather, because of – the instability of the third century, it became crucial for emperors to announce their presence in even the most remote parts of the Roman Empire. Thus, imperial portraits were commissioned in a variety of mediums, ranging from a monumental building to a tiny bronze coin.

This summer, Professor Lee Ann Riccardi and I examined portraiture found in Roman Provincial coins of the third century. More specifically, the study investigated numismatic portraits of 26 imperial members in 149 cities of the Roman Empire's Eastern Provinces. Such research substantiates Dr. Riccardi's hypothesis that provincial artists had more freedom than traditionally presumed when they created imperial portraits. Working primarily in the Princeton University Libraries, we found about 200 new publications in English, Greek, French, German, Italian, and even a few in Turkish with potential new coins and studies. We then compared these coins to Dr. Riccardi's original catalog, which consists of over 10,000 coins representing 2820 dies, and placed them in one of the 690 coin types, distinguishable by formalistic characteristics. For each type we also chose an example for illustration, which were scanned to publishable quality. Alongside these tasks, we revised and reformatted the manuscript to the publisher's specifications. Ultimately, this project will help challenge the assumption that provincial artists had to follow official imperial Roman portraits as models and that all Roman imperial portraits look alike.

Hyuna Yong Personal Statement

As a student who aspires to go to graduate school, I certainly believe that MUSE was an invaluable experience. Through this program, I was able to learn the process of researching for and preparing an art historical publication. Such research stresses the importance of knowing foreign languages and relying on meticulous observation in order to collect visual, empirical evidence. I also learned about a medium and period – numismatics and the Roman Empire in the third century – that are not as frequently taught in TCNJ. Most importantly, the program has strengthened my desire to obtain a PhD in art history, helping me confirm that research similar to this is something I want to do for my career.

Where Have We Been and Where Should We Go? A Thematic Meta-Analysis of Health Communication Research in the New Media Landscape

Phoebe Ling, Biology
Kathleen Ward, Communication Studies
Faculty Mentor: Yifeng Hu, Ph.D., Communication Studies

MUSE 2011 Project

Health communication is a multifaceted and multidisciplinary approach to reach different audiences and share health-related information with the goal of influencing, engaging, and supporting individuals, communities, health professionals, special groups, policymakers and the public to champion, introduce, adopt, or sustain a behavior, practice, or policy that will ultimately improve health outcomes. Recently, there has been increased interest in the use of information technology for health and health care delivery. For example, Internet search engines can offer a wealth of health information to anyone; online forums can provide social support to both cancer patients and family caregivers; and mobile technologies can be utilized for smoking cessation. It is clear that technology usages are having an increased impact on how patients receive counseling and therapy, cope with various diseases and health concern, and interact with physicians. Therefore, the purpose of this study was to examine the status quo of research regarding the use of new media technology in health communication, and propose topics that can be explored by future researchers in this area.

A thematic meta-analysis of research articles published in peer-reviewed journals during the last five years (2006 to 2010) was conducted. Major databases representing communication, psychology, and health disciplinary fields were searched. Variables coded for included researcher disciplinary affiliation, research focus, health concern, new media technology, phases of research development, theoretical framework, methodology, study participants' health related

identity, and targeted population demographics. A separate but representative sample of units was used to train two independent coders. Inter-coder reliability was assessed. Coding of articles from the full sample is currently in progress. Future data analysis and results will reveal topical, theoretical and methodological trends of research in this area and provide new insights for further research directions.

Phoebe Ling Personal Statement

MUSE has been an extremely valuable, enriching, and educational experience this summer. Through the program I have had the unique and rewarding opportunity to collaborate with Dr. Yifeng Hu and Katie Ward, both individuals from outside my disciplinary field. I was able to learn more about different research methods used in social sciences, particularly in Communication Studies, and even actively take part in designing, implementing, and fine-tuning various aspects of our study. In the process, I came to realize how challenging, and yet rewarding, research can be with smart, resourceful problem solving and subsequent celebration of all small (but always significant!) successes. In addition to developing useful lifelong research, work, and collaboration skills, I have also learned a lot about Health Communication and how it applies to the medical field through health information technologies, doctor-patient communication, public health campaigns, and patient therapy, counseling, and treatments. This summer has truly been memorable, and I am thankful for all the experiences I have gained through MUSE and working with fellow researchers Dr. Hu and Katie Ward.

Kathleen Ward Personal Statement

This summer, the MUSE program has granted me the opportunity to research and gain experience in a field that I am very passionate about. I now have a much deeper understanding of the current trends, popular methodologies, theories and future directions of the Health Communication field as it relates to new media technology. The most positive learning experience throughout the project was working with a student from the Biology Department, Phoebe Ling. She brought a great deal of knowledge to the project from a different side of the Health Communication spectrum. In addition, the guidance I received from Dr. Hu furthered my interest in the field as she expanded my knowledge on research guidelines and techniques. After successfully beginning a thematic meta-analysis, I am now more proficient at database searching, developing a codebook and problem solving with others. As I plan for my academic future, I know the research I have conducted on Health Communication and new media technology and the experience I have gained working with individuals from other disciplines will help me thrive in graduate school.

LIVING MY DREAM

Nicole Thompson, Communication Studies
Faculty Mentor: Susan Ryan

MUSE 2011 Project

In a time of severe budget cuts and federal requirements for higher scores on standardized tests, programs in the arts—theater, dance, visual arts, and media arts—may seem like a luxury better-suited to wealthier suburban school districts than inner city high schools. This documentary video explores how performing and visual arts programs are helping students develop an appreciation for different art forms and skills in a way that has made significant changes in their lives. We are focusing on an innovative program at the Emily Fisher Charter School in Trenton. Once known as a school for "bad kids" with behavioral problems, through the arts many of the kids are thriving. Throughout the documentary we will be examining a number of areas in interviews and scenes in the classroom and in performance: How do the arts make a difference? Since few students will go on to become professional artists, what are the skills and discipline taught in an arts curriculum that can help in other areas of schooling and in their personal lives? How does an emphasis on creativity tap into character development that students need to be successful in life? How can the arts help them live their dreams beyond high school?

Nicole Thompson Personal Statement

Under the instruction of Dr. Ryan, during the 2011 Mentored Undergraduate Summer Experience I have learned three essential lessons that are key to creating a successful documentary. The first lesson I learned is the importance of preparation. Before picking up a camera and just shooting, I've learned it is important to know exactly what you intend on shooting by doing research and creating an outline for your interviews. However, you are never restricted to shoot-

ing only that, for creativity and thinking outside of the box is always encouraged. The second lesson I learned is doing task that may seem monotonous, such as transcribing interviews is necessary because it pays off in the long run when it comes to editing. Lastly, I learned organization is the thread that holds an entire project together, for without it you are lost in all of the chaos. 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.

The Consequences of TANF time limits for NJ's poor: Evidence from Service Providers

Lauren Anne Rittenbach
Faculty Mentor: Dr. Michele Naples

MUSE 2011 Project

In 1996, the federal government passed the Personal Responsibility and Work Opportunity Act that placed a limit on the amount of county assistance a welfare customer could receive throughout his or her lifetime. This new welfare program became known as TANF, Temporary Assistance to Needy Families, and allows customers a lifetime limit of 60 cumulative months. Professor Naples and I questioned the effects of time limits on New Jersey welfare participants, some of which who have known little other than a life on welfare. In particular, we were curious as to how customers were earning incomes after they were prematurely no longer receiving TANF cash benefits.

Research was gathered through literature review and a series of interviews with welfare advocates, case workers, directors, and policy analysts in Newark and Trenton. The interviews revealed that a majority of customers do not deplete their allotted lifetime limits. For those who do, customers will continue to be provided for by TANF for a non-specific amount of time as long as they are meeting welfare work and self-betterment requirements. Time limits do not appear to be as great of a threat as I initially perceived them to be; in 2010, only eight families in Mercer County met their time limits and no longer qualified for further assistance. Research shows, however, that a sanctioning feature of the TANF program can compromise customers' wellbeing; customers that do not comply with TANF requirements will face a decrease in cash or service benefits. In order to make up for a loss in benefits, customers turn to alternative markets, family and friends, and non-profits to subsidize their losses. Though it is unclear how much customers rely upon the underground market and non-profits because of sanctioning and time limits, it is apparent that the sanctioning program does place additional pressure on food pantries and homeless shelters.

Lauren Anne Rittenbach Personal Statement

I will be a senior economics major with a minor in women's and gender studies. MUSE enabled me to pursue a topic that encompasses my interests in community development and economic well being as a result of policy, as well as a topic that is primarily centered upon women. I will take back from this experience a better understanding of local government and nongovernment agencies, and the importance of discussion amongst community providers. It is my hopes that I will be able to continue my MUSE project as a senior capstone project.

I would like to thank Dr. Michele Naples for her patience and guidance throughout this research process, and Dr. William Keep, Dean of the School of Business, for approving the funding of my project.

Effect of Income Distribution on Fiscal Policy Multiplier: Evidence from OECD Countries

Sujoy Gayen, Economics
Faculty Mentor: Dr. Subarna Samanta

MUSE 2011 Project

Economic literature has not come to a consensus about the fiscal policy multiplier. The effect of government expenditure on the GDP of an economy is a topic of debate among economists. One goal of this study was to determine the size of the fiscal policy multiplier by examining cross-sectional data from the advanced countries of OECD. In addition, this study investigated the effect of income distribution, as measured by the Gini coefficient, on the rate of growth of a country's GDP. Finally, this study explored the effect of a country's income distribution on the effective of fiscal policy designed to stimulate an economy, as measured by the fiscal policy multiplier. Preliminary results using fixed effects panel analysis indicate that government expenditure has a positive but inelastic effect on the GDP of a nation and that increases in income inequality are associated with lower GDP growth rate sin the advanced OECD economies. Future research will use simultaneous equations panel method to estimate the effect of changes in income inequality on the multiplier.

Sujoy Gayen Personal Statement

During this experience, I further developed research skills in economics, the subject that I majored in. I worked with Dr. Samanta on an interesting research topic, specifically the effect of income inequality on the effectiveness of government fiscal policy. This issue is an important one, in light of the current economic and fiscal difficulties that the

United States and other advanced economies, such as those of western Europe, are facing. There is fundamental political and economic disagreement about the effectiveness of increased government spending in strengthening an economy in a recession. I thank Dr. Samanta for allowing me to work with him on such an important and relevant topic.

BRIC Countries and Their Impact on World

Sunita Yadavalli, International Studies
Faculty Mentor: Subarna Samanta

MUSE 2011 Project

In an increasingly integrated world, BRIC countries (Brazil, Russia, India, and China) have been playing an increasingly important role in the global economy. So, it is vital to examine the economic and political impacts these countries have had on each other as well as on the world economy. Recently South Africa has been invited to join these key emerging economies to make it BRICS. To understand this new economic situation, I have worked with Dr. Subarna Samanta to conduct a cross-country analysis of the BRIC countries by looking at their individual economic infrastructure and other factors including: world trade vs. trade between the BRIC countries, GDP growth, per capita income growth/ rise of the middle class, and foreign direct investment. Next, we analyzed the legitimacy behind South Africa's invitation to BRIC to make it BRICS. By juxtaposing the South African economy with its fellow BRIC countries, I have evaluated whether South Africa's inclusion into this elite grouping of emerging markets is worthy of its recognition. And finally, I examined the relationship between indicators of global governance, Rule of Law, Voice and Accountability, and overall effectiveness of the government with the growth rates of the respective economies within BRICS. Overall, I have concluded that many democratic indicators do not have an impact on the overall success and growth of the BRIC economies, which gives light to the fact that three of the countries are democracies (Brazil, India, and South Africa) while two are not (Russia and China).

Sunita Yadavalli Personal Statement

Participating in MUSE this past summer has been one of the most valuable experiences of my college career. I have been able to utilize the campus to an extent that I had not had the opportunity to do during the semester. I am glad that I went outside of my school of Culture and Society and researched with Dr. Samanta in the School of Business. This research challenged and expanded my knowledge of political economics, and I have gained a better understanding of statistical research, which is a key component in the Political Science field. In addition to my greater understanding of economics, I feel my research will bring a more globalist perspective to the campus. It is essential to understand what key emerging countries are stepping up to become more globalized through trade and economic interaction. Overall, I am glad to have combined my passion of world affairs with my research by demonstrating just how important BRICS have been and will be to the world economy.

Unwanted Guests at a Family Reunion: A Comparative Historical Study of the Black Panther Party in the U.S. and Israel, 1966-1974

E. Kyle Romero, History
Faculty Mentor: Dr. Christopher Fisher

MUSE 2011 Project

Over the course of the summer, I have collaborated with Professor Christopher Fisher, of the History and African-American Studies departments, in a comparative historical analysis of the Black Panther Party in the United States and Israel. Born out of frustration with their exclusion from privileges of the broader society, each expression of the Panthers, the Black Panther Party in the US and Pantherim Shechorim in Israel, used protest and the language of revolution to challenge the dominant beliefs of their societies and uniquely influence national politics. The Black Panthers became an enormous thorn in the side of their respective governments and the goal of our research is to explore why this was the case. Chief among our considerations is why the Black Panthers, their terminology as well as their imagery, had such international currency, and why it had particular resonance in the political dialogue between Ashkenazi and Sephardic Jews in Israel.

By researching various scholarly articles and journalistic accounts, delving through historical newspaper posts, and culling the resources of Princeton University's library, our project bore some very interesting fruit. What we found was that from the years of 1966 to 1974, both expressions of the Party framed their identity and revolutionary rhetoric in the backlash from their respective governments. The outcome of which, spoke to alternative conceptions of modernity in advanced democratic states. Surprisingly, this desire for an alternate modernity was not a merely chance happening, it was an intentional act by the founders of the Party in the United States, and an act which carried meaning to oppressed peoples across the globe, specifically in our case the Sephardim of Israel and Oriental Jews from Northern Africa, primarily Morocco, and Arab states, considered the Mizrahim.

E. Kyle Romero Personal Statement

The MUSE program has been immensely helpful for me in my growth as both as a scholar as well as a person. The entire experience has helped me cement my career goals, and better understand both the difficulties and the joys that go into becoming a professional scholar. Working under the tutelage of Professor Fisher, I have spent weeks researching and analyzing a specific topic with much broader implications, and I have found the work to be both intellectually challenging as well as rewarding. As I plan on attending graduate school after my graduation, with the intent upon obtaining a PhD and becoming a college professor myself eventually, this program was incomparable in validating my desire as well as giving me valuable experience to apply in both my application to a graduate program and in furthering my own personal scholarship.

New Jersey Teachers' Attitudes toward Non-Standard American Dialects: Creating Linguistically and Culturally Informed Instruction

Cara Evans, English and Deaf Education
Faculty Mentor: Dr. Felicia Jean Steele

MUSE 2011 Project

United States educators have long recognized an achievement gap between poor and affluent students and between African American (AA) and white students. This study examines the role that dialectal differences play in that achievement gap. This research seeks to determine the correlation between the density of dialectal features (DDF) in student writing on standardized tests, student scores, and student identification for special services. We also have the opportunity to describe the inventory of dialect features in New Jersey students' writing and to gain authentic samples to study teacher reactions to dialect in writing. Dr. Felicia Jean Steele and I initiated our research this summer by familiarizing ourselves with the dialectal features of the primary dialect relevant to the urban Northeast: African American English (AAE). After researching the history and features of AAE, and the relationship between dialect, literacy, and writing, we began reading and analyzing over 1,000 samples of Ewing Public School students' NJASK and HSPA writing sections from 5th, 7th, and 11th grades, looking for dialect features. Since our sample size is large and our research will continue past the final day of MUSE 2011, our preliminary findings are based on a sample size of 100 essays per grade. We have approached these essays from a demographically-blind position to allow for a non-biased analysis of the es-

says. Findings have shown that the DDF in students' writing grows geometrically – the more prevalent phonological features are within the student's writing, the more likely he or she is to exhibit morphological and syntactical features as well. We anticipate correlates soon, and are also hoping to use this data in order to pursue further research concerning recommendations for special services (including speech services) and to create linguistically and culturally informed instructional materials for educators on this topic.

