MUSE 2016

The College of New Jersey


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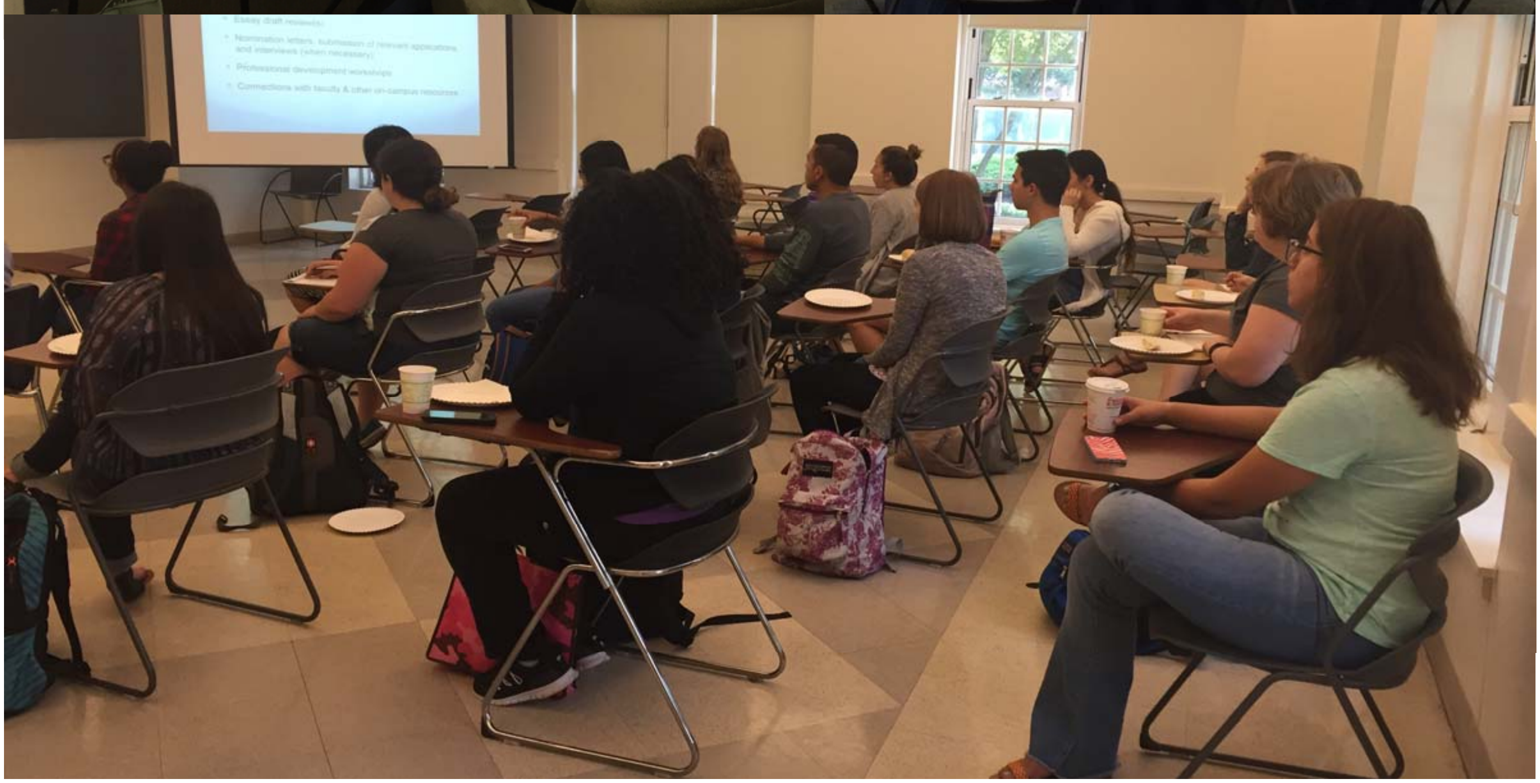
Professional development workshops
Connections with faculty & other on-campus resources

TCNJ prides itself on the teacher scholar model where faculty are not only excellent instructors to our students, but also generate new knowledge or creative projects in their disciplines. TCNJ's 2016 MUSE (Mentored Undergraduate Summer Experience) is the apex of the teacher scholar model by fully integrating faculty scholarship/creative projects with student learning and training. The program brought together 45 faculty members and 81 students from across campus over the course of 8 weeks in the summer where faculty mentors created a transformative educational experience for students while pushing their scholarly agendas forward.

The key to the success of MUSE is that students study at the cutting edge of their faculty member's discipline to generate new knowledge without the confines of student class schedules. Students develop the scholarly questions and the processes to answer the scholarly questions with their mentor. Students learn the importance of the background and context of their mentor's project when pushing the boundaries of current knowledge. They quickly learn that big scholarly questions must be broken into achievable outcomes by limiting the scope based on their current resources. TCNJ's MUSE students are ready to continue to tackle world problems through their disciplines by finding smaller steps towards the overall goal.

This training to think like a scholar is important to the future workforce. These skills are critical to the workforce so that MUSE students can become leaders and problem solvers in their careers. The MUSE students learn excellent resilience and alternate strategies when projects do not proceed as planned. Students solve problems where the solution may never have been done before and many find out they may be the only person to ever try to solve this problem. Graduates will be ready to solve critical problems in their careers because they have already tried to solve a major problem.

This strategic priority to enrich our scholarly community on campus could not have been done without the financial and personnel support of many groups and people. The Director and all the students and faculty of MUSE thank the Office of Academic Affairs with leadership from Provost Jaqueline Taylor and Associate Provost Kit Murphy and invaluable administrative support from Norma Garza and Jessica Stover, as well as assistance from student worker Melissa Albert. We thank the Offices of Residential Education and Housing, Conferences and Meeting Services, Catering Services, Finance and Business Services, and every School and Department office and Chair with MUSE students for their administrative support. We thank the Faculty Student Collaboration Program Council for guiding the vision of MUSE, reviewing proposals and recommending funding: Anthony Deese, Constance Kartoz, Jerry Petroff, Susan Ryan, Nicholas Toloudis, and FSCPC Chair Curt Elderkin.

The development of our students would not be possible without the generous support of TCNJ and external organizations. We would like to thank the following organizations: Bristol-Myers Squibb, The National Science Foundation, Research Corporation for Scientific Advancement, Petroleum Research Fund, National Library of Medicine, TCNJ Academic Affairs, TCNJ Foundation, TCNJ School of Science, TCNJ School of Arts & Communication, and TCNJ School of Engineering.