Cara Evans Personal Statement

The MUSE program has certainly been an invaluable and unique educational experience I will continue to appreciate throughout my career as a TCNJ student and beyond. MUSE fosters an outstanding atmosphere for scholarship and community between students and faculty. I feel exceptionally fortunate to have had the opportunity to collaborate closely with my linguistics professor, Dr. Felicia Jean Steele, while also engaging in meaningful research which marries several of my personal academic interests, including language, writing, and education. Although my academic major encompasses many classes which address these subjects, MUSE has allowed me to delve into a specific topic which I otherwise might not have had the opportunity to study in-depth during the school year. Our research objectives emphasize the importance of teachers' awareness of linguistics and culture in the classroom, and how to use this knowledge to provide students with the tools to be academically successful. As a future educator, this research has motivated me to whole-heartedly pursue solutions to promote change for the better within New Jersey public school instruction.

Nursing the Nation
Sana Ben Nacef, History
Faculty Mentor: Dr. Cynthia Paces

MUSE 2011 Project

Dr. Cynthia Paces and her student-collaborator Sana Ben Nacef have been working to understand the European fascination with breastfeeding and motherhood in the 19th and 20th centuries. This era coincided with the invention of artificial infant formula (1861), the increasing number of women in the workforce, and an understanding of the role of bacteria in childhood diseases such as summer diarrhea. In order to get a more holistic view of this particular era as it pertained to child-rearing, Dr. Paces and Sana thoroughly examined medical texts, artwork, postcards, stamps, and advertisements among other visual propaganda that was aimed at European women. Dark, foreboding advertisements about properly feeding infants were commonplace in France, Germany, and England, three of the most influential imperial powers.

This study focused on the era of imperialism, as Europe was extending its influence around the world. Schools for motherhood, clinics, and milk depots were implemented by the Europeans in various African and Asian colonies in effort to teach the native people about what the Europeans considered proper child-rearing. Much of the focus of these clinics and workshops was based around suitable breastfeeding practices.

One of the most interesting discoveries made this summer was that of the language directed at mothers in European countries and their respective colonies. The subjugation of women was a socially constructed aspect of European society. Advertisements and medical advice implied the moral duty and social obligation of a woman to breastfeed her child, or otherwise face dark consequences. While blaming mothers for high infant mortality rates, this propaganda also sentimentalized European mothers. Images of European women breastfeeding were idealized and innocent, whereas European-produced photographs of colonized women were considered erotic or humorous. Despite the variation in images, language, and approach, all of these sources demonstrate that Europeans were beginning to view public health—at home and in the colonies—as a responsibility of the state.

Sana Ben Nacef Personal Statement

The Mentored Undergraduate Summer Experience has enabled me to sharpen my research and writing skills. These skills are extremely importance to me as a history major because most of my academic work is comprised of researching and writing. By learning from the example of Dr. Paces and then personalizing the research methods, I feel as though my future research papers have the potential to improve exponentially.

Working with my mentor has also inspired me to take initiative in researching and applying to graduate programs after graduation. Through several in-depth conversations, we were able to discover not only what I want to research for

my senior capstone, but also what I would like to pursue in graduate school. Dr. Paces went to great lengths to help me understand the graduate research and application process while also assisting me in my search for a graduate program that would best suit my interests. I am extremely grateful for both MUSE and my mentor for providing me with an experience that has helped me determine an aspect of my future.

Distributive Justice in End of Life Healthcare
Domenic Siravo, Philosophy & Political Science
Faculty Mentor: James Stacey Taylor, Philosophy

MUSE 2011 Project

The aim of this MUSE project is to examine the problems of distributive justice faced in end of life healthcare. Since medical care is often expensive and is limited to finite resources, questions arise when deciding how these resources shall be justly distributed. This summer Domenic Siravo and Professor James Stacey Taylor specifically focused on policies of presumed consent in organ transplantations; in which persons are presumed to have consented to have their organs removed for transplantation unless they carry documentation explicitly stating otherwise. This project hopes to aid in evaluating if certain policies of organ transplantation and procurement fit into popular distributive justice schemas better than others. The research first consisted of acquiring data from nations with presumed consent, like those in continental Europe, and those with informed consent, like in the United States. This data included socioeconomic background, age, regional background and race. After the data was collected it was then compared and analyzed in order to search for any trends of inequality or inefficacy potentially associated with different organ procurement policies.
In addition to gathering data, the research involved consolidating and reviewing the relevant literature on distributive justice. By looking at the seminal works of John Rawls and Thomas Pogges, along with other respected works on justice, it became possible to see the potential moral problems that could arise in organ redistribution. The findings of the empirical analysis were evaluated with the findings of the relevant literature on justice.
The results of this research can be useful for policy makers hoping to create a just and morally permissible system of organ redistribution. It can also demonstrate the usefulness of combining philosophical argumentation and empirical analysis when discussing bioethical problems.

Domenic Siravo Personal Statement

Participating in the MUSE program has allowed me to cultivate my researching skills while simultaneously experience a taste of academia. Collaborating with my mentor has been extremely beneficial as philosophy research is traditionally a singular effort with peer reviewing coming after most of the research has already been done. Being able to have someone constantly available for feedback has been an invaluable experience. Additionally having the opportunity of meeting and working with my fellow peers who share the same passion for knowledge and research has been quite enlightening. My ability to work with others and independently has consequently improved and thus I am better prepared for undertaking any future research.

Let's Get Physical: Controlled Processing Might Not be Necessary to Produce an Isolation Effect
Colleen Mazzei, Psychology
Faculty Mentor: Dr. Tamra Bireta

MUSE 2011 Project

This summer, I worked under the direction of Dr. Tamra Bireta to collaborate on our 2011 MUSE project. The aim of this project was to examine the isolation effect for physical isolates (Exp. 1) and semantic isolates (Exp. 2) under full and divided attention. The isolation effect is a well-established paradigm in which items that differ from the surrounding context are better remembered. Items can be made to be distinctive using changes in color, font, size, language, category, etc. Current theories that explain the isolation effect often propose that the isolate is processed differently than the control items and suggest that the different properties of the isolate must be noticed in order for an isolation effect to be produced. These explanations, however, do not depend on the manner in which the isolate differs. A new theory of the isolation effect proposes that some isolates might be processed more automatically than others. To test this possibility, this summer's MUSE project examined the effect that different types of isolates have on the isolation effect under both full and divided attention. Results showed that divided attention eliminated the semantic isolation effect but had

no effect on the physical isolation effect. Our results support the hypothesis that physical isolates are processed automatically while semantic isolates require more controlled effortful processing. Additionally, semantic isolates were output earlier than control items, while physical isolates and control items were output similarly. This difference in output order further supports the hypothesis that physical isolates and semantic isolates both require different types of processing to produce an isolation effect. The current theories for the isolation effect need to accommodate the results of the current study.

Colleen Mazzei Personal Statement

The Mentored Undergraduate Research experience has provided me with the valuable opportunity to work collaboratively with a faculty mentor from The College of New Jersey. Through this experience, I was able to further develop my research skills and was challenged to think critically about our current research on the isolation effect and theories of memory. Working collaboratively with Dr. Bireta has taught me to look at problems from multiple perspectives and use these problem-solving skills to critically analyze data. I was able to explore the relevant literature to better understand theories of memory processes and relate these theories to our current research. The MUSE program has also allowed me to establish a mentor-mentee relationship, which will continue through the upcoming academic year as I pursue my senior honors thesis under the direction of Dr. Bireta.

Associations of Prestige with Gendered Occupations: Are Gendered Jobs Devalued?
Melissa Gutworth, Psychology
Faculty Mentor: Dr. Jason Dahling

MUSE 2011 Project

This summer, our work was based on Devaluation Theory which states that work contributions of women are devalued relative to work contributions of men. Past research has studied devaluation theory when studying wage disparities between genders. Limited research, however, has focused on the direct causes of why devaluation theory exists. Additionally, previous research has mainly studied gender and devaluation theory using explicit data collections such as surveys. These methods are prone to faking and social desirability when participants report on sensitive issues such as biases. In our study, we used an Implicit Association Test in addition to a survey to attempt to access unconscious biases. We hypothesized that we would see differences between prestige ratings of gendered occupations between the explicit and implicit measures. In addition to prestige ratings of gendered occupations, we also asked participants about their career interests, social dominance orientation, and conformity to traditional gender norms.

Although we had started data collection in the fall, we continued to recruit participants in the early stages of the summer program. While we were collecting more participants, I read about the theories and methods behind the IAT and learned more about the mechanisms behind the program. Once we obtained more participants, we cleaned and analyzed the data. While our original hypotheses received mixed support, we did see a slight overall prestige bias toward male jobs. Additionally, we found that men had a tendency to be interested in hands-on occupations such as an electrician or a mechanic and had a tendency to be disinterested in people-oriented jobs such as a teacher or social worker. Unexpectedly, however, we found that men rated traditionally-male jobs as more prestigious, while women rated traditionally-female jobs as more prestigious. This finding is inconsistent with Devaluation Theory and it provides interesting directions for future research.

Melissa Gutworth Personal Statement

The MUSE program has enabled me to work closely with my mentor on a project that was new to me both in topic and methodology. I am now more familiar with an implicit data collection method in addition to explicit methods that I have used in the past. Additionally, the experience I gained from creating and presenting research in a poster format is valuable and will aid me in future research presentations. Working collaboratively with a professor in the field of I/O Psychology is rare for undergraduates and having this experience has made me a more competitive applicant for graduate study. This opportunity provided me with a more well-rounded research background and has enabled me to advocate my fit for a wider range of graduate schools. The MUSE experience has reaffirmed my desire to continue researching and has made me feel more prepared for and capable of work at the graduate level.

Activism and Culture: Argentina's Madres de Plaza de Mayo as Cultural Producers and Symbols
Leah Ruediger, Sociology
Faculty Mentor: Dr. Elizabeth Borland

MUSE 2011 Project

This project addresses the question of how social movement activists can become both cultural actors and symbols. It combines data from a systematic coding of newspaper articles and an analysis of cultural objects (films, texts, songs, images, etc.) to examine the portrayal of Argentina's most well-known human rights organization, the Madres (Mothers) of the Plaza de Mayo. Preliminary quantitative analysis of the context in which articles reference the Madres indicates that a significant portion relate to cultural production. A second phase of quantitative analysis involving specifically the cultural references reveals that the Madres are frequently referenced as both producers of culture (organizing concerts and publishing poetry, for instance) and icons or symbols depicted by others (in paintings and songs, for example). Furthermore, certain cultural forms are frequently associated with particular producers, be they the Madres, artists collaborating with or receiving approval from the Madres, or producers not associated with the Madres. A supplementary qualitative examination of a sample of the cultural products, including films, songs, images, scripts, reveals that when the Madres are producers, they are most like to portray themselves as dynamic activists making contemporary claims in addition to their traditional claims. Collaborative work tends to represent the Madres as historical figures, but also allows them to create new dialogues between artists and aid in the communication of alternative histories. Non-Madres producers have the most variation in their message and cultural form; while some representations idealize the Madres and their work, others pose a potential threat to the Madres' continued relevance when co-optation of their message skews its meaning. Currently, the researchers are in the process of drafting an article manuscript to be submitted for publication that addresses how movements build long-lasting social change through cultural mechanisms, and how commercialization and co-optation of political messages can intervene in this process.

Leah Ruediger Personal Statement

Working alongside of Dr. Borland and her colleague Dr. Schoellkopf to investigate the cultural impact of the Madres de Plaza de Mayo, an internationally-recognized human rights organization based in Argentina, gave me a sense of what to expect when I advance on to future graduate studies in Sociology. I was given free rein to do much of the first phase of analysis, which included initial collecting and coding of data and subsequent use of the computer-based statistical analysis software SPSS. From this part of the project, I gained experience applying quantitative analysis methods. I was also actively engaged in other aspects of the research process, which included practical lessons in framing a literature review and strategically catering an article to a selected publication. When the entire research team came together to carry out the next phase of analysis, which involved a qualitative approach to a selected sample of the data, I realized how dynamic and exciting collaborative research can be when each member contributes a different area of expertise and lens of analysis. The end result was a thoroughly culled dataset and an article draft that is expected to be submitted for publication once finalized. I am thoroughly impressed by the work that we produced in such a short period of time (six weeks, as opposed to MUSE's traditional eight weeks). Ultimately, collaborating on this project confirmed my desire to enter a graduate program in Sociology, and gave me incredible cultural insight into the country where I will be studying abroad for the next four months. I could not have asked for a more thoroughly engaging and valuable MUSE experience.

The Rhetoric of Presidential Masculinity: Strategizing Gender in the 2008 Democratic Primary Elections
Kevin Adams, English
Faculty Mentor: Dr. John Landreau

MUSE 2011 Project

In the speech conceding her run for the 2008 Democratic presidential nomination, Hillary Clinton called the United States presidency the "highest, hardest glass ceiling." Her veiled exasperation is no exaggeration; there has never been a female president, and before Clinton no woman had come nearly as close as she. One cannot legitimately make the generalization that women are inherently less qualified, so the answer must lie in the biases of the electorate. Our research indicates that the public expects certain qualities from the commander-in-chief of the armed forces, and these qualities are traditionally linked with hegemonic notions of masculinity: toughness, strength, willingness to use force over peaceful coercion, and so on. We call this set of expectations "presidential masculinity." In order to win elections,

candidates must consistently demonstrate that they conform to this requirement. This handicaps women, who run the risk of appearing unwomanly should they too flagrantly forsake traditional femininity.

Our research differs from preexisting literature in that we avoid the oversimplification that Clinton lost because she is a woman, and we instead focus on the relational nature of gender performance. Hillary's performance of gender did not occur in a vacuum; her advisors were aware that the public was constantly contrasting her to Obama's equally-manicured image. Therefore, we hold that the candidates' gender performances must not be viewed in isolation, but must always be seen as connected.

Of particular interest to us are the moments when gender performance changes in response to public opinion and pivotal campaign moments. By analyzing the rhetoric of advertisements, debates, and speeches, and plotting moments of gender identity reinvention against a backdrop of major events during the race, we explore how presidential candidates strategically and self-consciously craft gendered images of themselves, and to what extent gender permeated and determined the 2008 Democratic primary elections.

Kevin Adams Personal Statement

My summer in the MUSE program has been the most enriching of my life. For the first time, my academic curiosity was channeled out of a traditional classroom, and I found great intellectual stimulation working one-on-one with my mentor. Our collaboration flourished into a full-on partnership, in which the burdens of research were shared equally and the fruits of ideas were traded freely. The line between work and play was sometimes blurred; why discuss theory in a classroom when you can park your kayak in the middle of a tranquil lake? This working relationship benefited me greatly, as the challenge of perpetual engagement with an intellectual superior elevated my critical thinking to new heights. And I had an absolute blast doing it.

One of the central goals of MUSE is to build community between the disciplines, and to that end the program undeniably succeeded. I am now conversant in everything from quantum mechanics to ancient art, and in the process I made good friends and lifelong memories. Thank you, MUSE, for an unforgettable summer experience.

Pedagogical Relationships in Secondary Social Science Classrooms
Trevor McLaughlin, Secondary Education
Faculty Mentor: Dr. Brian Girard

MUSE 2011 Project

The goal of this project is to study the relationships in social studies classrooms between teachers, students, and the curriculum through the lens of simulation activities. Dr. Brian Girard and I defined simulations as instructional games that allow students to encounter and engage in meaningful, real-world situations, either historical or current, in a simplified and controlled classroom environment. Simulation, as a pedagogical strategy, provides the potential to engage students in active, disciplinary-based learning experiences. In an effort to uncover the educational value and learning opportunities within these games, we studied how simulation activities build or constrain pedagogical relationships. The research that I did this summer helped substantiate our claim that the literature on classroom simulations requires a more theoretical grounding and empirical investigation.

Over the course of this program, I oscillated between an engagement in sociocultural theories of learning and the substantive literature on simulations and video games for the classroom. I explored the works of mathematics educators, social learning theorists, and epistemic gamers as well as experts in the social studies to get a holistic picture of how students learn by playing simulation games. At the same time, I scoured the academic writing on simulations over the past twenty years and developed a deep understanding of the field's current knowledge. I read about games that ranged in topic from activities on Wernher von Braun and the Space Race to mock-trials involving the Triangle Shirtwaist Fire of 1911. In collaboration with Dr. Girard, I made connections between the theoretical and substantive scholarship that informed our views of pedagogical relationships in the classroom.
My work this summer helped us draw conclusions about the current state of simulation games in the social studies classroom, offer suggestions to the educational community, and propel future research.