—Dr. Jarret Crawford, Director of Faculty-Student Scholarly and Creative Collaborative Activity

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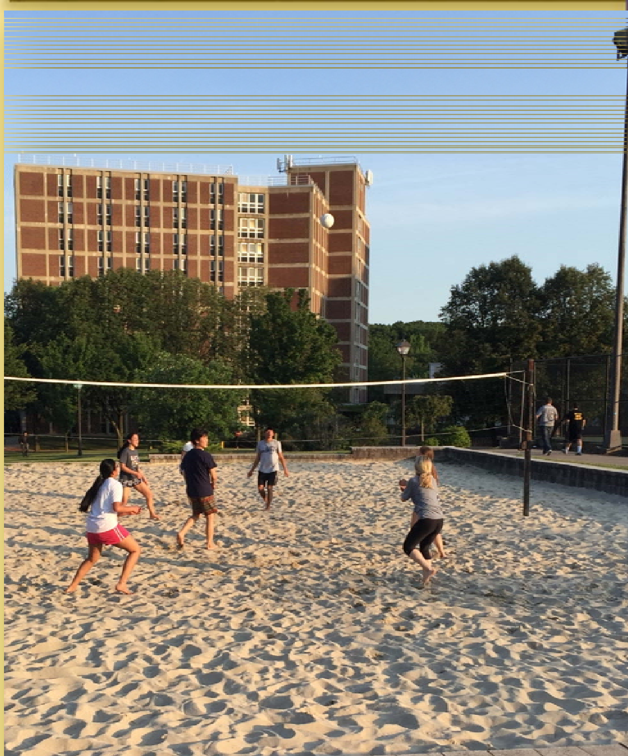
What the office offers
to students




EXIT


Class of 2018


Why I Teach.

Just Looking; Staging Points of View through Art (Part 2)

Alyse Delaney
Faculty Mentor: Professor Liselot van der Heijden (Art and Art History)

Our MUSE project concentrates on video installations for exhibitions. The project consists of multiple video recordings of actors in New York City from several simultaneous viewpoints. In the final installation of multiple video channels these viewpoints will be shown at the same time in monumental scale to create an immersive experience. These multiple, simultaneous viewpoints challenge preconceived ways of viewing time-based images and place the audience in a fragmented space, one that implies an exchange between the various perspectives while subverting the idea of sequential images as cohesive linear narratives. We also work on a related series of still photographs, prepare grant proposals for future projects and design an artist web project.

Alyse Delaney - Personal Statement: Participating in the MUSE Program has allowed me to strengthen both my technical art-making skills as well as my professional development skills. A large part of our project consists of sharing time between campus and Professor van der Heijden's studio at the Elizabeth Foundation for the Arts in New York City. This has given me the opportunity to fully immerse myself in the New York City art world. In addition to spending time on our project, I have been using my summer in New York to visit contemporary art museums, attend gallery openings for current exhibitions, and sit in on studio visits and meetings with other art world professionals. These experiences are providing me with a crucial understanding of how the New York City art world functions. Overall, participating in the MUSE program is giving me the opportunity to develop all of the necessary skills for a future sustainable practice as a professional artist.

SHE-SEA (Project 1), Global Kettles (Project 2), and Book Arts, Handmade Paper, and Laser Cutting (Project 3)

Kristina Robold
Emily Vogel
Faculty Mentor: Professor Elizabeth Mackie (Art and Art History)

S*HE-SEA*: In collaboration with the Independence Seaport Museum in Penn's Landing, Philadelphia Sculptors has launched "Artship Olympia," an exhibition of site-specific installations aboard the Cruiser Olympia, the oldest steel warship afloat in the world. MUSE mentor Elizabeth Mackie is one of the artists invited to participate in this exhibition, and the student collaborators have assisted her in the creation of an immersive installation. SHE-SEA—an installation of draped fabric, projected video, and sound—explores the history of how the sea has traditionally been referred to as a woman. For this project, members of the group light-proofed the space with blackout curtains and have engaged with the space by creating a volumetric "ocean" with draped netting. Underwater audio and digital video of dresses, hair, and water for the projections have also been recorded. After the exhibition opens, all installations aboard the Artship Olympia will also be documented.

Global Kettles: For this second project, the MUSE team will begin by making six works from large-scale sheets of handmade paper. For this, the chemistry behind pigmenting will be used in order to dye the paper pulp various colors before spraying it onto hand-stretched screens. Imagery will then be applied by hand-cutting. The projects will be installed in a gallery space and photographic documentation of the artwork will be taken.

Book Arts, Handmade Paper, and Laser Cutting: For the third project, the group will make small books using laser cutting and book making techniques and will experiment with pulp painting techniques.

Trenton Makes Music

Patrick Roderman
Gabriel Salazar
Christopher Tenev
Faculty Mentor: Professor Kim Pearson and Dr. Teresa Nakra (Journalism, Music, and International Multimedia)

We are working on a project with additional funds from the New Jersey Council for the Humanities to document the rich history of music-making in Trenton. Our project goals include:

- an accessible, searchable archive of information, interviews, and podcasts at trentonmakesmusic.org

- analytics and community outcomes from our website and social media outlets (facebook, twitter). Both the website and mobile platforms will employ social media extensions and online fora that will allow site interactors to comment upon and contribute to the site's content. Social computing tools to encourage interaction will be employed, such as voting systems for comments and tools for sharing and recommending content.
- active participation in musical events and conversations by current Trenton students and community members
- increased communication, prominence, and value of cultural assets and civic institutions in community planning
- increased data related to cultural heritage available for the Trenton Historical Society
- stimuli for scholarly interest in this topic among universities and institutions of higher learning in central New Jersey and beyond
- to foster collaboration between faculty and students at TCNJ and the surrounding community built upon a sustainable approach to preserving the region's cultural heritage

Project Background: Known anecdotally as the spot where the American Revolution turned a corner toward victory, Trenton was a thriving industrial powerhouse along the Delaware River for most of its history. Beginning in the mid-twentieth century, however, things started to get complicated when the local manufacturing base began to diminish. Since that time, Trenton has struggled to maintain its economic and cultural vitality. Nowhere is this struggle more poignantly expressed than on the Lower Trenton Bridge, which, since 1935, has featured large lettering that reads: "Trenton Makes | The World Takes". The Trenton Makes Music project calls attention to the little-studied but significant role that musicians and institutions in New Jersey's capital city have played in the city's formation, growth, and revitalization efforts. This project will contribute to historical knowledge while stimulating conversations across cultures and generations that will help to boost civic pride, as well as support ongoing efforts toward cultural revival. The overarching purpose of our proposed project is to apply the "Trenton Makes" motto to contextualize musical culture as an important driver of cultural memory, identity, and economic development. Research has shown that the artistic heritage of a community can be a great catalyst for cultural and economic development – amply demonstrated in other New Jersey cities such as Asbury Park, Red Bank and Newark. Indeed, Trenton itself has invested substantially in arts and heritage tourism over the years, sometimes with great success. Events such as the annual Trenton Jazz Festival were a staple of the 1990s, waning as a result of the city's downturn during the Great Recession and its aftermath. The current mayoral administration has stated that developing the city as an arts and tourism destination is a key element of its strategic plan . Documenting and preserving the city's musical history would contribute significantly to that effort.

Effects of Paid Parental Leave on Employment in the United States

Josh Reed
Faculty Mentor: Dr. Donald Vandegrift (Economics)

Our project seeks to capture and quantify the effect of New Jersey's paid parental leave policy. New Jersey is one of only two states in the United States to have enacted such a policy and therefore, it provides a unique opportunity to view paid parental leave in action before it becomes the norm throughout the country. Proponents of the policy cite benefits to child development as well as employment equity while detractors argue that the policy will discourage employers from hiring and specifically harm demographic groups most likely to take parental leave. The project will utilize a difference-in-difference design to observe a natural experiment using counties on either side of the Delaware River as the subjects. These counties operate in the same labor market due to their geographic proximity and relative similarity. Counties on the Pennsylvania side will serve as the control group and counties on the New Jersey side will serve as the treatment group. We have located an incredibly detailed dataset of quarterly workforce indicators that should provide us with the necessary data for a thorough analysis of this issue. Overall, this project should provide valuable insight on a controversial issue.

Understanding the Economic Impact of Urban Street Grids: Evidence from a Natural Experiment in Manhattan

Daniel Nason
Faculty Mentor: Dr. Trevor O'Grady (Economics)

This project investigates a key institutional platform through which many modern urban economies developed—the rectangular street grid. A remarkable amount of urban land throughout the world has been consciously demarcated into systematic rectangular grids and represents a single decision that / has dramatic effects on the infrastructure, density, and flow of a city. Though the importance of urban grids has attracted significant scholarly attention over time and from a variety of disciplines there has been a lack of rigorous economic analysis of this geographic phenomenon and its influence on urban development. This project attempts to fill this gap by investigating a natural experiment in Manhattan, where in 1811, city officials took unprecedented measures to implement a systematic rectangular street grid for areas of the island that were not yet densely settled. The uniform system was and remains today a sharp contrast to the haphazard layout of Lower Manhattan. Our analysis will use both historical and contemporary lot-level data to compare land values, building density, and public infrastructure provision within Manhattan's grid to similar areas just outside the grid. While assisting with this research I have taken on numerous tasks including reviewing relevant academic literature, managing and cleaning of historical data, and statistical data analysis. In particular, I developed programming skills within Stata 14 to help manage messy data, and with the guidance of Dr. O'Grady, further enhanced my ability to analyze and visualize data in statistically defensible ways.

An Ideal School of Education/Middle School Partnership

Joshua Fausti
Faculty Mentor: Dr. Jonathan Ryan Davis (Educational Administration and Secondary Education)

This project examines the inter workings of a partnership between a collegiate School of Education and a Middle School. Within the "partnership" there are a few major components, they are: a summer institute for professional development, an interdisciplinary grade level specific project, and a student teaching program. For this project we used observational data and interviews to examine the effectiveness of each component and how it can be improved for TCNJ and for other colleges to model.

Interdisciplinary Projects and their Impact on Urban Middle School Students

Nicole Rivera
Faculty Mentor: Dr. Jonathan Ryan Davis (Educational Administration and Secondary Education)

This project analyzes the use of interdisciplinary projects within a middle school educational setting. The project focuses on Kilmer Middle School, a public urban school in Trenton, New Jersey. Within the school, teachers implemented grade-specific interdisciplinary project. This project focuses on the outcomes of that project, both positive and negative, and the impact an interdisciplinary project can have on students in an educational setting, more specifically focusing on its impact on urban students engagement and motivation.

Immigrant Preschoolers in New Jersey Project: Investigating Cultural Beliefs and Practices in Early Childhood Classrooms

Jennifer Choi
Alejandra Meneses
Faculty Mentor: Dr. Kim-Bossard (Elementary and Early Childhood Education)

The Immigrant Preschoolers in New Jersey Project is a video ethnographic study that borrows from and seeks to extend the literature in the field of early childhood education and educational anthropology. This project investigates cultural beliefs and practices in early childhood classrooms that are often unidentified or ignored. Compared to their domestic counterparts, immigrant students and families face daily challenges both in and outside of school because school staff and members of local community often do not recognize the different cultural norms that children learn at home. Preschools are often one of the first places that immigrant children are formally introduced to cultural customs of American society and therefore play a critical role in their adjustment and well-being. The state of New Jersey, in particular Mercer County, is a desirable location to conduct this research due to the rapidly increasing numbers of immigrant families within the state and region (U.S. Census Data). The specific goals for the proposed project are to: (1) produce two 20-minute films of a typical day at two preschools with immigrant students (one film per preschool); (2) conduct one self-contained focus group with teachers, students, parents, and administrators at each preschool (total 8 focus groups) using ethnographic interview methods that examine the cultural norms of interviewees in their natural setting; and (3) transcribe interview data and begin preliminary analysis of themes.

Identifying Best Practices in Video-Prompting Methods for Students with Autism Spectrum Disorders

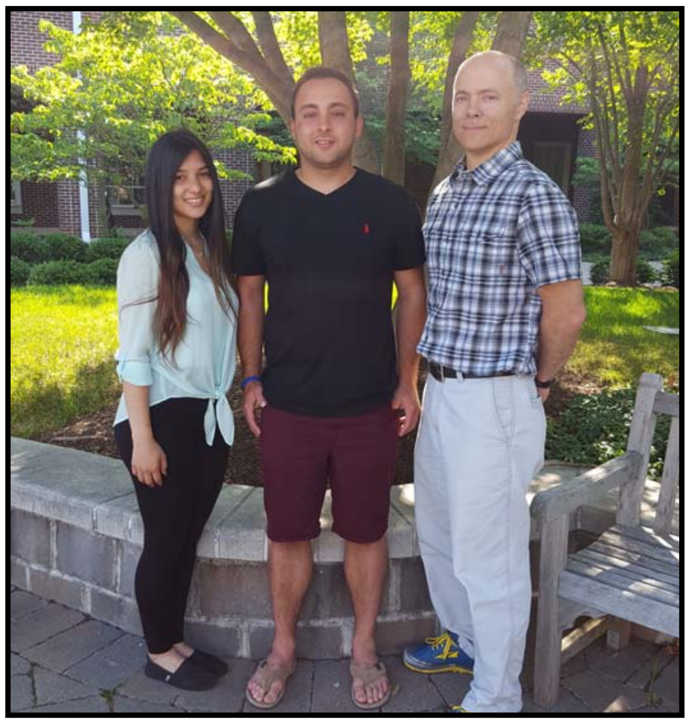
Jennifer Pagliaro
Faculty Mentor: Dr. Sarah Domire (Special Education, Language, & Literacy)