Trevor McLaughlin Personal Statement

As a participant in the MUSE program, I encountered both the challenges and rewards of doing educational research. Even though wading through the sea of educational scholarship was sometimes overwhelming, Dr. Girard helped me approach the research process in a manageable and cyclical manner. This meant that I frequently refocused my research by alternating between reading for the big-picture and the practical examples. Among the many things I learned from my mentor, I learned how to develop and redefine a theoretical framework in relation to my substantive research. The faculty-student MUSE community gave shape and direction to our project, especially from the many conversations we had about our work over lunch and other activities. By collaborating with Dr. Girard on this project, I developed the skills and methods employed by educational researchers; yet, these lessons will serve me well in my role as a middle or high school social studies teacher. My experience in the MUSE program instilled upon me the importance and ambition of becoming a teacher-scholar when I graduate from TCNJ next year.

Increasing Teacher Competence through Confidence: Understanding Social Justice in the Elementary Classroom
Mariah Y. Alston, Urban Education
Faculty Mentor(s): Dr. Tabitha Dell'Angelo & Dr. Louise Ammentorp

MUSE 2011 Project

This summer, I have worked on research about social justice education in elementary school classrooms with Drs. Dell'Angelo & Ammentorp. Prior to this summer, data was collected with sophomore and senior student teachers from TCNJ. The students explored the ways in which social justice is incorporated in their cooperating classrooms. The survey asked them to observe any lesson and then guided them through a list of "yes or no" questions that defined social justice education, as well as open- ended questions to share comments about their observations.

First, I conducted a literature review on social justice education. I found that social justice is described as best practice for education, yet it is still not being utilized to the extent desired. After much research, Dr. Ammentorp and I focused on the qualitative aspect of the survey. We coded our findings and observed patterns in the answers that linked to the literature. Next, I worked with Dr. Dell' Angelo on the quantitative aspect of the survey. We used SPSS statistics software to determine patterns and significant results in the answers.

Consistent with the literature, our results point to a lack of social justice infused education in the schools where

our data was collected. The quantitative results shows us what specific parts of social justice education are and are not being utilized while our qualitative analysis gave us insight into pre-service teachers' feelings and reactions to their classroom experience. Many of the student's responses reflected a tone of defensiveness as to why social justice was not seen in their particular classrooms. We feel this dispositional stance may lead to lack of progression and possibly negatively affect students' effectiveness as teachers in the future.

Mariah Alston Personal Statement

The MUSE program has been a great experience where I have learned a lot. Not only did I put all of my energy and focus for two months into a subject that I am passionate about, but I also gained useful skills and experience throughout the process. Through this project, I learned research skills and methods, how to use the SPSS statistics software, and developed ways to analyze and think about results. I gained insight and knowledge in the field I am interested in pursuing a career in, learned more critical ways to make my own conclusions and decisions about the results at hand, and the project has given me great experience that will be useful in my future. Also, this experience makes me even more passionate about my goal to open a charter school, and to make a positive change in the education system and the lives of students through social justice education.

The Scope of Co-teaching: Analyzing Data from the Co-teaching Experiences Survey

Rosie Rarich, Special Education and English
Faculty Mentor: Dr. Nadya Pancsofar, Assistant Professor, Special Education, Language and Literacy

MUSE 2011 Project

This summer, Dr. Nadya Pancsofar (professor in the department of Special Education) and her junior collaborator Rosie Rarich (SPED and English double major) continued a project that began in 2010. Dr. Pancsofar and Dr. Jerry Petroff (also department of Special Education) collected data from over one hundred educators in six school districts around New Jersey to research the current statuses of co-teaching models. They designed and administered a multipart quantitative online survey to gather information regarding teachers' attitudes and experiences towards co-teaching.

The survey included questions about pre-service and in-service training, teachers' attitudes about participating in co-teaching, and educators' confidence in performing various teacher responsibilities. The survey was primarily multiple choice but was also composed of an open ended section. The survey was distributed to new teachers as well as experienced once, co-teachers and non co-teachers, Special Educators and General Education teachers. To begin to understand this data, we examined correlations between the amount of in-service and/or pre-service training that teachers had in relation to their confidence in that same area. We will continue to work with this data by creating subscales to recognize the groups of teachers that had similar experiences.

Rosie Rarich Personal Statement

This summer I was fortunate to be exposed to the research side of the field of Education, while working with Dr. Nadya Pancsofar on a survey about co-teaching experiences. I was fascinated by the trends and connections we found as well as the extensiveness of statistics that was gathered. I transcribed interviews, created a codebook of variables, and became cognizant of the computer program SAS and how to understand the statistics. Before delving into the data, I had to educate myself on the background of co-teaching in order to become familiar with the terminology and methods. Being that there is little awareness of co-teaching models, studies like this one are imperative steps to making co-teaching a more widespread practice. I am deeply grateful that Dr. Pancsofar asked me to join her in this project although I was completely new to statistics and working with quantitative data.

Watershed Moments in the Autobiographies of Deaf Adults: A Pilot Study

Dana Morton, Psychology
Faculty Mentor: Dr. Jean Slobodzian, Department of Special Education, Language, and Literacy

MUSE 2011 Project

This study employs qualitative research methodology to examine the autobiographies of deaf adults. The goal o this research project is to examine first-person reports told by deaf people, locating and classifying descriptions of iden tity and sense of place within the context of American society. Narrative analysis is used to organize selected life exper

ences. Watershed moments, which are the pivotal instances of declared self and cultural identification, are revealed during the analysis phase. The deaf identity is unique in that all deaf people ultimately define themselves in terms of either belonging primarily to the Deaf or hearing culture. Between three to five such watershed moments occurred in each of the four life stories examined. The coded data further demonstrates that, across the board, the two issues of communication and attitudes towards deafness critically impact identity development on both the group and individual levels. These two themes are used to discern why these individuals have classified themselves as either culturally Deaf or culturally hearing. Additionally, the researchers consider James Marcia's four identity statuses in chronicling significant life moments. As this is a pilot study, analyses of further autobiographical texts will be needed to garner a greater understanding of whether or not these themes are reinforced by the experiences of the diverse deaf population.

Dana Morton Personal Statement

The Mentored Undergraduate Summer Experience has provided me with an amazing opportunity to further develop my research and analytical skills. As a psychology major, I had not previously been exposed to qualitative research. Throughout this process I have become familiar with narrative analysis and coding data, very useful tools for my anticipated graduate career. I have greatly enjoyed working with Dr. Slobodzian for a variety of reasons. Her expertise in qualitative research has been extremely useful in acclimating me to this new methodology, and she has challenged me to become a more sensitive researcher. At the same time, she views the project as a co-collaboration and our partnership is one of mutual respect. This is a deviation from the traditional faculty-student mentality experienced in classroom settings. The emphasis on the mentor-mentee relationship has allowed me to push my researching skills to exciting new limits. Additionally, this project has enabled me to pursue my two academic passions, psychology and deaf studies, in conjunction with one another. Only through MUSE was I able to explore the intersection of these fields.

New Literacy Writing: Captioning Digital Video

Katie O'Dell, Special Education, Language & Literacy
Faculty Mentor: Dr. Barbara Strassman

MUSE 2011 Project

In response to the complexity of twenty-first century technology, educators are faced with the growing need to equip students with the ability to navigate, create and understand texts across a wide variety of mediums. The goal of this study was to situate writing instruction for deaf students within the realm of these new literacies by using captioning, a genre already familiar and relevant to deaf individuals, as a writing platform. A sample of 64 deaf middle school students completed a writing to learn activity in which responses to content area writing prompts were revised and edited with the help of software that allowed students to display their texts as open captioning to digital images. Quantitative analyses showed significant increases in content vocabulary used, text length and inclusion of main ideas and details. These findings suggest that the images acted as a procedural facilitator, triggering deaf students' recall in each of these areas, while qualitative interviews revealed student's enthusiasm for the technology and method of writing.

Katie O'Dell Personal Statement

My participation in the MUSE program has given me the opportunity to explore my chosen discipline in greater depth than I had previously experienced. Working with my faculty mentor as we analyzed data and wrote our manuscript allowed me to expand my body of knowledge, think critically about issues relating to deaf education, and improve my academic writing skills. Prior to participating in MUSE, I had never considered the possibility of conducting research or pursuing a doctoral degree; as a result of this experience, however, I have developed an interest in research which I hope to pursue in my professional career. In addition to the professional and academic benefits of the program, I have had the privilege of working and socializing with other members of the MUSE community, from whom I have learned a great deal about their respective disciplines.

The Effect of Disturbed Blood Flow Patterns on Thrombosis

Melissa Calt & Richa Lamba, Biomedical Engineering
Faculty Mentor: Constance Hall

MUSE 2011 Project

Hemostasis is the normal cessation of bleeding caused by blood vessel injury and involves the activation of platelets and coagulation. Coagulation is a series of enzymatic reactions initiated by the exposure of tissue factor (TF) in the blood vessel wall followed by a propagation phase that produces thrombin from prothrombin (prothrombinase activity). A recently discovered contributor to coagulation are cell-derived vesicles (.1 to 1 micron) termed "microparticles" (MPs) that circulate in the blood in small numbers under normal conditions, but are present in increasing amounts in certain disease states. Mononcyte-derived microparticles (MMPs) express TF and support the propagation phase of coagulation and may increase clot formation. In addition, flow conditions in the vasculature can influence clot formation. Fluid flow produces forces that affect the generation of microparticles from cells and influence the incorporation of microparticles into clots. The effect of fluid forces on MPs generation in whole blood was examined by isolating microparticles from human blood previously exposed to high forces in three different rotary pumps and testing for TF and prothrombinase activity. The microparticles showed significant prothrombinase activity but little TF activity, implying that these MPs may contribute to the propagation of coagulation, but not to the initiation of coagulation. In a second study, a human monocytic cell line (THP-1) is being used as a model cell for human blood monocytes. The cells will be exposed to lipolysaccharide (LPS) and a calcium ionophore to stimulate the synthesis and expression of tissue factor and extensive production of microparticles. These mircroparticles will be tested for prothrombinase and TF activity to indicate if they can promote clotting. Future experimentation will involve looking at the microparticles under various flow conditions produced in specially designed chambers to determine the effects of specific flow conditions on the localization and incorporation of microparticles in clots.

Richa Lamba Personal Statement

Participating in MUSE 2011 gave me the opportunity to collaborate with Dr. Connie Hall and fellow student, Melissa Calt. Working in Dr. Hall's lab provided me exposure to research in the field of biomedical engineering. It helped me build upon my previous research experience and reinforced essential lab skills while also adding to my knowledge of working with cell cultures by exposing me to new lab techniques. Since Dr. Hall's lab is in the early phases of being established and is one of the first labs at TCNJ to utilize human source materials, I also gained insight into what it takes to start up a research laboratory. Through this experience I learned how to work in a team and take instruction from a mentor while also being able to work independently when necessary. I am thankful to the MUSE program and my mentor, Dr. Hall, for giving me this opportunity through which I have acquired valuable research, academic and personal skills that will be beneficial to me throughout the rest of my academic career and beyond.

Melissa Calt Personal Statement

MUSE presented me with the opportunity to collaborate with fellow student, Richa Lamba, and with mentor, Dr. Hall to investigate the effects of blood flow on clot formation and to characterize Monocyte-derived microparticles, which are tiny, cell-derived vesicular structures (.1-1 microns) believed to be involved in blood clotting. The lab work included running specific functional assays, growing cells, and stimulating the cells to shed microparticles. I learned valuable lab techniques, and quickly became comfortable with solving lab-based problems. In conjunction with the experimental research, I used a modeling program called Computational Fluid Dynamics to verify the lab results. MUSE has expanded my knowledge to new areas outside of the classroom, raised my confidence as an individual thinker and problem solver, and helped me to form stronger relationships with fellow student, Richa Lamba, and mentor, Dr.Hall. I am very grateful to Dr. Hall, with her endless patience and intelligence, for working alongside me through this unique and mind-stimulating experience.

Solar Farm Implementation in Hunterdon County, New Jersey

Heather A. Petersen, Technological Studies
Faculty Advisor: Michael Shenoda, P.E., Ph.D., Civil Engineering

2011 MUSE Project

This Summer I researched the implementation of solar farms in Hunterdon County, New Jersey. This project came to Dr. Shenoda's attention last winter, due to the rising concern of local citizens about the possibility of these solar farms being implemented. They were unsure of the economic, environmental, and social impacts of solar farms on the area. We decided to perform this research project in conjunction with the Sustainability Australia study abroad program that Dr. Shenoda led this summer, where I learned about sustainability, how it is being practiced in Australia, and how that compared to initiatives taking place in NJ. I worked on a project proposal for a potential solar installation on the TCNJ campus, and gained knowledge about the economic incentives for utilizing solar energy in NJ.

Recently, Hunterdon County established an ordinance outlining zoning regulations for land to be used as "Solar Farms". In the aftermath of this, there are already two solar farms that are in the planning process in East Amwell Township: a 16-acre property, and a 90-acre one. Since the smaller farm had already started the process, I attended town meetings and reviewed the site plans for that solar farm as a case study. I interviewed the engineer who was working on this solar farm, received information from the New Jersey Clean Energy Company about the incentives offered, as well as interviewed the public to learn what their opinions and concerns were. I then was able to create a scoring system that could be used to determine the feasibility of future solar farm implementations in Hunterdon County, based on: basic characteristics of potential solar farm properties, the ordinance, solar energy equipment, and economics, allowing landowners to decide whether to continue the process of solar farm implementation before undertaking further investment.

Heather Petersen Personal Statement

This summer, I had a really great experience working with Dr. Shenoda. Through the MUSE Program, I had my first professional experience in the field of engineering. I was able to interview and work with real engineers, and to learn a lot about green energy and all of the regulations and processes that need to be followed in order to plan for a new project. I am really excited about my project, not just because it provided me with a great learning experience, but because I also think it will help to educate the people of Hunterdon County to better understand this relatively new technology, and have a well educated opinion on it. I think this project will look great on my resume, and will help me to be a better Technology/Pre-Engineering Teacher when I graduate.

Modeling and Simulation of Smart Grids-Power Systems with Automation, Distributed Generation, Renewable Energy, and Energy Storage Capability

Audrey Baricko, Electrical Engineering
Vishal Jani, Biomedical Engineering
Faculty Mentor: Dr. Anthony Deese

MUSE 2011 Project

State estimation in power systems, or the process of assigning a value to an unknown system state variable based on the measurements from the system, is currently centralized. Some of the many disadvantages associated with a centralized state estimator are 1) the long time needed to perform the estimation 2) the complexity and calculations increase with size, 3) security for a single estimator can be troublesome, and 4) the centralized solution grows less viable as power systems move towards distributive generation. In answer to these problems, we proposed a distributed dc state estimation on a microcontroller as a solution.

We began our research focused on the theoretical basis and implementation of state estimation within electric power and energy systems, with emphasis on the importance of such analyses to increased security, reliability, efficiency, and renewability. Prior to beginning the MUSE program, we had 1) reviewed the mathematics and systems theory behind state estimation, 2) applied this theory to a basic dc power system (one for which only voltage angle is assumed to vary), and 3) acquired preliminary results via implementation in Mathworks Matlab.

Since the program started, we have implemented the same dc power system on an mbed microcontroller, writing the code to minimize program memory used. A more realistic and complex ac state estimator has also been created

for Matlab. We used all three programs to measure speed and accuracy. The objective was to prove that the dc state estimator on the cheaper microcontroller was faster than and as accurate as the dc state estimator in Matlab, and that the dc state estimators both produced estimations that were reasonably accurate when compared with the ac state estimator.

Audrey Baricko Personal Statement

My experience this summer as part of the MUSE program has been academically stimulating and extremely rewarding. This project gave me the chance to pursue an area of interest in my field. I was also able to utilize and polish programming skills that I will likely need after my undergraduate career. However, I feel the most important part of the MUSE program, and the part that I benefited the most from, is the faculty mentorship. With Dr. Deese as a mentor, I was given the opportunity to grow as a researcher, and an engineer, and his guidance has helped me realize and given me more confidence to pursue my post-undergraduate goals.