This research focuses on video prompting, a form of video modeling where a video of someone performing a target skill is shown to a student. However, unlike video modeling where the video shows the performer completing the entire task, video prompting breaks the task into clear and definitive steps. These steps are typically broken down into clips that are less than 30 seconds in length and the student is asked to perform each step before the next clip in the video sequence is viewed. This method is an effective tool in teaching students with disabilities who may need more gradual and focused practices when learning new tasks. When information is presented to students in small segments, it can allow students to gradually attain the steps required to perform the desired skill while gaining confidence regarding their performance. Our project works to analyze and synthesize the existing literature on video prompting and related disciplines to determine the best practices and guidelines to make these videos as effective as possible for use in the classroom.

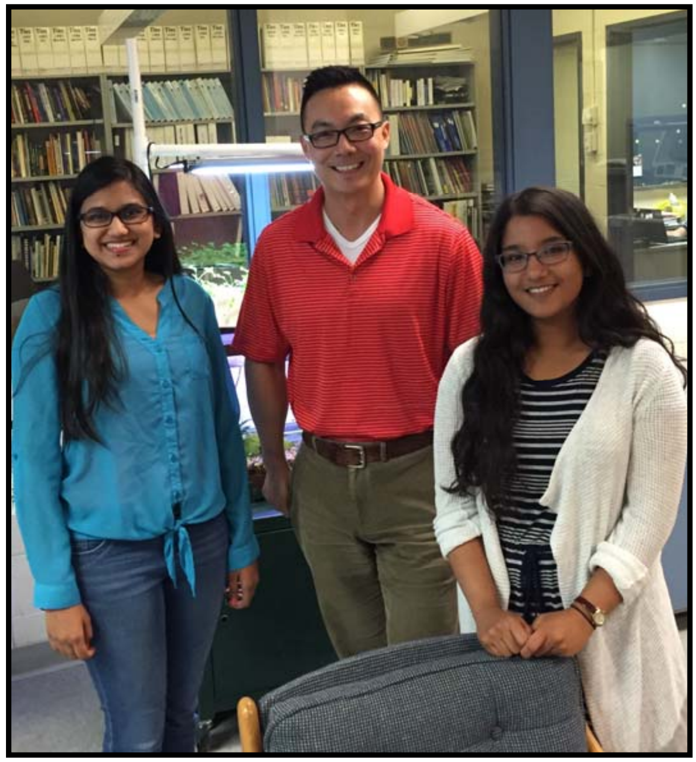
School of Engineering

An Effective 5-Finger Exoskeleton for the Human Hand

Dayberkis Arias
Christopher Gearhart
Faculty Mentor: Dr. Brett BuSha (Biomedical Engineering)



Over 450,000 Americans currently suffer from debilitative disorders that decrease hand function. The objective of this research effort is to design and implement a powered glove-like exoskeleton for the human hand to improve pinching and grasping finger movements. Preliminary design work will be completed using SolidWorks, a computer-based three-dimensional (3D) modeling and simulation software environment. Prototype designs will be manufactured using a 3D polymer printer that is located in Armstrong Hall. Pressure sensitive sensors will be added to the inside of the fingertips of the exoskeleton and a wrist mounted Arduino minicomputer will be interfaced with the sensors. Three linear electric motors will be controlled by the Arduino and provide assistive forces to the exoskeleton's digits. The device will be powered by 9-volt alkaline batteries. With TCNJ IRB approval, healthy adults over the age of 18 will be recruited to test the functionality of the exoskeleton through force production efforts and pinching and grasping tasks, such as picking up a pencil, a water bottle and/or an apple. The electrical activity of the skeletal forearm muscles (EMG) and grip force will be recorded using BioPac, a human signal data acquisition hardware and software package. We hypothesize that when the exoskeleton device is activated, subjects will use less muscle force, objectively assessed using EMG, when using the device, as compared when the device is unpowered or not used. If functional, the powered exoskeleton would allow subjects to more easily grasp items for a longer period of time as compared to bare-handed grasping efforts.



Computational Modelling of Axon Block as a Mechanism of Deep Brain Stimulation

Amulya Veldanda
Faculty Mentor: Dr. Xuefeng Wei (Biomedical Engineering)

The objective of the project is to investigate computationally the effects of extracellular potassium accumulation on blocking nerve impulses in hippocampus of rat brain as a possible mechanism of deep brain

Optimization of Fractal Electrode Geometries for Neural Stimulation

Aakhila Rameeza
Faculty Mentor: Dr. Xuefeng Wei (Biomedical Engineering)

The objective of the study is to optimize efficiency of fractal electrode designs for a variety of neural stimulation applications and targeted nerves. Specifically, this study will investigate the optimization of planar fractal geometries when surface stimulation is required, such as cortical stimulation, as well as the optimization of needle-shaped fractal geometries when tissue is required, such as deep brain stimulation. The electrodes are designed in Solidworks and evaluated in COMSOL Multiphysics. Additional programs, NEURON and Matlab, are used to analyze data and generate recruitment curves.