Vishal Jani Personal Statement

The M.U.S.E. program and specifically the state estimation project, has given me a glimpse of field of electrical and power engineering. This research is unique and challenging at the same time. It required that I learn and reacquaint myself with certain programming languages, which I barely remembered. I also had the creative freedom to write the program to my liking, as long as it met the criteria. Participating in the M.U.S.E. program, gave me an opportunity to work on a graduate level topic during my under-graduate career. Since the topic was completely new to me, the implementation and testing involved a lot of troubleshooting and reassessing. I will cherish this summer, because although the subject matter was specific, the crucial skills I developed as a result of the M.U.S.E. program will help me in my future post-graduate endeavors.

Design criteria for preventing friction-induced squeak of Ceramic-on-Ceramic Hip Implants

Mark Sidebottom, Mechanical Engineering
Faculty Mentor: Dr. Manish Paliwal

MUSE 2011 Project

The goal of this study to determine possible factors that cause squeaking hips. The evaluation of the phenomena of ceramic on ceramic hip implants involved three analyses: Acoustic, Modal (Numerical), and Mathematical.

Acoustic analysis involved extracting and analyzing audio data from the videos provided by the patients with squeaking ceramic hips. These files were transformed from the time to frequency domain to identify the squeal frequencies (1500-3000 Hz). These results concurred well with the literature, and are serving as a guideline to validate the Numerical and Mathematical models.

Modeling involved the 3-D rendering of the hip implant (ceramic femoral head, ceramic cup liner, and the metallic cup shell) using computer-aided-design software (Pro/Engineer, PTC, MA). The femoral head forms a couple with the liner which sits in the shell. The shell is inserted into the patient's hip socket.

Modal analysis involved the importing of the model into commercial finite element analysis software (Ansys, Ansys Inc., PA). These parts were given physical properties (material, density) and their modal frequencies were evaluated individually to investigate their contribution to squeal. Results of the analysis showed the metallic shell would audibly resonate at 4600 Hz, which matches results found in literature.

Mathematical analysis involved the investigation of the role of the frictional stick-slip phenomenon of the metal shell and ceramic liner on squeal, a 2-DOF mathematical model was created and analyzed using Matlab/Simulink commercial software. Mass, stiffness properties, and coefficient of friction of the components were incorporated to study the limit cycle (displacement-velocity plot), which is an indicator of the stability of the system. Parametric studies are being conducted to better understand the squeal phenomenon, and the results are being compared with numerical analysis. Further research will involve conducting the numerical parametric analysis and increasing the degrees-of-freedom of the mathematical model by adding additional components.

Mark Sidebottom Personal Statement

The Mentored Undergraduate Student Experience has helped me develop and understand the processes and procedure associated with a study in the field of engineering. My professor, Dr. Paliwal, has been a great collaborator who has guided my research but considers my ideas and opinions about our study. I have learned the importance of

understanding one's area of research before one begins a study. My study also required me to contact and communicate with patients and professionals to acquire the information I needed to perform the analyses correctly. During my research, I have needed help from a variety of resources including a Music professor who helped me with audio analysis. I now appreciate how two fields widely considered to be very different can intertwine and be useful to one another. This project helped me understand how to effectively evaluate a complex problem in a scientific and scholarly way.

Electrospun Nanofibers of the Biopolymer Alginate for Removal of Lead Ions from Water

(Funded by the New Jersey Space Grant Consortium and Academic Affairs of The College of New Jersey through the Mentored Undergraduate Summer Experience)

Melissa Bradley, Technological Studies
Faculty Mentor: Dr. Matthew Cathell

MUSE 2011 Project

The goal of this project was to create biopolymer fiber mats that successfully filter toxic metals out of water. These mats were made from the biopolymer alginate, a water-soluble polymer known for its ability to bind to heavy metals. The production of these mats was achieved by electrospinning, a process in which micro- or nano-scale fibers are fabricated from polymer solutions in a high voltage electric field.

The initial challenge was to research and decide on what carrier polymer to use in the alginate solution. It was determined that the biocompatible polymer polyethylene oxide (PEO) had characteristics that made it an ideal candidate for use in electrospinning. A surfactant, Triton X-100, was also used to increase the smoothness and uniformity of the fibers. Micro- and nano-scale fibers were successfully electrospun and imaged using scanning electron microscopy (SEM).

Once an ideal solution was designed, we began investigating the most effective methods to crosslink the fibers. Crosslinking causes bonds to form within the polymer chains, strengthening the fibers and making them suitable for water filtration. For this process, we used calcium ions to create initial electrostatic crosslinks, followed by epichlorohydrin treatment to form stable covalent crosslinks.

The final step in our research was to determine metal sorption capabilities of the fibers. Through colorimetric testing with a UV-visible spectrophotometer, it was determined that the fibers successfully sequestered significant amounts of lead (II) ions from aqueous solutions.

This project lends itself to many future research opportunities. Exploring additional crosslinking methods and testing metal binding with other heavy metals (i.e. chromium, mercury) are two possibilities. In addition, this project has valuable applications beyond use of the fiber mats in water filtration. It is an ideal project to explore with students in a STEM classroom, as it involves the application of scientific and mathematic principles to applied technology and engineering.

Melissa Bradley Personal Statement

The MUSE program has taught me a great deal about collaborative research. In the past two months, I have developed valuable research skills and laboratory techniques that I will take with me as I continue my education. This experience has also challenged me to think outside the box and problem solve. Much of our project was chemistry-based, so I was constantly challenged with new science concepts that I was otherwise unfamiliar with. Being fully immersed in a research project was an experience I fully enjoyed, and participating in the MUSE program has given me the confidence to pursue graduate research in the future. I also enjoyed the opportunity to meet other MUSE students and learn about academics disciplines and research projects vastly different from my own.

Acute Metabolic Response and Resistance Exercise Performance Using Different Rest Interval Lengths: The Influence of Maximal Aerobic Capacity

Joseph Rosenberg, Health and Exercise Science
Faculty Mentor: Dr. Nicholas Ratamess

MUSE 2011 Project

The purpose of the MUSE 2011 study was to examine the relationship between maximal aerobic capacity (VO_2 max) and acute resistance exercise performance using different rest interval (RI) lengths. Eleven resistance-trained men (age = 21.2 ± 0.8 years; height = 178.1 ± 5.4 cm; body mass = 88.3 ± 19.9 kg; VO_2 max = 44.0 ± 7.1 ml/kg/min) were familiarized to the testing procedures, tested for VO_2 max, and maximal strength (one repetition-maximum [1RM]) of the barbell squat and bench press exercises. Subjects performed three resistance exercise protocols (separated by 2-3 days of rest) using different RI lengths assigned in random order. Each protocol consisted of performing 5 sets of up to 10 repetitions of the squat and bench press (in random order) using 75% of the subjects' 1RM using RI lengths of 1, 2, or 3 min. Oxygen consumption was measured every breath and total number of repetitions successfully performed were recorded. One-way analysis of variance was used to analyze the metabolic and performance data. Pearson-product moment correlations were calculated investigating the relationship between VO_2 max and acute resistance exercise performance. The preliminary findings indicated that VO_2 max was significantly related to squat and total repetition performance (the sum of squat and bench press repetitions combined) when 1-min RI was used and to total repetition performance when 2-min RI was used (r = 0.61 to 0.63). No such relationships were observed when 3-min RI was used. In addition, RI length significantly affected the acute performance and metabolic responses such that 1-min RI yielded the lowest number of total repetitions but the highest metabolic response and 3-min RI yielded the highest number of repetitions but the lowest metabolic response. These preliminary findings indicate VO_2 max is related to acute lower-body resistance exercise performance when short RI is used.

Joseph Rosenberg Personal Statement

Through the opportunities provided to me within the Mentored Undergraduate Summer Experience (MUSE), I believe my understanding and appreciation for research and my laboratory and interpersonal skills have increased tremendously. I was fortunate to have used the equipment in the Human Performance Laboratory previously through class laboratory sessions and by assisting professors in prior research studies. However, the level of involvement, collaboration, and functional independence bestowed upon me throughout the MUSE program has substantially increased my practical knowledge and scientific foundations needed for graduate school. In addition, I was presented with the task of problem solving under the guidance of my mentor. This not only improved my ability to deal with real-life scientific issues, but also provided me with valuable insight regarding the challenges I may face in graduate school. Overall, I truly feel fortunate to have been given the opportunity to work so closely with respected faculty, particularly in the field in which I plan on pursuing in graduate school.

Conservation Genetics of the Threatened Yellow Lampmussel, *Lampsilis cariosa*

(Funded by US Fish and Wildlife State Wildlife Grant through Pennsylvania Fish and Boat Commision)

Victoria Hotz, Brianna Reilly, & Tyler Vitone
Faculty Mentor: Curt Elderkin

MUSE 2011 Project

Unionidae is a family of sessile freshwater mussels that rely heavily on a host fish for dispersal of parasitic larvae known as glochidia. Because of this reliance, barriers to fish and river flow become barriers to gene flow, and can easily divide and isolate populations of freshwater mussels. In the United States and Canada, freshwater mussels are the most at risk group for extinction, with 70% of the species at risk of extinction or have already gone extinct. Threatened and endangered species exist in small isolated populations that and are prone to the loss of genetic diversity. These small populations may be more at risk of extinction if they do not maintain high genetic diversity, a necessary component for adaptation to changing environments. Therefore, genetic diversity is a recognized level of conservation, along with biological and ecosystem diversity. Population genetics works to determine the genetic diversity within and among distinct populations based on geographic location. The threatened Yellow Lampmussel , *Lampsilis cariosa,* is found in the rivers of the Atlantic Slope of North America. *L. cariosa* is believed to be extirpated from many parts of its Atlantic slope habitats, and where it does exist it is often listed as imperiled or threatened. However, *L. cariosa,* still exist in large populations in the tributaries, and the main branch, of the Susquehanna River in Pennsylvania. The goal of our study was to characterize the genetic diversity between multiple populations and use these data to determine whether populations were genetically isolated. We analyzed the genetic structure of 14 Susquehanna populations using the mitochondrial gene cytochrome oxidase I (COI) (N= 110). In addition we are currently in the process of analyzing seven microsatellite loci.

Victoria Hotz Personal Statement

The MUSE program this summer has been a wonderful experience for me. I had the opportunity to collaborate closely with two other biology majors and my faculty-mentor, Dr. Elderkin. The research project that we worked on this summer was a wonderful opportunity to learn about population genetics and threatened species firsthand. This lab experience provided me with valuable insight into what scientific research is like on a day-to-day basis and taught me how to troubleshoot and solve scientific problems. Not only did I have the chance to work in the lab, but I also had the chance to do some field work. I realized how closely connected these two different environments—the field and the lab—are, as well as how much fun snorkeling for mussels is. I have come to appreciate unionids in a way that I most definitely would not, were it not for this summer program.

Brianna Reilly Personal Statement

The Mentored Undergraduate Summer Experience (MUSE) has given me an incredible opportunity that I don't believe I could have received at any other institution. Having already spent some time working in a research environment during the semester, this summer allowed me to experience another aspect of research in the field of biology. This experience has been invaluable to me, because it has allowed me to explore multiple options for my future career, and has helped to shape my future goals by giving me a broader spectrum of experiences. Aside from this, MUSE has taught me a lot about how to be a better scientist, and how much effort is dedicated to a project. I have learned how to work with others cooperatively on a project, and have become better at using resources that are offered to me. Overall, this experience has been a fantastic way to learn more about myself, to sharpen my skills, and to evaluate my future goals.

Tyler Vitone Personal Statement

Participating in MUSE has truly been an interesting and intellectually stimulating opportunity. Through close collaboration with the professor and peers on our project, I obtained skills and knowledge that will allow me to excel in my education and future. I became very comfortable with techniques utilized in our laboratory and fieldwork, as well as with instrumentation within the lab and the department. Many of these skills will be applicable in projects and experiences in the future. Besides technical skills, I have learned a lot more about the research process and field of conservation genetics. By becoming immersed in our project, my scientific curiosity has greatly increased. Also, group discussions of literature with faculty and peers were truly interesting and added to my understanding of the subject matter. Overall, MUSE has been an invaluable experience for the skills, knowledge, and relationships I obtained.

Serotonin, SIDS, and the maturation of cardiorespiratory control: Effects of prenatal nicotine exposure on postnatal survival in the serotonin-deficient *Pet-1* knockout mouse

(funded by Bristol-Myers Squibb)

Laurie Delatour, Biology
Melissa Toledo, Biology
Faculty Mentor: Dr. Jeffery Erickson

MUSE 2011 Project

Sudden Infant Death Syndrome (SIDS) is a leading cause of postnatal infant mortality in developed countries. Although the cause is not known, SIDS has been linked to a brainstem serotonin (5HT) deficiency in humans. This has led to the "5HT triple risk" hypothesis which states that death due to SIDS may results when 1) an infant with an underlying vulnerability (e.g. 5HT deficit) is exposed to 2) an environmental stressor during 3) a critical period of early development. Here we used the 5-HT-deficient neonatal *Pet-1* knockout mouse as an experimental model for SIDS since these mice are known to suffer several SIDS-like respiratory deficits. We hypothesized that prenatal exposure to nicotine (a major component of cigarette smoke and suspected risk factor for SIDS) would exacerbate the already abnormal breathing behavior in the neonatal *Pet-1* knockouts. We used autoresuscitation (a spontaneous recovery of breathing following apnea (cessation of breathing)) as an output measure since a failure to autoresuscitate has been proposed as the precipitating cause of death in SIDS. In addition, we attempted to incorporate heart rate measurements into our experimental protocol since changes in heart rate are an integral part of the autoresuscitation response and an inability to recover a stable heart rate following apnea could contribute to SIDS. Contrary to our initial hypothesis, we found that prenatal exposure to nicotine actually improved the abnormal respiratory phenotype of *Pet-1* knockout neonates, relative to normal (wild-type) littermates. However, despite this improvement in breathing behavior, nicotine-exposed knockouts experienced a higher post-autoresuscitation mortality rate than wild type animals (regardless of treatment) and saline-treated knockouts. We suspect that the increased mortality may be due to an inability to recover heart rate after resuscitation. Since we were able to successfully measure breathing and heart rate simultaneously, future studies may address this issue.

Laurie Delatour Personal Statement

Through the MUSE program, I had the opportunity to continue my research project in Dr. Erickson's lab using *Pet-1* knockout mice as an animal model for SIDS. This experience has afforded me the unique experience to assist in the development of new techniques that will further the research investigations in our lab. I have also enhanced my own ability to draw information from various sources, analyze data, and think critically when faced with problems that arise during the course of research. The opportunity to fully immerse myself in a research project has allowed me to gain a better understanding of and appreciation for what a career in research will entail. This experience has been very rewarding and I greatly appreciate the mentorship of Dr. Erickson and the close collaboration with my lab colleague, Melissa Toledo. The skills and knowledge that I have acquired over the summer will serve as a firm foundation as I continue with independent research next semester.

Melissa Toledo Personal Statement

To work in a research lab a scientist must possess qualities that cannot be gained by reading a textbook, but instead are learned through experience. These qualities are, but not limited to, cooperation, patience, and the ability to think critically. In the MUSE Program, I practiced these qualities repeatedly while collaborating with Dr. Erickson and Laurie Delatour, a senior Biology major, on a research project. The project entailed the cooperation of three distinct individuals, thus the ability to coincide was key to a successful day. Acting as a second party was our model organism, the mouse; hence patience was essential because these organisms have minds of their own and did not always coincide with our objectives. The most important quality I practiced this summer was the ability to think outside the box. As a discipline that involves critical thinking, research is a process that requires a constant flow of questions and answers. In conclusion, MUSE enabled me to practice such qualities, thereby reinforcing my aspirations to complete a PhD program in the biological sciences.

The Role of the Npl3 Protein in the Coordination of Gene Expression

Jenna Lobby, Biology
Aron Moazamian, Biology
Faculty Mentor: Dr. Tracy L. Kress

MUSE 2011 Project

The goal of this project is to investigate the role of the protein, Npl3, in the coordination of two key steps in gene expression: transcription and RNA modification. In the process of transcription, a complementary strand of RNA is created from a DNA template. This RNA strand is then translated into a protein. However, before translation can take place, the newly formed RNA must undergo several modifications. One such modification, splicing (the removal of non-protein-coding sequences from the RNA), is known to initiate before the completion of transcription. Both transcription and splicing require proper recruitment of several proteins (known as transcription factors and splicing factors) in order to initiate, propagate, and terminate. Previous data has demonstrated that co-transcriptional binding of splicing factors occurs, however, it is still unclear as to how such events are carried out to ensure efficient and accurate gene expression.

We are studying how Npl3 coordinates transcription and splicing. Npl3 is a protein found in our model organism, budding yeast (*Saccharomyces cerevisiae*) that is known to promote splicing by facilitating recruitment of splicing factors and can interact with transcription factors. Npl3 is composed of 4 protein domains. To better understand how Npl3 interacts with the splicing and transcription factors we are examining which of the protein domains are important for contacting the splicing factors and transcription factors. We have successfully created new proteins that contain one or more of Npl3's domains in addition to a FLAG tag (used to monitor expression of the domains in the yeast). We have demonstrated that the full length FLAG-tagged Npl3 protein can restore growth to a yeast strain that is missing an NPL3 gene. We are currently inserting the pieces of Npl3 into yeast so that various assays may be performed to test for which domains are required for contacting the splicing and transcription factors.

Jenna Lobby Personal Statement

Over the past eight weeks I have acquired skills that will surely prove to be valuable in my future endeavors. During the many hours spent in lab, I have learned various procedures, troubleshooting, and decision-making strategies. This summer has introduced me to aspects of research that I had never before encountered. Outside of the lab, I have truly enjoyed working with Dr. Kress and Aron. Additionally, meeting and conversing with other faculty provided me with great insight and advice regarding future career choices. Furthermore, I enjoyed meeting people from various departments and being introduced to their research projects. Fellowship is an important part of academia and I am grateful for having been able to take advantage of all the opportunities MUSE offered. Overall, MUSE was an awesome experience that I would encourage any student to take part in.

Identifying the Role of the Snu66 Protein in Coordinating Gene Expression

Aron Moazamian, Biology
Jenna Lobby, Biology
Faculty Mentor: Dr. Tracy Kress

MUSE 2011 Project

The fundamental process of transferring genetic information from cell to cell follows the same basic pattern among living organisms; information flows from DNA to RNA to protein in which it becomes expressed. The process of gene expression requires several highly coordinated steps and the proper regulation of gene expression is a fundamental preventative of numerous types of genetic diseases, including cancer. The goal of this project is to elucidate what interactions may be taking place between the multiple steps in the coordination of gene expression utilizing the model organism *Saccharomyces cerevisiae*, a species of yeast. Our lab will be studying the interactions of specific proteins involved in such coordination. Specifically, we are investigating the Snu66 protein, a protein which is involved with regulating the expression of a subset of genes known as ribosomal protein genes. Snu66 regulates these genes through its modulation of a step known as RNA splicing in which non-protein coding regions of RNA are removed. Interestingly, the expression of the ribosomal proteins genes is also regulated at a different point in the flow of information known as transcription (RNA synthesis) by specific proteins. We hypothesize that Snu66 might interact with these specific transcription factors to coordinate the expression of the ribosomal protein genes. To identify such interactions we are utilizing a ge-

netic interaction study. Our preliminary results suggest that Snu66 does in fact coordinate with a regulatory transcription protein known as Eaf3 that is known to affect ribosomal protein gene expression. Notably, our preliminary results also suggest that Snu66 does not interact with another regulatory DNA transcription protein known as Set2 that does not specifically regulate ribosomal protein genes. These initially observed interactions are indicative of a potential co-temporal regulation of gene expression between the splicing protein Snu66 and other transcriptionally related proteins. Our future directions will expand the study to determine the interactions between multiple different RNA synthesis and DNA transcription regulatory proteins.

Aron Moazamian Personal Statement

MUSE has been one of the most personally rewarding experiences of my life, in a number of different ways. First and foremost, I thoroughly enjoyed strengthening the relationships I share with my own mentor, Dr. Kress, and the other professors in the Biology Department. We had a series of meetings during the program, and a cookout at one of the professor's houses, during which the professors shared their own personal stories of career and graduate decisions as well as invaluable insight on how to approach the seemingly endless opportunities that are available to us upon graduation from TCNJ. MUSE also enabled me to thoroughly experience what life as a biological research scientist would be like; how it feels to work day in and out in a research lab, when experiments fail and succeed. These are experiences that can never be fully understood unless they are actually undergone, and I am so grateful for participating. Lastly, but certainly not least, MUSE promoted an environment in which I could further enhance the skills necessary to work as a team. Working with my lab partner, as well as interacting with the other Biology MUSE participants was exceptionally rewarding.

Genetic Analysis of GLD- 1 Modulators During Germ Line Development

Laura Pierce, Biology
Faculty Mentor: Dr. Sudhir Nayak

MUSE 2011 Project

GLD-1 is a protein expressed in the germ line of *Caenorhabditis elegans*, a transparent nematode approximately one mm in length. GLD-1, an RNA binding protein, acts as a translational repressor of over 100 mRNA transcripts. This protein allows for oocyte development and male sex determination. GLD-1 is first expressed about five cell diameters from the Distal Tip Cell (DTC), a single cell that forms all gametes. The onset of GLD-1 protein expression coincides with the onset of pachytene. GLD-1 levels begin to decrease just past the germ line loop coinciding with diakinesis and diplotene. The goal of this project was to analyze genes responsible for the regulation of GLD-1 expression. In order to do this we used a forward genetic screen. A forward genetic screen requires the disruption of normal GLD-1 expression, a screen to look for variable phenotypes, and a mapping experiment to determine the gene controlling the underlying phenotype. Approximately 300 worms were subjected to ENU, a mutagenic agent that produces a variety of mutations in the genome. The worms were placed on plates and given time to lay eggs. These eggs were the first filial generation, or F_1s. The F_1s were screened about five days later for variation in phenotypic expression of GLD-1. Any worm that showed deviation from wild type expression was placed on a new plate to test mutation heritability. Eggs were collected from the F_1 generation and given time to reach adulthood. In total, 50,000 F_2s will be screened for phenotypic variation of GLD-1 expression. Any F_2 that improperly expresses GLD-1 will be placed on a new plate to see if the mutation is stably transmitted. The worms that do stably transmit mutations will then be out crossed for five generations to ensure that the phenotypes are caused by a single mutation. The single mutations will then be mapped to a location in the genome.

Laura Pierce Personal Statement

Coming into MUSE, I had the idea that I wanted to take a year off after college to work and apply to Medical School. I have always enjoyed doing research but I had never considered going to graduate school to earn a Ph.D. Having the opportunity to participate in this program has really opened my eyes to this possibility. It was a great experience to work closely with the TCNJ Biology faculty both on my individual project as well as on my career path. I was given the opportunity to hear about the journey each biology professor participating in MUSE had taken to get to where they are now. It was nice to get to know the professors on a more personal level, as well as benefit from the advice each had to offer. I was also fortunate to work with some of the brightest students in the TCNJ Biology program. Witnessing the

accomplishments my peers have achieved has pushed me to work harder to obtain my own success. I am grateful for all the opportunities MUSE has given me.

Identification of novel motifs in unaligned protein and nucleic acid sequences
Zachary Zappala, Biology
Faculty Mentor: Dr. Sudhir Nayak

MUSE 2011 Project

The goal of this project was to continue developing cross-platform software utility for the discovery and visualization of patterns in nucleic acid and amino acid sequences. Pattern discovery programs can be used to detect structural and functional motifs (e.g. binding sites) in biological sequences, and can also be used to detect homology and cluster related sequences. The algorithm used for recovering motifs is a modified version of the CONSENSUS algorithm (Hertz et al. 1999) with adjustments allowing it to run efficiently on personal computers. The original algorithm searches for patterns of size *K*; the new algorithm will discovery patterns of size *K* as well as larger patterns by detecting overlapping patterns (motifs are recovered as position-specific scoring matrices, or PSSMs). In addition to motif discovery, this software facilitates the viewing and analysis of pattern occurrences in biological sequences through a number of different graphical depictions. The program will highlight patterns specified as either PSSMs or networked regular expressions (i.e. regular expressions joined by flexible spacer ranges). Motifs derived from *C. elegans* heat shock genes, major sperm genes, and uncoordinated genes have so far demonstrated the differential value of this approach.

Zachary Zappala Personal Statement

The Mentored Undergraduate Summer Experience research program has been an invaluable experience that has allowed me to further develop my research and laboratory skills. Being able to spend so much time on my research project has been a wonderful way to really grasp what it means to do research; during an academic year there is simply not enough time available to really devote oneself. Doing research full time has allowed me to develop my critical reading skills, technical skills, and, most importantly, my communication skills. Ultimately, the MUSE program has helped solidify my desire to go to graduate school and has done a wonderful job preparing me for my future academic pursuits.

Regulation of gurken mRNA translation by cytoplasmic polyadenylation
Jason Wong, Biology
Julie Steinway, Biology
Faculty Mentor: Dr. Amanda Norvell

MUSE 2011 Project

The goal of our MUSE project is to study oogenesis in the model organism Drosophila melanogaster. Specifically, we are interested in the expression of a protein involved in correct embryonic development. The establishment of protein asymmetries is integral to coordinate cell orientation in nearly all cell types. In all eukaryotic cells, protein production involves nuclear DNA being transcribed into mRNA, which is then exported to the cytoplasm where it may be translated into proteins by ribosomes . In *Drosophila*, Gurken (Grk) is one such asymmetrically localized protein, and it is required for normal oogenesis and embryogenesis. The oocyte develops within a cluster of 15 support cells called nurse cells. *grk* mRNA is made in the nurse cells and is transported into the oocyte, where its localization at the dorsal anterior corner of the oocyte late in oocgenesis permits proper translation of Grk protein. In order to prevent inappropriate accumulation of Grk protein prior to the localization of its mRNA, the transcript is translationally repressed by an unknown mechanism. Modifications of RNA (post-transcriptional) may influence stability of the transcript and protein production. One specific RNA modification is the addition of a poly-adenosine (poly-A) tail at the end of the RNA molecule. The poly-A tail is essential for translation of mRNA into protein and when minimized or absent may impair protein production. To investigate whether regulated polyadenylation of *grk* mRNA is a mechanism to regulate its translation, we have analyzed *grk* RNA poly(A) tail length in a variety of mutants. Our data supports a model in which regulated polyadenylation provides spatial control for Grk translation during oogenesis.

Jason Wong Personal Statement

Participation in MUSE 2011 has left a strong impact on not only my research skills, but also in solidifying my career path to pursue the biological sciences. During the academic year, it is difficult to do research because of other obli-

gations, but doing research everyday during MUSE has taught me significantly more laboratory techniques and has trained me to think more like a scientist. Not only have I added to my toolbox of molecular biology techniques, but I also have learned that I am certain I want to go to graduate school to do research and obtain a doctorate in a field of biology. On top of learning new lab techniques and solidifying my future directions, MUSE has given me the opportunity to experience other types of research projects across the disciplines and has broadened my perspectives.

Julie Steinway Personal Statement

My experience in the summer 2011 MUSE program has been a collaborative effort alongside Jason Wong and under the direction of our mentor, Dr. Amanda Norvell. The focus of our research encompasses the study of the protein Gurken, which is involved in the generation of asymmetry during Drosophila oogenesis. Specifically, we are interested in investigating whether or not *grk* expression is regulated by a specific modification known as polyadenylation. While this experience has undoubtedly educated me on various lab techniques and challenged me to investigate the intricate web of molecules involved in regulating gene expression in the oocyte, it has also taught me the importance of trial and error and critical thinking. I look forward to continuing to develop my interest in research in the coming year. I feel fortunate to have worked alongside a peer and mentor whose enthusiasm and knowledge made for an enjoyable, fulfilling experience.

Investigation into Rapid Evolution of Threespine Stickleback Fish (*Gasterosteus aculeatus*) in Cheney Lake

Omi Singh, Biology
Faculty Mentor: Dr. Matthew Wund

MUSE 2011 Project

Rapid evolution of adaptive traits often occurs when members of a population encounter a new environment. Rapid divergence was studied in the model organism threespine stickleback (*Gasterosteus aculeatus*). Stickleback are an ideal model system for the study of evolution due to the presence of multiple isolated freshwater populations and the continued existence of the ancestral (marine) population. By comparing freshwater populations to marine populations, it is possible to determine the extent to which the freshwater population has evolved. Populations can evolve in response to habitat structure, diet, the presence of predators, and many other factors. Additionally, stickleback are capable of plastic responses to environmental variables, particularly shallow vs. deep water environments and foraging technique. This means that stickleback that are genetically the same may have different phenotypes in different environments.

Members of a threespine stickleback population native to a marine environment were used to repopulate a cleared freshwater Alaskan lake. This population progressed for one generation in the new environment. Offspring of the lake population (Cheney Lake) and the source population (Rabbit Slough) were raised under controlled laboratory conditions. Fish from both populations were reared in benthic and limnetic environments and fed corresponding diets. Morphology of the fish was measured and compared in order to evaluate effects of environmental induction and genetic evolution. The results indicate the influence of phenotypic plasticity on morphology, and provide limited evidence for rapid evolution. The comparison of the results of this study to field findings will help us understand the contributions of phenotypic plasticity to evolution, and to further elucidate the early evolutionary dynamics of a population as it adapts to a novel environment.

Omi Singh Personal Statement

Participation in the Mentored Undergraduate Summer Experience (MUSE) program provided me the opportunity to immerse myself in the continuation and expansion of an existing project. This research experience allowed me to refine my technique and efficiency in the laboratory. I was also able to explore a different facet of biological research when I assisted with fieldwork. MUSE encourages discussion both within and among disciplines; this dialogue has improved my communication of my research to different audiences. Participation in MUSE has enhanced my abilities to work and think independently, and the knowledge and skills gained will be valuable in my academic future and career.

Effect of Paternal Care on Learning in Threespine Stickleback fish (*Gasterosteus aculeatus)*

Poonam Chitale
Faculty Mentor: Dr. Matthew A. Wund

MUSE 2011 Project

The purpose of my research was to investigate the role of paternal care in the teaching of antipredator behavior in threespine stickleback fish. (*Gasterosteus aculeatus).* Threespine stickleback fish are ideal for studying antipredator behavior because they are vulnerable to a large range of predators and they often exist in many different locations that are exposed to varying predation regimes. It has also been shown that the influence of paternal care is an important factor in learning antipredator behaviors. Previous investigations have shown that fish from high predation environments that were raised by their fathers showed more pronounced antipredator responses than did similarly raised fish from low predation environments. However, when fish from the same populations were raised without their fathers they had little to no response.

In order to test the hypothesis that paternal care does indeed influence antipredator behavior, fish from six lakes of varying predation densities (high, none, and introduced predators) were raised in the lab. Once the fish reach sexual maturity, males will placed in new tanks with gravid females and will be allowed to mate. After the fish have laid their eggs, half the clutch will be removed and will be raised without a father as a control. When the fry (baby fish) hatch, the interaction between the father sticklebacks and their fry will be recorded and scored in order to determine if fry from all six populations have the ability to learn antipredator reflexes from their fathers.

Poonam Chitale Personal Statement

The Mentored Undergraduate Summer Experience (MUSE) has provided me with a unique opportunity to learn new laboratory skills as well as apply previously learned skills in a new setting. One of the most important skills I learned this summer is how to troubleshoot an experiment. Troubleshooting is a large part of any research experiment and it gave me the opportunity to enhance my understanding of the subject as well as my problem solving abilities. In addition to working in the lab, MUSE also provided me with the opportunity to travel to Alaska for an intensive two week period of field and lab work where I learned various techniques that were essential for the type of research that I was interested in pursuing. The skills I have acquired over the summer will help me in my independent research this upcoming year and I am extremely grateful to have had this experience.

Crystal Engineering of Pyrazinamide Cocrystals

Jesus Melendez, Chemistry
Faculty Mentor: Dr. Heba Abourahma

MUSE 2011 Project

Crystal engineering is the design and synthesis of solids with desired properties, based on an understanding and exploitation of intermolecular interactions. Crystal engineering applies the concepts of supramolecular chemistry, which is inspired by many biological processes. It focuses on the construction of molecules via noncovalent interactions, including hydrogen bonding, metal coordination, hydrophobic interactions, van der Waals forces and pi-pi interactions.

Specifically, we have been looking at hydrogen bonding as a means to create new solid-state phases using a process called cocrystallization. Cocrystallization is a research area that has sparked much interest, especially in the context of pharmaceuticals. By cocrystallizing an active pharmaceutical ingredient (API) with a cocrystal former (a coformer), one can create new solid state phases which may have improved properties over existing solid state phases of the original API.