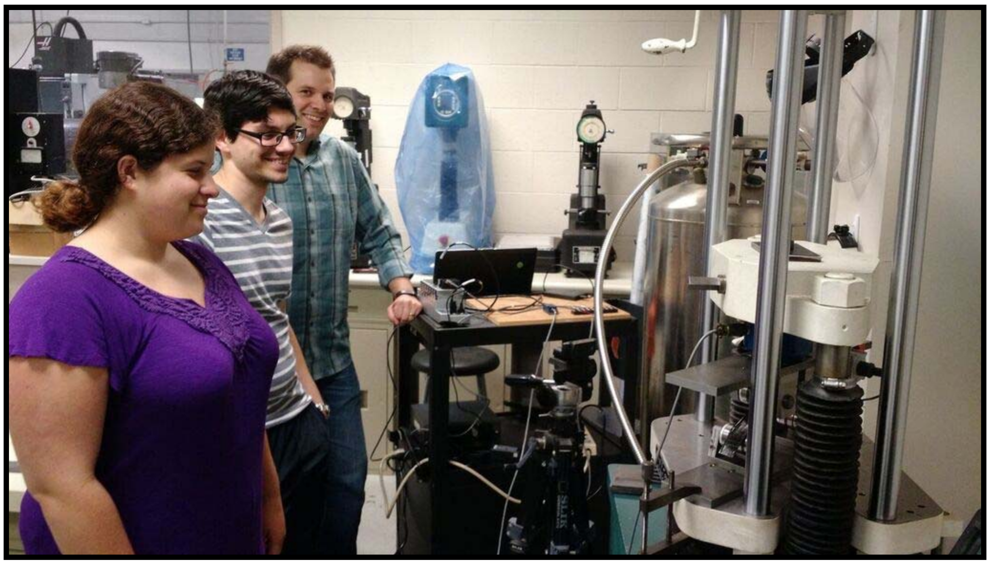
Radiation's Effects on Bone Strength

Steven Ayala
Alexander Borg
Faculty Mentor: Dr. Anthony Lau (Biomedical Engineering)

Rat test subjects were exposed to radioactive activity in an effort to correlate loss of bone strength and sensitivity to radiation exposure. Because the bones are on such a small physical scale, unique measures must be taken in order to test their physical strength after this irradiation. Computer modeling software was employed to design multiple machine attachments which interface with the rat femurs in a physiologically accurate manner. Such attachments will be connected to a larger machine that breaks the rat femurs and the maximum force they are able to withstand. Finite element modeling of the femurs of the afflicted rats was conducted with supporting micro-CT scan data to confirm the bone mass deterioration. These results will be correlated to those from existing studies – namely that of Dr. Katie Davis at Johns Hopkins University – while setting a foundation for future studies in this field of research. Because there is typically minimum radiation inside earth's atmosphere, this is a clinically relevant study for the health of astronauts – humans which are not protected by earth's atmosphere. Prolonged exposure to an environment beyond our atmosphere still maintains a variety of induced traumas to the human body – whether acute or chronic – that requires research to move toward a preventative solution. Both unloading and heavy ions pose health risks to tissue with the effective magnitude of each being unspecified by the National Aeronautics and Space Administration (NASA).

Creation of Test for Composite Tube Samples

Lauren Santullo
Alberto Torres
Faculty Mentor: Dr. Andrew Bechtel (Civil Engineering)



To achieve the goal of developing a method to determine material properties of composite hollow cylinders, tests on metal tubes were first completed. To determine the actual material properties, metal and composite rectangular coupons were prepared and tested. While the properties were determined, relationships for deflection and stress of curved beams in a proposed apparatus were developed. Composite and metal arc samples were then prepared and tested. Data collected was used to accurately predict the modulus and yield strength of the arc samples. Students became familiar with ASTM tests, especially those focused on composite materials. They gained experience with data acquisition software, and analyzing the resulting data. This included the use of Excel, AutoCad, Mathmatica, ImageJ, and Labview. The students learned about the implementation of curved beam theory and the expected tolerances associated with structural engineering calculations.

An SOR-like Method for Model Predictive Control

Haley Blanchard
Faculty Mentor: Dr. Ambrose Adegbege (Computer and Electrical Engineering)

This project proposes a novel iterative method for solving convex quadratic programming problems, which involve the optimization of a quadratic function with multiple variables subject to linear constraints. The proposed method utilizes a matrix-splitting scheme and can handle problems involving both upper and lower bounds in addition to equality constraints. The corresponding algorithm can easily be implemented and can be tuned for optimum performance and global convergence. The method's performance is analyzed and compared with those of other well-known existing methods via Matlab simulations. The proposed method has prospects in machine learning and in embedded control, where optimization problems in the form of a quadratic program must be solved quickly and accurately in the shortest time using limited computational resources.

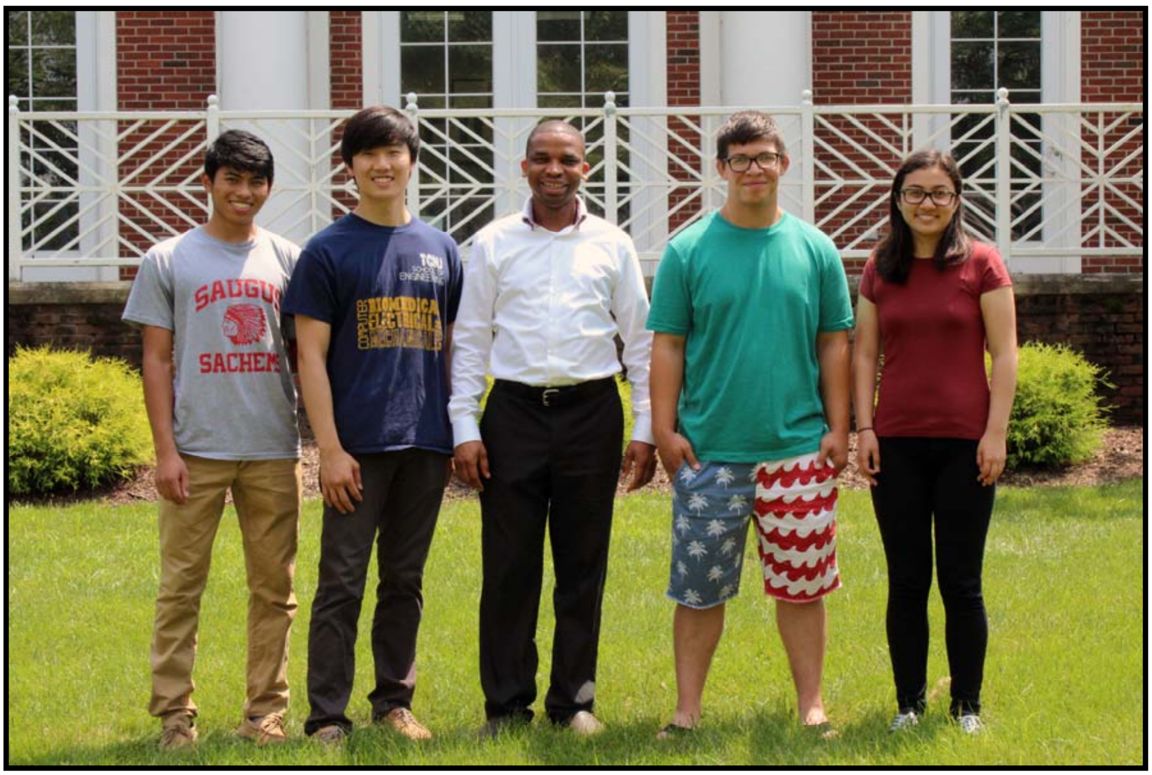
Constrained Primal-Dual Gradient Dynamics and Applications to Economics Dispatch