Our research focuses on pyrazinamide, an API used in the treatment of tuberculosis. The objective of this project is to synthesize and characterize new cocrystals of pyrazinamide using a series of related coformers. Specifically, we tried to address the electronic and bulk effects of the coformers on cocrystal formation. Our studies concluded that: 1) coformers with bulky substituents that hinder the hydrogen bonding interactions between the API and coformer do not result in cocrystal formation; 2) coformers with substituents that enhance the hydrogen bonding ability of the coformer do result in cocrystal formation.

Jesus Melendez Personal Statement

This MUSE program is a huge step on professor-student collaboration and improvement on laboratory skills and techniques. I have worked under the supervision of Dr. Abourahma for one year, but nothing compares to the experience I received while working alongside her during the summer. Dr. Abourahma has placed much confidence in m and has allowed me to direct myself through the program. A 40-hour week in the lab has given me opportunities to work independently and efficiently, up until the very last hours of the day. In our lab, we have seen how there are mar different routes to synthesize our desired compound, just as there are many different ways to tackle and solve a problem. The program helped mold my mind in problem-solving, peer interactions, and analyzing any sort of problem that may occur. I am truly grateful Dr. Abourahma and the rest of the MUSE committee granted me such a constructive opportunity.

Evaluating the Relative Strength of Hydrogen Bonds Sustaining Theophylline Cocrystals

Jennifer Urban, Math and Chemistry
Faculty Mentor: Dr. Heba Abourahma

MUSE 2011 Project

Cocrystallization, the process of creating solid crystals that contain several compounds in the lattice, of a targ compound with another compound (called a "coformer"), is known to affect the physical properties of the target co pound while retaining its chemical properties. In previous work we assessed the stability of a cocrystal in the solid sta in the presence of competing coformers and determined that it was possible to displace one coformer in a cocrystal wi another. Our current goal is to determine whether the positions of substituents on a series of coformers affects th binding ability to the target compound, and also to assess the effects of electron withdrawing versus electron donati substituents on the ability of a coformer to bind to the target compound. Our target compound is theophylline, an acti pharmaceutical ingredient (API) used in asthma medication. We have focused our attention on the theophylline hydroxybenzoic acid (TP·HBA) cocrystal, which makes a good model system due to its ease of synthesis. To achieve o goal, two general types of experiments were conducted: selectivity and competition experiments. Competing coforme that were studied in this project are all derivatives of benzoic acid. For the position studies, benzoic acid (BA), HBA, hydroxybenzoic acid (oHBA), and m-hydroxybenzoic acid (mHBA) were the chosen coformers. For the electronics stu ies, BA, HBA, p-nitrobenzoic acid (pNBA), and dimethylaminobenzoic acid (DMABA) were the chosen coformers. Th far it has been found in the position competition studies that with BA and mHBA, TP·HBA stays intact, and partial d placement occurs with oHBA. In the electronics competition studies thus far it has been found that TP·HBA remains i tact in all cases, suggesting that in this series of coformers, electronics may not govern the cocrystal forming abilities TP.

Jennifer Urban Personal Statement

In the sciences, collaboration is incredibly important. Anyone planning on working in the field of chemist must be able to work with their peers and superiors, thus, participating in the MUSE program was an excellent opport nity for me. Being fully immersed in chemistry lab work for 8 weeks straight is very different from working with a pr fessor during the school year when one has to juggle classes, homework, clubs, and other activities along with the r search. It has given me a taste of what working as a full-time researcher in chemistry is really like. I have learned much in the past two years working with Dr. Abourahma, and I am extremely grateful that she allowed me the opport nity to work with her for the past three summers.

Using Fluorescence Resonance Energy Transfer to Understand Peptide Conformation in Ionic Liquid

David Léon, Chemistry
Faculty Mentor: Dr Michelle R. Bunagan

MUSE 2011 Project

Previous research has shown that ionic liquids (IL), liquid salts at room temperature, have a wide range of us and applications. Unusual solvation properties, low combustibility and excellent thermal stability make them ideal alt natives for highly volatile, flammable and toxic conventional organic solvents. Consequently, ILs are increasingly bei used in various fields such as electrochemistry, catalysis, engineering and biochemistry. With regards to proteins, pr

tein-IL solutions can exhibit increased thermostability relative to that of aqueous solutions. Yet, the mechanism by which ILs stabilize large proteins is complex and not entirely understood. Therefore, we have sought to better understand the effect of ionic liquid on the conformational dynamics of the small helical peptide AKA_2. Our previous circular dichroism (CD) studies show that the stability of AKA_2 is increased remarkably by the solvent. Additionally, temperature-dependent CD study of AKA_2 in IL showed an anomalous heat induced folding of the peptide. Seeking to better understand the effects of temperature on the structural dynamics of AKA_2, we have used Fluorescence Resonance Energy Transfer (FRET). By labeling each end of AKA_2 with well chosen chromophores, we are able to use fluorescence emission to monitor the temperature dependent end-to-end distance of the FRET labeled peptide in 1-butyl-1-methylpyrrolidinium bis(trifluoromethylsulfonyl) imide. In conjunction with CD data, the end-to-end distance can be used to predict the preferred peptide conformations. Our data shows that, at low temperature and aquous conditions, the distance between the donor probe cyanophenylalanine (PheCN) and the acceptor probe tryptophan (Trp) is about 16 Å, a value that is consistent the fact that 51.9% of the peptide is in the folded state. At high temperature, the peptide unfolds and becomes compact as indicated by the decreased end-to-end distance. Additionally, energy transfer to the IL quenches PheCN fluorescence, resulting in more complex data interpretation.

David Léon Personal Statement

Working with Dr Michelle R. Bunagan has provided me with great knowledge and skills. I have been exposed to a form of learning that cannot be found in the classroom as I learned to use new instruments and familiarized myself with different methods of analysis. As my mentor, Dr Bunagan gave me the impression that I was a valuable collaborator and that I was equally important to the success of the project. She guided me throughout the research experience and was incredibly supportive of my work. As a result, I felt more involved in the project each day and my interest in doing research over the fall semester grew. Most importantly I became more confident in my ability to succeed and learned to work and think independently; key aptitudes that will better prepare me for the challenges that I will come across as I pursue my career in medical school.

The Synthesis and Characterization of Novel Thermoelectric Materials

Vincent Wu, Chemistry
Matthew Kita, Chemistry
Faculty Mentor: Dr. Benny Chan

MUSE 2011 Project

The series of compounds with formula $K_2RE_2Bi_2Se_9$ (RE=La, Ce, Yb) have potential application as thermoelectric materials. Thermoelectric materials have the ability to convert heat to electricity and vice versa. Because of this property thermoelectric materials have applications in heating and cooling as well as power generation. Current thermoelectric materials have a low a level of efficiency therefore new materials must be found to make thermoelectric materials applicable in everyday scenarios.

The compounds studied were synthesized using molten flux synthetic techniques and analyzed using single crystal x-ray diffraction. It was found that when RE=La the compound solved in the space group Pbam and when RE=Ce, Yb the compound solved in the space group $P2_12_12$. While both compounds look very similar they contain different symmetry elements making them subtly different.

In order to further understand the slight change in structure magnetic measurements must be performed. To perform these measurements the synthesis needed to be optimized to yield large amounts of product. After trial and error it was found that a stoichiometric mix with slightly more potassium gave a large percent yield. Currently samples are ready for magnetic measurements. With magnetic measurements it might be possible to better understand the subtle structure change the compound undergoes. In all versions of the compound the RE is in a +3 oxidation state. This would mean that La has no electrons in its f-orbital's whereas rare earth elements Ce and on would contain unpaired electrons in the f-orbital's. These unpaired electrons could lead to interesting magnetic properties that could account for the space group shift. Once the structure shift is understood further work can be done to test the compounds use as a thermoelectric material. With synthesis optimized these measurement should be very easy to perform.

Vincent Wu Personal Statement

This summer, I studied solid state chemistry, a branch of chemistry that I have never been exposed to. In the

past 8 weeks of MUSE, I have come to become familiar with many new concepts and ways of thinking. I've come to learn that in order to succeed in solving the crystal structures of our compounds, one needs to have a comprehensive knowledge of many different fields of chemistry, besides solid state chemistry. I also find studying rare earth elements to be quite fascinating. Since the rare earths are well, rare, I feel like I am observing something that is quite special and can potentially hold many scientific breakthroughs. Pursuing the unknown and unfamiliar this summer has truly been a humbling experience for me.

Matthew Kita Personal Statement

Previously in the Chan group I have worked on synthesis of new superconducting materials. This summer however I was switched to the thermoelectric project. This enabled me to broaden my understanding of solid state chemistry. This summer I was also faced with the challenge of training people in the lab. The techniques involved to make solid state involve working in a glove box and handling a very hot flame. Teaching my fellow lab partners these techniques was very nerve wracking but worthwhile.

The Development and Characterization of Peptide-Based Hormone Mimics with Implications in Human Health

Megan Decker, Chemistry
John Ferrie, Chemistry
Faculty Mentor: Dr. Danielle Guarracino

MUSE 2011 Project

Vasopressin is a cyclic peptide hormone naturally produced in the pituitary gland. The disease Neurogenic Diabetes Insipidus is characterized by a deficiency of this peptide hormone. As a result of this disease, new research is being dedicated to synthesizing molecules with the capability of performing the function of vasopressin in the body. These molecules maintain the overall three-dimensional macrocyclic structure of vasopressin, but feature a more stable amide backbone and a smaller overall ring size. These alterations should give the synthesized "mimics" increased stability in the presence of protease enzymes that breakdown peptides and are present inside cells. The ability of these "mimics" to withstand treatment with proteases will testify to their candidacy as first generation pharmaceuticals.

This summer, the previously synthesized molecules were purified and tested for their stability in the presence of such enzymes as compared to the parent vasopressin molecule and a linear control molecule. Stability assays were performed against three specific digestive enzymes: alpha-chymotrypsin, pronase, and pepsin. These assays were performed by placing each molecule in solutions that approximated the redox environment of living cells, with and without the enzyme. After solutions of the molecules were incubated at body temperature over various time intervals, the relative concentration of the molecule in solution was measured using high performance liquid chromatography (HPLC). The stability of the mimic molecules was assessed by comparing the degradation of each mimic molecule over time to the degradation of the parent vasopressin and linear control molecules. The data from these assays verified the mimic molecules display increased proteolytic stability compared to the parent vasopressin molecule.

Megan Decker Personal Statement

Through the Mentored Undergraduate Summer Experience I developed valuable laboratory techniques and organization. This summer, I was able to actually practice methods in protein synthesis that I had previously only learned about in the classroom. In addition, through analysis of our products, I became adept at using standard chemical instruments. The methods used in our study required me to focus in on my organizational and time-management skills, which will benefit me in the upcoming school year and in my future studies at either graduate or medical school. Furthermore, reading and understanding scientific literature, which had been a challenge to me before, became an easy task and now I feel more comfortable with the idea of interpreting information in literature if I decide to continue my education in graduate school.

John Ferrie Personal Statement

The Mentored Undergraduate Summer Experience provided me with a valuable opportunity to develop laboratory and management skills. Summer research allowed me to refine my laboratory skills as well as gain proficiency with standard chemical equipment. Also the MUSE environment allowed me to structure my own daily and weekly schedule, which helped me develop important time management skills. Reading scientific literature was also an important part of the project. By reading more journal articles I was able to become more familiar with reading and obtaining in-

formation from scientific publications. Lastly, the weekly MUSE luncheons provided me with important information for fellowship and graduate school applications. Overall the experience provided me with important skills that will have a positive effect on the remainder of my undergraduate career and my pursuit of graduate school.

Determining the Rate and Mechanism of Nitric Oxide Production in Marine Diatoms
Faculty Mentor: Dr. Donald Hirsh
Niketh Bhashyam, Biology

MUSE 2011 Project

We are studying the production of nitric oxide in the marine diatom, *Phaeodactylum tricornutum* (*Pt*), in collaboration with Prof. Kay Bidle and his research group at Institute of Marine and Coastal Sciences at Rutgers University. Diatoms are a type of algae or phytoplankton and are important for their role in CO_2 fixation and sequestration. The two types of diatoms tested were the wild type and the 18-58 clones of *Pt*. The clone over expresses Death-Specific Protein (DSP), a protein associated with programmed cell death, or apoptosis. Production of high levels of nitric oxide is also associated with apoptosis in marine diatoms and we wanted to know if elevated levels of DSP would lead to elevated levels of nitric oxide. Surprisingly, the over-expression of DSP in the 18-58 clones increases the ability for *Pt* to grow under low-iron conditions. Nitric oxide production of the wild type and 18-58 clones of *Pt* was examined under iron-rich and iron-starvation conditions. Nitric oxide is detected is by its binding to an iron complex known as MGD_2-Fe (II), and the MGD_2-Fe(II)-NO complex is detected by Electron Paramagnetic Resonance spectroscopy.

Niketh Bhashyam Personal Statement

The MUSE program allowed me to collaborate with other students and faculty, develop research skills such as preparing enzyme assays, and work with instruments far beyond what would be learned and used for a class such using an Electron Paramagnetic Resonance instrument. I also had the privilege of working alongside Ms. Marisa Sanders and Mr. Kevin Lee under the instruction of Dr. Donald Hirsh and Dr. Kay Bidle from the Institute of Marine and Coastal Sciences at Rutgers University. The students and faculty were highly supportive and nurturing, which allowed me to grow and learn in the field that I was working in. I am truly grateful to Dr. Hirsh and Dr. Bidle for taking me on as a mentee and to TCNJ MUSE and Bristol Myers Squibb for funding and supporting my research. Without them, I would not have been able to meet and work with such kind and knowledgeable students and faculty, nor would I have been able to learn so much in these past eight weeks.

The Nature of Metal Ion Binding in Chemically Modified DNA Duplexes
Faculty Mentor: Dr. Donald Hirsh
Marisa Sanders, Chemistry
Kevin Lee, Chemistry

MUSE 2011 Project

DNA is also known to transmit charges over tens of nanometers so the potential exists for DNA-based molecular electronics. Here we examine the structure, electronic, and magnetic properties of chemically modified DNA duplex that may be able to act as an electronic switch. A chemically-modified DNA duplex with an EDTA-bound metal ion and nitroxide spin-label acts as the model system. Previous findings reflect that weak bonds form between the metal ion and the DNA backbone, thereby changing the shape and flexibility of the DNA helix. It is hypothesized that this "secondary binding" alters the long-range magnetic interactions that have the potential to enhance DNA's charge transfer ability.

Previously-conducted research indicates that secondary binding is present in dysprosium, while it is absent in terbium. Chemically, the two metal ions are essentially identical except for a slight difference in ionic radius. In a phenomenon known as the "lanthanide contraction," as atomic number increases, lanthanide "ionic radius" decreases. To examine this effect, 8 additional lanthanide ions, 4 of which are smaller than dysprosium and 4 of which are larger than terbium were tested for the presence of secondary binding. In turn, the ability for certain lanthanide metals to exhibit secondary binding will tell us something about the "size" of the interaction site, subsequently revealing insight on how the magnetic "switch" works.

Previous experiments using dysprosium with the DNA helix suggest the change in shape that is propagated in only one direction along the helix axis(toward the radical, a nitroxide spin label). This theory was tested to by reversing

the attachment of the Dysprosium ion and radical. Two different DNA duplexes were prepared. We will report on our initial thermodynamic and dynamic characterization of these duplexes based on Circular Dichroism and Electron Paramagnetic Resonance spectroscopy.

Marisa Sanders Personal Statement

MUSE has exposed me to a fresh mode of scientific reasoning and intellectual contemplation. As opposed to "class lab," in which a variable has been tested repeatedly and certain results are expected, the research environment in which I took on my MUSE studies allowed me the opportunity to plan my own experiments and problem solve beyond the confines of classical coursework. In doing so, I was able to test contemporary methods of instrumentation, including EPR (Electron Paramagnetic Resonance) and Circular Dichoism, many of which I probably would not have seen so early on in my chemistry career without the summer experience. The experience I gained from collaborating with Dr. Hirsh has also allowed me to develop as an individual and has inspired me to continue pursuing scientific experimentation. Perhaps most important, however, is the awareness I've gained through my research to accept potential failure in the hopes of moving forward. It is the application of this perspective to all areas of study that has made MUSE such a valuable and gratifying experience.

Kevin Lee Personal Statement

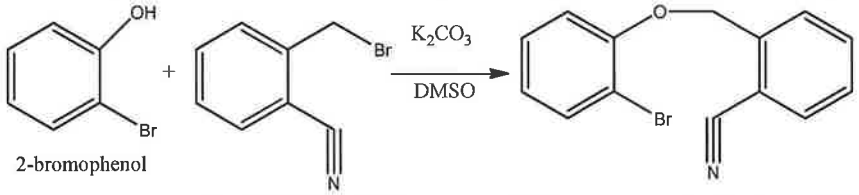
The Mentored Undergraduate Summer Experience (MUSE) 2011 program has allowed me to enhance my knowledge and passion for the field of chemistry. Through this program, I have been able to immerse myself in many different biophysical chemistry concepts and techniques, many that I would have never been able to learn in the classroom. Not only was I able to gain valuable lab techniques, but more importantly, I also was able to truly grow as a person. I learned how to cope with failure, and learn from my mistakes. In addition, my experience has enabled me to think critically about problems. I have also developed an appreciation for the mentor-mentee relationship, which has continuously encouraged and motivated me to never give up on my project. The MUSE program has given me a strong foundation and basis that will enable me to succeed as a future dentist through the interpersonal and organizational skills I have acquired.

Development of a Novel Ring Forming Reaction

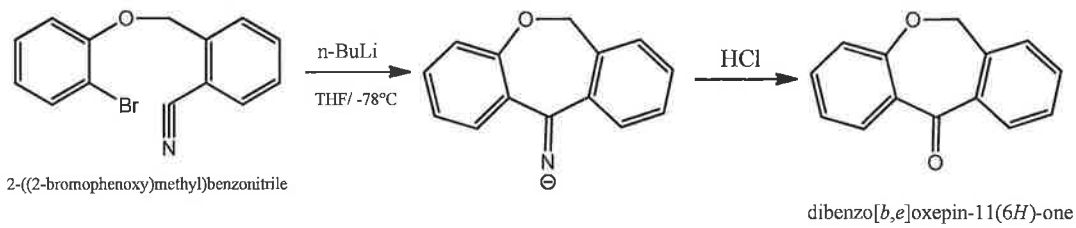
John Farrokh, Chemistry
Faculty Mentor: Dr. David Hunt

MUSE 2011 Project

Benzo-fused 7-membered heterocyclic ketones have been shown to possess pharmacological activity. The goal of our project is to develop a new method of synthesizing these compounds. Starting materials were typically prepared by reacting a compound unique to each reaction with 2-cyanobenzylbromide.

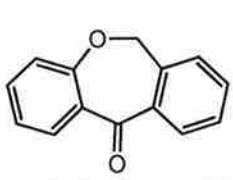


The reaction utilized to prepare these products entailed the formation of a N-lithioimine salt by reacting the starting material with n-butyllithium at -78 °C followed by an acidic work-up and extraction.



Seven variations of the starting material used in this reaction were used. All products were produced, however only a

small amount of thiopinone product was detected and several products have not yet been purified.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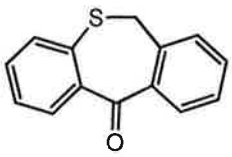
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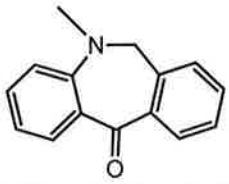
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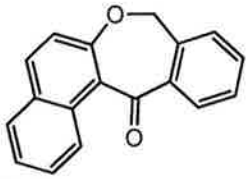
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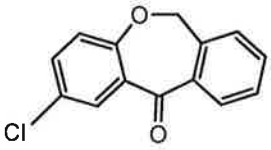
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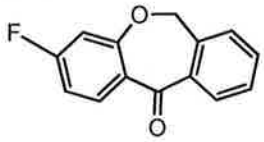
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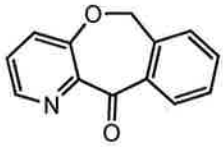

benzo[5,6]oxepino[3,2-*b*]pyridin-11(6*H*)-one

John Farrokh Personal Statement

Over the past two months, The Mentored Undergraduate Summer Experience has enabled me to gain invaluable experience in the laboratory. My knowledge of and proficiency at performing various chemical synthesis techniques, along with my familiarity with scientific instrumentation available at The College of New Jersey, have improved dramatically. In addition to improving my lab abilities, MUSE has given me the opportunity to work alongside my peers with projects both similar and different from mine. I have expanded my appreciation of the work done in other disciplines, as well as the projects under-taken by my fellow scientists. Thanks, to MUSE, I have been given a unique opportunity to develop both as a student and as a researcher. The skills I have gained in these past two months will be priceless assets during my junior and senior years, at graduate school, and in industry.

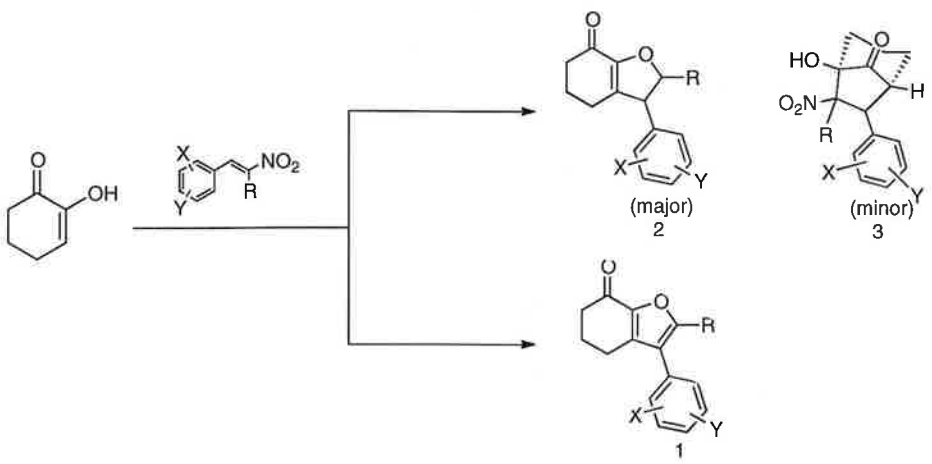
Michael Additions of B-Nitrostyrenes to 1,2-Cyclohexanedione

Chad Simpkins, Chemistry
Faculty Mentor: David Hunt

MUSE 2011 Project

The benzofuran structure is of value in medicinal research today since the derivatives from this class of heterocyclic systems possess a wide variety of biological activities including uses as anticonvulsants, blood anticoagulants, and antidepressants. In our research, we desired to design a simple, one-step synthetic procedure capable of preparing a variety of fused-ring furan systems which could lead to the benzofuran system through one further step. Our plan was based upon the known Michael behavior of b-nitrostyrenes. We envisioned that the condensation of these Michael acceptors with 1,2-cyclohexanedione could result in the formation of the desired product.

After having success with the original structures, we continued our studies by performing the same procedure on substituted derivatives of the b-nitrostyrene. Should the reaction be successful with a variety of derivatives containing substitutions on both the phenyl ring and at the b-position, the wide applicability of the method would be proven.



Chad Simpkins Personal Statement

Over the past eight weeks spent performing organic synthesis research for the Mentored Undergraduate Sum mer Experience, I have accomplished more on my project than I ever thought possible. Having worked on the project fo the past two semesters, I had already acquired the necessary skills in order to synthesis and characterize both the star ing materials and final products of the reactions and was able to take full advantage of my time in the laboratory Through literature review, we were able to solve many of the problems that had been hindering our progress and we ar now moving forward at a greater pace. It is in the nature of the project that there are many compounds that must be syn thesized and without the opportunity provided by MUSE, it is unlikely that the project would have been even close t completion by the time I graduate. Luckily, this is not the case, as we are currently working towards writing a paper o our research and much of our future work will focus on gathering what we need for publishing.

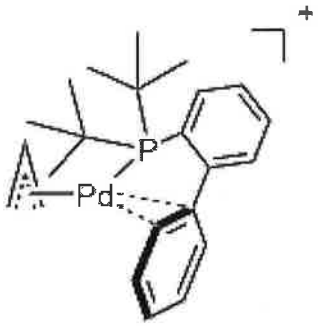
Synthesis, Characterization, and Reactivity of New Palladium Complexes for Catalytic Applications to Make Polymeric Materials

Katherine McGarry, Chemistry
Faculty Mentor: Dr. Abby O'Connor

MUSE 2011 Project

Polymers are all around us, making it impossible to go through our daily lives without using several different type of them to accomplish even the most minimal tasks. For example polymers are used to make plastics for trash bags, f bers for carpets and clothing and elastomers for tires. This project explores the preparation and characterization of new palladium metal complexes to serve as catalysts for polymerization reactions. A catalyst increases the rate of a chemica reaction allowing the process to occur at more ambient conditions, but the catalyst is not consumed during the reaction Catalysis also allows for reactions to proceed at lower temperatures and pressures, allowing for more energy efficien and sustainable processes that are better for the environment. The goal of this project is to synthesize and to characteriz new palladium complexes that contain various phosphine ligands. So far twelve new palladium complexes have bee synthesized and characterized by Nuclear Magnetic Resonance (NMR) and X-ray crystallography. These technique allow us to structurally characterize the compounds we make. We have started to explore the reactivity of the palla dium complexes to assess the binding strength of different arene fragments to the palladium center. In the future, thes palladium complexes will be screened for polymerization of alkenes and other monomers.

Scheme 1: Example of a new palladium complex synthesized this summer.



Katherine McGarry Personal Statement

The Mentored Undergraduate Summer Experience at The College of New Jersey was an extremely rewarding program. This was my first opportunity working in an independent research environment and I plan to continue my research during the school year. This program presented me with opportunity to learn new laboratory techniques that I can now work to improve upon and take with me to graduate school. The time in the laboratory strengthened my abilities as a chemist, as well as a scientist by giving me the ability to begin asking my own questions and forming my own hypotheses. Dr. O'Connor was an excellent mentor and I am thankful for her time and knowledge that she contributed this summer. This program also aided me on a non-scientific level by presenting valuable information regarding gradu

ate school as well as presentation techniques that will be useful in the future. This experience has been the highlight so far of my college career, and I am excited to see what opportunities will present themselves months after this program has concluded.

Development of Selective Insecticides Through the Disruption of Isoprenoid Forming Enzymes

Michael Grasso, Chemistry
Samantha Iamurri, Chemistry
Faculty Mentor: Stephanie Sen

MUSE 2011 Project

Throughout this summer, Dr. Stephanie Sen and her student collaborators Michael Grasso and Samantha Iamurri, both senior Chemistry majors, have worked on the characterization of three enzymes of the spruce budworm, *Choristoneura fumiferana (Cf)*. First, two forms of farnesyl diphosphate synthase (FPPS), referred to as Type 1 and Type 2 FPPS, were studied. The aim was to explore the structure and activity of each and to establish their cooperative role in forming isoprenoids, which are essential natural products for insect growth and development. Because the Type 1 protein has an N-terminal extension that is predicted to target import into the mitochondria, several CfFPPS1 constructs were prepared, expressed and studied. We determined that neither the full nor the truncated versions of Type 1 FPPS were catalytically active unless very small amounts of Type 2 protein were added. These findings lead us to pursue circular dichroism studies to determine the structure and stability of the Type 1, Type 2, and combined Type/Type 2 proteins. While all proteins show similar secondary structure, they show distinct denaturation profiles, indicating that different higher order structures were present. Native gel PAGE electrophoresis has partially confirmed this conclusion and suggests that the addition of Type 2 protein to Type 1 FPPS causes a change in the aggregate form of the proteins.

The enzyme isopentyl diphosphate isomerase (IPPI) was also studied this summer. The IPPI of the brown spruce longhorn beetle *Tetropium Fuscum (Tf)* was assayed using a library of compounds previously tested for their ability to inhibit CfIPPI. The purpose of this work was to determine whether the beetle enzyme display different biological activity. In addition the data would allow us to evaluate the validity of a homology model of TfIPPI, prepared earlier this year. The inhibitory potencies of the compounds tested were different between the moth and beetle enzymes, suggesting that there are structural differences between the two proteins.

Michael Grasso Personal Statement

My work with Samantha Iamurri and Dr. Stephanie Sen throughout the summer during the MUSE program has given me the opportunity to practice some of the laboratory techniques necessary in the field of chemistry (and biochemistry). It also helped me gain knowledge of biochemistry. This summer helped me think on my own, but also helped me develop skills in working with a team. These kinds of practices have helped me garner the skills I need to pursue my goal of becoming a research chemist.

Samantha Iamurri Personal Statement

The MUSE program was great, it provided me the opportunity to continue with the research I have been working on for the past two semesters. It allowed me to fully immerse myself in my project and understand its long-term goals. MUSE not only gave me experience in the lab but it also gave me the chance to learn invaluable lab techniques. These techniques will aid me not only during my research next year but also in my future studies. I am grateful for the chance to work in a field that I plan on pursuing in graduate school.

Deep structure controls on magmatic output of Klyuchevskoy volcanic group in Kamchatka

Zachary Oliff, Physics
Faculty Mentor: Dr. Maggie Benoit

MUSE 2011 Project

The goal of this project is to map the crustal thickness of the Earth underneath the Klyuchevskoy volcanic group in Kamchatka, Russia. The study particularly focuses on an anomaly located roughly 200 kilometers beneath the Earth's surface. By using seismic data obtained from seismic stations in the region, the region was able to be mapped using receiver functions. This discovery suggests that the volcanic activity in the region is not caused by typical tectonic plate interaction, but potentially by a fragment of a tectonic plate that was broken off of another tectonic plate. The depth of

the anomaly indicates that the cause of the volcanic activity in Kamchatka cannot be attributed to normal tectonic plate interaction because the vast majority of volcanoes are caused by a subduction zone between tectonic plates located about 100 kilometers beneath the Earth's surface. This region varies greatly in density from the surrounding crust suggesting that the anomaly is the cause of the volcanic activity in Kamchatka. The anomaly is far denser than the surrounding rock. This data could prove valuable in the future study of volcanic activity in Kimchatka as well as around the world.

Zachary Oliff Personal Statement

The Mentored Undergraduate Summer Experience has provided me with the unique opportunity to work alongside fellow students and faculty members, while still furthering my own independent research abilities. Over the course of the program I was able to completely invest all my time and effort into my area of research without the responsibilities of classwork. I have learned invaluable techniques and skills in the field of science. By being able to learn and work through my mistakes, I have become a better student-researcher as well as a problem-solver. Furthermore, I now understand the true importance of teamwork and relying on fellow students for advice and input when dealing with research. I now see collaboration as a key component of science and research in general. As a result of my experience, I feel as if I have explored a field of science I may wish to pursue in graduate school; however, more importantly, I am grateful for the lessons and skills I have learned from my advisor and fellow students.

Surface Wave Dispersion of Northeastern United States

Sean Vanadia, Physics

Faculty Mentor: Dr. Margaret Benoit

MUSE 2011 Project

The goal of our project is to measure the seismic velocity structure of the eastern United States to find the depth of the crust in this region. Dispersion curves were created from the analysis of seismic surface waves along the northeastern United States. The data that we used consisted of the ambient Earth noise that is mostly produced by ocean waves and atmospheric disturbances. We analyzed data from 5 seismic stations, and produced dispersion curves for station pair. A four-step process was conducted to produce the dispersion curves from the raw data. Several computer programs were designed to cut the data from each station into equal-length, day-long files. The files were then mathematically correlated, producing correlation graphs per each set of stations per day. We then stacked the correlation graphs to minimize incoherent noise, and formed dispersion curves from the stacked data. The dispersion curves show how surface waves with different frequencies travel at different velocities along the northeastern United States. They indicate the density and temperature of the earth's material from the surface to approximately 100 miles beneath the surface.

Sean Vanadia Personal Statement

The MUSE research program gave me the opportunity to conduct meaningful research for a TCNJ faculty member in a field that is of high interest to me. I have learned many valuable skills first-hand this summer. I now consider myself a valuable team worker, communicator, and also an independent and self-sufficient worker. I believe that these qualities that I have attained from this research experience make me a well-rounded scientific researcher. I have learned to be patient, persistent, and driven in a scientific setting. This experience has given me the opportunity to deal with real physical data and enhance my computer skills to a much higher level. MUSE has made me a more confident researcher and worker, and it has helped me develop my analytical skills, interpersonal skills, and intelligence. I want to thank MUSE for giving me the chance to better myself and make an impact on an important scientific research project.