Munyoung Kim
Faculty Mentor: Dr. Ambrose Adegbege (Computer and Electrical Engineering)

The research project studies a continuous-time approach to convex optimization using analog recurrent neural network emulation of the associated constrained gradient dynamics. The applications of the approach are in an economic dispatch problem and active power loss minimization problem, which deal with minimization of power generating costs, adjustment of power supply and demand, while accounting for constraints such as voltage and thermal limits on transmission lines. These problems are classic examples of convex optimization problems. With my principal investigator Dr. Adegbege, I developed a mathematical model enumerating analog recurrent neural networks for optimizing these problems. We successfully simulated the model through MATLAB. The research will continue following the conclusion of MUSE with a goal of submitting to a peer-reviewed, conference proceeding.

Non Square Anti Windup Control Design for Systems with Saturating Inputs

Brandon Simon
Faculty Mentor: Dr. Ambrose Adegbege (Computer and Electrical Engineering)



The focus of my research is controlling systems with saturating inputs. Such systems are commonplace with examples in aerospace, autonomous drones and fast electromechanical systems. Utilizing a new set of conditions for the bounds of the nonlinearity, non square sector conditions, the design of the controller is vastly improved. This was done using linear matrix inequalities(LMI) and numerical computing tools. I will have learned by the end of the research advanced mathematics, use of LMI for control design problems, and the use of MATLAB for solving the LMI problem.

VLSI Approach to Circuit Design for Real-Time Optimization of Control

Sean Fernandez
Faculty Mentor: Dr. Ambrose Adegbege (Computer and Electrical Engineering)

This project proposes a very large scale integration (VLSI) approach to an analog circuit implementation for naturally occurring optimization problems in control applications. The approach utilizes operational transconductance amplifiers (OTAs), which have become a de facto choice for integrated circuit (IC) design due to its compactness, low component count, and tunability via a bias current and ultimately its low-power consumption and high computational efficiency. The analog circuit presented in our research can be broken down into three main components with interconnections between them; the first being a summing amplifier, the second a shaping op-amp, and the third being an integrator op-amp circuit. Implementing each component using the OTA technology yields a circuit solution that can easily be prototyped on a fast analog processor or miniaturized using the VLSI technique. The results are promising and offer a new paradigm for real-time implementation of advanced control algorithms.

Study and Development of Audio Processing Algorithms for NAO Utilizing Stochastic Petri Nets

Chelsea Cantone
Faculty Mentor: Dr. Seung-yun Kim (Computer and Electrical Engineering)

The objective of this research is to review audio processing techniques and develop algorithms using stochastic Petri nets (SPN) that improve audio recognition. The research will study Petri nets (PNs) and Stochastic Petri nets (SPNs), including Markov theory such as the Markov chain, Markov reward model and Markov regenerative process. To demonstrate the efficiency of developed algorithms, simulations will be run in the Petri net simulation tool, such as HPetrisim and PIPE2.

Time Petri Nets as Applied to Optimal Kicking Motion of Nao Robots

Daniel Ponsini
Faculty Mentor: Dr. Seung-yun Kim (Computer and Electrical Engineering)

The focus of this research is to develop a kicking algorithm for the Nao robot and model the system using Time Petri nets. Time Petri nets are an extension of basic Petri Nets with time constraints incorporated in order to increase the complexity of the modeling capabilities. The research will focus on different applications of Petri nets and develop various methods and techniques for a Nao to kick a soccer ball. These methods can then be used towards creating a team to participate in the RoboCup.

Towards Efficient Pattern and Gesture Recognition Algorithms using Colored Petri nets in a Nao Environment

Kieutran "Theresa" Pham
Faculty Mentor: Dr. Seung-yun Kim (Computer and Electrical Engineering)

This research will look into algorithms of pattern and gesture recognition while working to develop the artificial intelligence of Naos. Because of the complexity of modeling pattern and gesture recognition, a modeling tool will be used for simulating complicated concurrent processes. Colored Petri nets (CPNs) are graphical and mathematical tools for effectively and efficiently modeling multilevel dynamic systems. CPNs allow for data types and data manipulation through the use of color sets, which are used to define data types and will be helpful when dealing with the more complicated parts of the recognition system. The main research goal is to improve on the computer vision of the Nao robot, and to model that using Colored Petri nets.

Characterization of Barnacle Glue Morphology on Hydrophobic Surfaces

Madison Mastroberte
Lovejot Singh
Faculty Mentor: Dr. Manuel Figueroa (Technological Studies)

In our MUSE 2016 project, students will be introduced to silane chemistry to make hydrophobic surfaces to reduce barnacle adhesion. We are also studying if there are morphological differences in the remnants of barnacle glue adhered to the hydrophobic coatings. The morphology of the barnacle glue will be characterized by taking SEM micrographs and AFM images of the samples. We are using ImageJ to analyze the structures found in our images.

Professional Teaching Identity and Lesson Plan Development

Marissa Capobianco
Marilyn Widman
Faculty Mentor: Dr. Courtney Faber (Technological Studies)

Our MUSE project seeks 1) to understand how technology/engineering education (Tech. Ed.) students come to see themselves as a teacher, 2) to examine the processes these students use to develop lessons, and 3) to explore the connections between teacher identity and lesson plans. There are two separate aims of the project. Aim 1 is Teacher Identity Development. Data was collected from Dr. Faber's junior practicum class over the course of the spring 2016 semester. This data is reflective of the way these students see and identify themselves as a teacher. We hope to see change over the course of the semester, as well as evidence of the students developing professional identity. / Aim 2 is Lesson Plan Development. Data was collected from the same group of students, but this time includes lesson plans the students wrote as groups and individually, and personal accounts of how they went about writing the lesson plans. We will use open coding to analyze this data so to add to the very little knowledge there is on this topic so far. We are looking to see in what ways students use their resources (content knowledge, pedagogical content knowledge, goals of the course, and curriculum standards) to write their lesson plans.

School of Humanities and Social Sciences

From "Ujamaa" to Structural Adjustment
Taylor Hart-McGonigle
Faculty Mentor: Dr. Matthew Bender (History)

The chief goal of this project is to gather research for and structure the arguments of the seventh and eighth chapters of Dr. Matthew Bender's book: Water Brings No Harm: Knowledge, Power, and the Struggle for the Waters of Kilimanjaro, Tanzania. The book will examine water usage on Mount Kilimanjaro from the early nineteenth century through the present. The book explores the Chagga, an agrarian people who have long lived on the mountain, and the challenges to their perceptions of water that they have faced through encounters with people foreign to the mountain. Water's importance to the Chagga, both as a basic human need and its role in religious beliefs, cultural practices, social relations, and identity formation will be studied in depth. This portion of the project will produce research for the seventh chapter in Water Brings No Harm. The chapter aims to focus on the Chagga's conceptualization, use, and management of water resources from the 1980s until the present. This chapter begins with the transition from the socialist ujamaa policies to neoliberal economic policies following the election of President Ali Hasan Mwinyi in the mid 1980s. The chapter continues to cover the various structural adjustment policies, national-building policies, and bureaucratic structures implemented in Tanzania that fundamentally impacted water resource management and the perception of water resources. It includes the involvement, influence, and intersection of supranational, foreign national, and domestic organizations. Finally, the chapter will cover the current issues and challenges regarding water usage.

Global America in the Twentieth Century
Justine Thomas
Katheryn Wertheimer
Faculty Mentor: Dr. Robert McGreevey and Dr. Christopher Fisher (History)

For the summer of 2016, Katie Wertheimer and Justine Thomas helped Drs. Robert McGreevey and Christopher Fisher revise their co-authored book manuscript entitled, Global America in the Twentieth Century. Global America is under contract with Oxford University Press with a planned publication date of 2017. This book is one of the first to synthesize for undergraduates new scholarship on the historical relationship between America and the rest of the world. Global America will be used in college courses on US foreign policy, and the history of the US in the World. Katie and Justine have been instrumental in providing the final details--maps, graphs, charts, pictures, and edits--necessary for Global America to go into production.

It is God's Will, and also Deforestation
Ryan McClean
Faculty Mentor: Dr. Matthew Bender (History)

The chief goal of this project is to gather research for and structure the arguments of the seventh and eighth chapters of Dr. Matthew Bender's book: Water Brings No Harm: Knowledge, Power, and the Struggle for the Waters of Kilimanjaro, Tanzania. The book will examine water usage on Mount Kilimanjaro from the early nineteenth century through the present. The book explores the Chagga, an agrarian people who have long lived on the mountain, and the challenges to their perceptions of water that they have faced through encounters with people foreign to the mountain. Water's importance to the Chagga, both as a basic human need and its role in religious beliefs, cultural practices, social relations, and identity formation will be studied in depth. The project will also produce research on the eighth chapter of the book, which will focus on the rapidly shrinking glaciers of Kilimanjaro. Since 1912, the glaciers have decreased in size by more than 85%, and some scientists estimate that they could vanish entirely by as early as 2022. What exactly is causing the ice caps to melt at rates unprecedented in the Holocene is a question still lacking a definitive scientific answer, but this chapter will explore all of the possible explanations offered by the scientific community. The main source of disagreement between climate scientists on the state of Kilimanjaro's glaciers is whether the melting is due primarily to global climate change or more regional environmental factors. The chapter will also focus on the Chagga communities, and their perceptions of the state of the glaciers. Their more intimate connection to the mountain, and their understanding of its glaciers in a historical context that can easily be missed by climate scientists will be explored in detail. In a chapter focusing on the mountain in a global setting, the telling perspectives and concerns of the people living on it will not be overlooked.

Employee Coaching

Claudia Gargano
Brittany Wetreich
Faculty Mentor: Dr. Jason Dahling (Psychology)

We are conducting a literature review of prior employee coaching research that we will submit for journal publication. This involves extensive research of the existing studies concerning employee coaching, pulling out relevant articles, creating an outline and submitting it to the journal editor, analyzing data and configuring charts and graphs, and writing the actual review.

Event-Related Potentials and Encoding Focus in Source Monitoring

Brittany A. Mok
Faculty Mentor: Dr. P. Andrew Leynes (Psychology)

This project involves the research, application, and analysis of additional cognitive-behavioral models to an existing data as well as the development of a research paper. The purpose of this study was to use ERPs to examine the effect of encoding focus on source monitoring, the process of determining the source of a memory based on the qualitative characteristics and cognitive processed involved during the encoding of the memory. In this study, we used ERPs to examine the effect of that varying the encoding focus would have on source memory. Participants studied words spoken aloud by two voices and were instructed to focus on whether they liked the words or whether the speaker liked the words, producing two encoding contexts. During a subsequent memory test, we tested participants on their memory for the source of the studied words. In this project I am learning how to manage and analyze data through statistical analyses as well as develop the infrastructure to apply new cognitive-behavioral models in order to examine the data through different angles. The project integrates interdisciplinary methodology to examine the cognitive and neurobiological nature of recollection memory, allowing me to develop the skills of synthesizing information and communicating it concisely.

Testing Competing Psychological Hypothesis on the Effects of Threat on Political Attitudes

Victoria Germano
Faculty Mentor: Dr. Jarret Crawford (Psychology)

During MUSE 2016, Dr. Crawford and I are exploring how an individual's political orientation changes when they are threatened. The two competing hypotheses that we are testing are the conservative shift perspective and the worldview defense perspective. The conservative shift perspective suggests that when threatened, an individual will become more conservative. The worldview defense perspective suggests that an individual will hold on more strongly to their prior beliefs after being threatened, meaning liberals will become more liberal and conservatives more conservative. By conducting extensive literature reviews on this topic, we will focus on their strengths and weaknesses in order to develop quality experiments to better adjudicating between the two competing hypotheses. I will be strengthening the statistical analysis skills I have acquired from previous classes, in addition to drafting APA style reports.

Women's Responses to Ethnic Health Disparity Information

Jenna Maurer
Faculty Mentor: Dr. Barnack-Tavlaris (Psychology)

This summer, we are working to extend previous research that has investigated how Hispanic women respond to health disparity information regarding cervical cancer. We will be collecting data from a comparison sample of White women through an online survey, and analyzing the effect of different presentations of health disparity information on various outcomes. We will see how the type of fact sheet that the participants are exposed to about cervical cancer affects their affect, perceived risk, and behavioral intentions. Based off of our findings, we will also design future studies to further the body of research in this field.