Crustal Depths of the North Eastern United States from Receiver Functions

Eli Raymond

Faculty Mentor: Margaret Benoit

MUSE 2011 Project

Although the eastern coast of the United States is not considered a seismically active region, it does have a very rich geologic history. The crust of the northeast is known to contain remnants of the rift valleys associated with the split up of the great supercontinents, as well as the remains of the Appalachian Mountains from when they were the highest

peaks on Earth.

The studying of crustal depths allows us to develop a picture of the sub-surface structure of the Earth, including the approximate depth of the moho (crust-mantel boundary) and any unexpected features residing kilometers within the Earth that may be present. In order to do so, we used seismic data taken from seismometers all around the northeast. The seismometers recorded tens of thousands of events from all around the world, which we then both manually and statistically quality controlled. The remaining "good" events were iteratively deconvoluted (in the time domain), and then put through a stacking process and receiver function via funclab within the MATLAB program. The stacking process averaged the data into a unified "stack," which was run through a receiver function. The receiver function created a sub-surface image of the crust based on the time difference between the arrival of the initial P-wave and the generated S-wave that occurs at crustal boundaries. From the images generated, we are able to make accurate estimations of the crustal thickness and the depth of the moho in the areas surrounding the stations. We also found several crustal anomalies at various stations, suggesting the possibility of a double moho, or even potential underplating.

Eli Raymond Personal Statement

This summer I was able to participate in the rewarding and oft sought after opportunity of undergraduate research. Throughout the summer I have participated in hands-on scientific research, an experience that will serve me well in any graduate program or post-graduate work I choose to partake in. From the MUSE sponsored program I have learned how to cope with the frustrations and excitement of research, as well as how to operate smoothly in group-oriented projects while maintaining independence and working efficiently as an individual. These are skills that are applicable to all fields of work, research based and otherwise, and they well indubitably contribute to any success I may have in the future.

Spectral Analysis of Gravity Data and Preliminary Moho Depths of the Eastern US

William Dybus, Physics/Secondary Ed
Faculty Mentor: Dr. Margaret Benoit

MUSE 2011 Project

The structure of the earth under the Appalachian Mountains is not well understood. The strength of the earth's gravitational field varies with several factors, all of which affect the isostatic equilibrium of the earth. The Appalachian Mountains are a heavy load and as a result the depth to the Moho should be much deeper underneath the mountains. Seismic data presents a good view of what lies beneath, and analysis of gravity data provides an alternative way to map deep structures.

The gravity data was analyzed using the science and engineering program, Matlab. To determine the depth to the Moho I first mapped the spatial gravity data, and then applied a Fourier transform on smaller, overlapping windows to bring the spatial data into the frequency spectrum. From the frequency spectrum the power spectral density (PSD) was determined, and then radially averaged the PSD. The radially averaged PSD was then graphed against the wavenumber, with the slope being proportional to the depth of the Moho. Future studies of deep structures can use the methods of this study as a supplement to seismic data analysis.

William Dybus Personal Statement

The MUSE research program has given me valuable insight into scientific research and the thought process behind it, much more so than any "cookie cutter" lab conducted in a classroom setting. I have also become more interested in conducting more research because of this program. I did not originally plan on going to graduate school, but this program has made me reconsider the idea. I plan to bring the knowledge gained here with me into the classroom as a future teacher.

Construction and Initial Operation of TCNJ's First Radio Interferometer (TFRI) &
Observational Constraints on Transient Radio Emission from Binary Neutron Star Mergers
(Funded by NASA through the Impress-ED program)
Dana Dispoto, Deaf Education- Math/Science/Technology
Joanna Papadopoulos, Special Education- Math/Science/Technology
Faculty Mentor: Dr. Michael Kavic

MUSE 2011 Projects

Construction and Initial Operation of TCNJ's First Radio Interferometer (TFRI)

Using a preexisting dipole radio telescope on the TCNJ campus, we conducted observations of strong radio transient emissions associated with solar flares and Jovian S and L bursts created by the interaction between Jupiter's magnetic field and its moon Io. This data was analyzed and submitted to NASA's RadioJOVE database, an open access database for transient radio events within the solar system.

We have added a second dipole station to the existing radio telescope in order to create TCNJ's First Radio Interferometer (TFRI). TFRI will allow for removal of background interference from our own galaxy- the Milky Way, allowing us to observe extragalactic radio sources that would have otherwise been unobservable. TFRI will also allow us to determine the position of astronomical objects and by varying the baseline of the interferometer the intrinsic size of astronomical objects can be measured.

Observational Constraints on Transient Radio Emission from Binary Neutron Star Mergers

The merger of a binary neutron star pair is expected to generate a strong transient radio signal. This emission will be strongest at low-frequency and will disperse as it transverses the interstellar medium arriving at Earth after coincidentally emitted gravitational or (higher frequency) electromagnetic signals. The rate of compact object merger events is poorly constrained by observations. The Eight-meter-wavelength Transient Array (ETA) telescope is a low-frequency radio telescope initially located at the Pisgah Astronomical Research Institute (PARI), which is sensitive to a frequency range of 29-47 MHz. It is now located at Virginia Tech where it continues to conduct low frequency observations. This instrument is an all-sky instrument designed to detect astronomical sources of radio transients. We calculated the sensitivity of ETA to transient radio emission from binary neutron star mergers and used ETA observations to constrain the rate of such merger events.

Dana Dispoto's Personal Statement

Through IMPRESS-ed and the Mentored Undergraduate Summer Experience I have had the chance to participate in a 2 week common module session in which I was able to learn about how to incorporate real-time data and research techniques into the K-12 classroom and work with a mentor and peer on a 6 week research project. This experience has not only helped me enhance my teaching abilities and science lesson planning skills by incorporating real-time data, but it has also has given me a chance to mature as an individual and fine-tune my problem solving skills. With no set syllabus or outline handed to us, it was important to realistically look at the project and set obtainable goals as a group. I have learned the value of scientific literacy and the value in having confidence in myself and my thoughts. I enjoyed working closely with the faculty, fellow Impress-ED and MUSE peers over the summer as it has fostered a sense of community within the overall experience. This experience has shaped my future as a student as well a future teacher and will aid in my endeavors as I begin student teaching in the spring.

Joanna Papadopoulos' Personal Statement

Through the IMPRESS-ed and MUSE summer research programs, I was able to establish a sense of networking between different disciplines. This research opportunity has given me a very valuable experience that allowed me to learn different methods of incorporating real time data in the classroom as well as establishing a sense of community between peers. Through the two week common module, I was able to use my creativity skills to construct lesson plans through the incorporation of various programs, websites and hands-on activities to enhance learning in the classroom. Our faculty members encouraged us to be creative and work as a team towards one goal. These modules have inspired

me to go forth as a teacher, who wants to educate students about the importance of science literacy as well as incorporating real time data into the curriculum. Just like the faculty members that encouraged us to be creative with our research projects, I hope to also exemplify creativity in my classroom.

Measurements of Thin Epitaxial Ice Films Using Spectroscopic Ellipsometry

Adam Cumiskey, Physics

Faculty Mentor: Dr. Nathan Magee

MUSE 2011 Project

While some equations exist that can model the formation of ice crystals in the atmosphere, they are not very precise, especially at the low temperatures found in cirrus clouds. The main focus of our research is to study ice crystal growth in the lab and compare our results to the current mathematical model. This data will hopefully be able to reduce uncertainty in models of climate change.

This summer I have been designing and building the diffusion chamber for the experiment. This chamber uses Peltier coolers to freeze a layer of ice to the top and bottom plates of the chamber and cool the air inside down to the temperatures found in cirrus clouds. By creating a temperature differential between the two plates, the air in the chamber becomes supersaturated with water vapor. A substrate will be placed between the top and bottom plates that will allow the supersaturated air to grow a layer of ice crystals.

To examine these ice films we will be using a spectroscopic ellipsometer. The ellipsometer reflects a beam of polarized light off of a sample and then analyzes how the polarity has changed to give nanoscale information on the thickness and optical properties of the sample. This will allow us to gather data about the ice as it grows. We also hope to take an ice crystal sample to Princeton University's Imaging and Analysis Center to examine with the environmental electron microscope.

Adam Cumiskey Personal Statement

Working on the MUSE project this summer with Dr. Magee has allowed me to experience many different aspects of scientific research. Designing the chamber not only challenged me to use problem solving skills to overcome obstacles, but also to learn how to use computer aided design programs like DeltaCAD and Google SketchUp as well. I was also able to learn metalworking because we had to fabricate most of the chamber in the machine shop. Another great experience the MUSE program gave me was the opportunity to go to Princeton to learn how to operate their Environmental Scanning Electron Microscope. Collaborating with Dr. Magee on this project has given me skills and experience that will undoubtedly be vital in the remainder of my undergraduate years and beyond.

Comparative Altitude Determination of Overshooting Tops in Severe Thunderstorms

(Funded by the National Aeronautics and Space Administration)

Rachel Goldberg, Physics

Faculty Mentor: Dr. Nathan Magee

MUSE 2011 Project

We have analyzed five methods of determining cloud top heights, specifically in deep convective clouds. An overshooting top is a portion of some cumulonimbus clouds that is taller than the rest of the cloud and has a "cauliflower-like" texture. This feature is often associated with especially intense thunderstorms and its evolution has been linked to aviation accidents and costly re-routings as well as to the onset of tornado formation.

In order to specify the occurrences of deep convection, we used the data from three NASA satellites that form part of the "A-Train", a suite of co-located polar-orbiting research satellites: Aqua-MODIS, CALIPSO, and CloudSat. CloudSat and CALIPSO generate a vertical slice through the clouds, so we were able to see a cross-section of cloud structure. The instrument MODIS on Aqua provides a horizontal view of the clouds.

After cataloging all of the occurrences of deep convection from January through June of 2011, we used archived ground-based Doppler radar and numerical modeling data to estimate the cloud top heights. The radar data gave us an additional cloud top height measurement at the specific time the storms were intersected by the satellite sensors. The model output was visualized using the software package "BUFKIT", giving us the predicted cloud top heights for the storms with a several hour lead-time. In addition to looking at data, we used a surveyor's transit on a cumulus humilis over New Jersey at the same time CALIPSO passed overhead on June 30 and July 16. This allowed us to compare geo-

metrically derived cloud top heights by direct sighting to that of CALIPSO's lidar determination. Our research has given us insights on how the different methods in determining cloud top heights compare. The continuation of this project should contribute to enhancements in aviation decision-making in the vicinity of strong convection and to improved forecasting of tornado onset points.

Rachel Goldberg Personal Statement

Impress-Ed, in association with MUSE, has further taught me about the earth sciences that I love and has given me the ability to explore the research world. Through this research, I got to discover more about the atmosphere and weather around us. Not only have I gained new knowledge about the subject I love, but also am getting the opportunity to contribute my work to the field. This opportunity has been incredibly insightful, as I had never really known about all the complexities of cloud development and determining cloud top heights. I got to meet and work with a well-educated and knowledgeable mentor, fellow students and faculty who were all conducting amazing research. MUSE and Impress-Ed has been incredible and I am so glad I was given the chance to participate in these fantastic programs.

Fabrication of azo-dye doped polymer films for nonlinear optical applications

(Funded by National Science Foundation DMR-RUI award #1138146)

John Lenehan, Physics
Mina Shenouda, Physics
Faculty Mentor: David J. McGee, Department of Physics

MUSE 2011 Project

Nonlinear optical materials can control the speed of light through electric field-induced changes in their index of refraction and are integral to applications such as fiber optic data transmission. Demands for compositional flexibility have motivated research in dye-doped polymer films as next generation nonlinear optical materials. These consist of a transparent host polymer blended with a highly conjugated azobenzene dye molecule. For device applications, polymer films must be fabricated with precisely controlled thicknesses in the 500 nm- 7 μm range and with refractive index greater than 1.5. In this research, physics faculty member David J. McGee worked with students John Lenehan and Mina Shenouda to demonstrate that polymer-dye solutions of amorphous polycarbonate (APC) and disperse-red 1 (DR1) can be spin-cast into high quality thin films with thickness and index measured by optical prism coupling experiments. By correlating thickness with spin speed, we determined that APC-DR1 films can be fabricated over a range of thickness from 1 to 5 μm. The refractive index was measured to be 1.58 at 633 nm. This is suitable for optical waveguiding applications, and it is anticipated that a wider range of thickness can be achieved through additional control of polymer viscosity.

John Lenehan Personal Statement

My work this summer has been an amazing learning experience. I have spent a great deal of time working hands-on with state-of-the-art equipment that I wouldn't have been able to learn to use anywhere else. My project has relied on topics from chemistry, mechanical engineering, and several different fields in physics such as optics. As a result I have learned a lot about not just physics, but also other fields that I wouldn't generally get hands on experience with. I've also started to learn to use LabView, a powerful computer program used to run experiments and gather data. This program has given me many skills that will set me apart when applying for REUs, graduate schools, and work, but it has also given me much more. By working independently, I have grown academically and personally, but thanks to the collaborative work with my faculty mentor Dr. McGee, my partner Mina Shenouda, and the other research teams, I've been able to do so while becoming a part of an incredible community at TCNJ.

Mina Shenouda Personal Statement

This research opportunity was my first step into a professional career. I was fortunate enough to learn many new skills and techniques and develop academically, while exercising professionalism in an independent yet collaborative working environment. In the projects I worked on this summer, from making polymer solutions and measuring film thickness, to constructing a poling stage and putting up curtain railings, I exercised skills in physics, chemistry, and engineering. I increased my knowledge of optics and laser technologies and their seemingly limitless capabilities. Since this was my first research experience, I also developed other skills, including time management and keeping a data log. Un-

der the helpful guidance of faculty mentor Dr. McGee and my partner John Lenehan, I have learned invaluable collaborative skills as well. My experience this summer was so great that I plan on continuing researching and developing with Dr. McGee throughout the upcoming year. As a result of this program, I am a much stronger candidate for my future career, and I am far more confident as a student and professional.

Characterizing Star Formation Regions Using Hubble and GALEX Images
(funded by a NASA Impress-Ed Grant to TCNJ)
Thomas O'Dell, Physics
Faculty Mentor: Dr. Paul J. Wiita

MUSE 2011 Project

We have conducted a search for star-forming regions (SFR) in galaxies with a redshift between z=0.004 and z=0.05. All these galaxies are spiral or irregular in classification, and both Seyfert and non-Seyfert galaxies are included. Star-forming regions of interest are those in the spiral arms of the galaxies, not within the nucleus as the extreme brightness of the nucleus makes individual star-forming regions there impossible to observe. We made composite images from multiple individual waveband images from both the Hubble Space Telescope and the GALEX ultraviolet space telescope. Star-forming regions are indicated by extreme brightness in the ultraviolet and blue wavelengths. However, dust and gas blocking these regions absorb the ultraviolet emissions and re-radiate in the infrared portion of the spectrum. By combining images taken in the ultraviolet, visible and infrared, we can completely map the star formation activity. While many galaxies have been previously studied using these techniques, the relatively recent availability of ultraviolet images from the GALEX satellite aided us in locating previously undiscovered areas of star formation.. We found that irregular galaxies exhibit, on average, a much larger number of star formation regions than do spiral galaxies, both with or without Seyfert activity. We also found that the average radial location of star formation regions does not seem to depend on galaxy morphology or the presence or absence of Seyfert activity, and that merging irregular galaxies have an extremely high rate of star formation. Future work on this project will center on expanding the sample size and studying the luminosities of the individual star-forming regions.

Thomas O'Dell Personal statement

My work on this project through the Impress-Ed program, in conjunction with MUSE, has taught me much about scientific research that will help me greatly as a future science educator. Over the course of this project I have experienced not only the rewards of research but perhaps most importantly the challenges that must be faced and overcome. I have also developed an even stronger interest in astronomy and more fully realize the importance of integrating its study into high school science curriculums that too often leave astronomy out. Astronomy is, after all, the study of the cosmos that we live in, and a truly educated global citizen should have a good understanding of our universe and the value of exploring it. Having had this brief experience in research, which unfortunately not many secondary science teachers have had, I feel uniquely qualified to help inspire my students to pursue a career in science and become the innovators of tomorrow.