School of Humanities and Social Sciences/School of Nursing

College Student Employment, Socio-Economic Class, and Consumption

Yani Aldrich
Melissa Reed
Faculty Mentor: Dr. Miriam Shakow (Sociology and Anthropology)

How does socio-economic class affect students' time for academic work? How do students of all socio-economic classes make decisions about how to spend their time and money? What are the factors that shape which low-income and first-generation students drop out or suffer low grades? What role does employment as students play in these outcomes? These questions are at the core of the democratic promise of higher education, yet we still do not have a good understanding of the answers. To date, scholars have primarily approached these questions through quantitative surveys, which do not allow us to understand students' perspectives and experiences with clarity. This research project addresses these gaps in our knowledge by eliciting students' narratives of particular instances in which they made decisions about paid employment, about their relationships with their parents and other members of their support networks in regard to paid employment, how they spend money, and the ways in which they managed the demands of paid employment and academics alongside their social lives, leisure time, and extra-curricular activities.

School of Nursing

Parental Perceptions of Improved Confidence and Fitness by Girls on the GLOW

Danielle DeGraw
Marissa Hazel
Faculty Mentor: Dr. Laura Bruno (Health and Exercise Science)

Our project was designed to examine if (1) aerobic fitness and improved confidence (defined as self-esteem and overall wellness) occur as a result of participation in the Girls on the GLOW program, and (2) if parental perceptions offer an accurate measure of such confidence. We worked with the GLOW program which is located in Mullica Hill, NJ. Approximately 30 girls (6-12 years old) self-selected to meet once weekly for 75min each, over a period of 8 consecutive weeks to engage in the

GLOW training and curriculum. During these 8 weeks, we collected pre and post-data. Subjects completed the FitnessGram PACER test to assess aerobic fitness levels, as well as completed the Kid-KINDL ® Quality of Life Questionnaire for Children (Ravens-Sieberer & Bullinger, 2000) which assessed perceived self-esteem and overall wellness (confidence). Additionally, parents/guardians were asked to complete the corresponding Parents' Questionnaire KINDL ® (Ravens-Sieberer & Bullinger, 2000) as well. Our hypothesis is that as aerobic levels improve, so will confidence (noted as perceived self-esteem and overall wellness). Our second hypothesis is that parents/guardians will report their daughters to have higher levels of perceived self-esteem and overall wellness than the subjects report.

Examining the Health Disparities and Psychological Struggles Experienced by LGBT Youth: An Empirical Review of the Literature

Chaya Himelfarb
Faculty Mentor: Dr. Tracy Perron (Nursing)

This MUSE project consists of two parts. Part one encompasses a literature review examining the health disparities and psychological struggles experienced by LGBT youth related to bullying. Part two we have created a comprehensive information packet that will inform school nurses of the health challenges and psychological struggles facing LGBT youth that they may refer to when caring for these students.

School of Science

Testing Golden King Crab Samples for Shell Strength

Lalitya Karra
Faculty Mentor: Dr. Gary Dickinson (Biology)

Using equipment to test hardness and thickness of different crab samples, we plan on understanding the potential different effects of specific pHs on crab carapaces and claws. Hardness is tested by measuring how resistant the carapace or claw sample is to a given amount of force and thickness is measured using microscopic tools. These two measurements will offer an idea on how the different pHs of 7.5, 7.8, and 8.1 affect the ability of the golden king crabs to form strong outer layers to protect themselves.

Biological Responses in Barnacles to Ocean Acidification and Climate Change

Lalitya Karra
Shrey Patel
Faculty Mentor: Dr. Gary Dickinson and Jessica Nardone (Biology)

The lab procedure calls for raising groups of barnacles in eight different environments (different tanks with controlled pH and temperature). The barnacles grow on panels, and there are four panels per tank. The adhesion strength is measured when removing the barnacles from the panels. After growth, the barnacles are dissected and the eggs, internal organs/ body, and base plate are separated. Then, the shell of the barnacle is placed in a liquid Epoxy solution and solidified. Next, the sample is ground and polished in a multi-step process until the sample is smooth and scratch-free. Once polished, the toughness and strength of the base plate and two parietal plates are measured by making at least 30 total indents on the plate, while measuring the diagonals of the indent as well as the crack lengths. Next, the thickness of the base and parietal plate are measured, and all the collected data is statistically analyzed. Throughout this experiment, we learned how to use a polishing machine, a hardness tester, various types of microscopes, and numerous computer programs used for taking and analyzing measurements.

Characterizing the Function of yqgF

Elena Aversa
Katie Bellissimo
Faculty Mentor: Dr. KT Elliott (Biology)

Our lab studies ways in which mutations, or changes in DNA, arise using the soil baciterium Acinetobacter baylyi as a model system. Currently, we are studying a gene in A. baylyi, yqgF, that is found in nearly all bacteria and makes A. baylyi more susceptible to DNA damage from antibiotics and UV light. We are investigating the role of both yqgF and its adjacent gene, yqgE, and whether they work together. Through this project, we are mastering molecular and microbiological techniques including cloning, PCR, electrophoresis, and sequence analysis. This research helps to further our understanding of bacterial antibiotic resistance as well as how new mutations occur.

(Deer) X (Invasives)^2 : Interactive Effects in the Herb Layer of Suburban Forests

Scott Eckert
Ryan Goolic
Marisa Grillo
Kiara Proano
Faculty Mentor: Dr. Janet A. Morrison (Biology)

Suburban forests offer the average person access to nature, house biodiversity, and provide numerous ecosystem services. Expanding human settlements have fragmented these forests and increased their susceptibility to invasions by non-native species. We are investigating the experimental effects of two co-occuring, dominant invasive species (Alliaria petiolata and Microstegium vimineum) and white-tailed deer to better understand the complex, multi-factorial processes that impact the resident plant community. We also observe environmental factors that may influence the forest community. Our work includes, but is not limited to: plant identification, data collection, and data analysis. Through our summer research experience, we have learned visual and interpersonal communication skills, teamwork, and perseverance.
that hatch.

Fieldwork on Alaskan Threespine Stickleback Fish (Project 1) and Evolutionary divergence of learned anti-predator behavior (Project 2)

Meagan Rodriguez
Elizabeth Thoresen
Faculty Mentor: Dr. Matthew Wund (Biology)

During the early part of MUSE, we traveled to Alaska for 2.5 weeks to collect stickleback that will be used in a variety of

experiments in the coming year. We used minnow traps to collect reproductive adults from a variety of lakes and streams that have particular features of interest to our research (e.g., certain types of predators, habitats, etc.). We bred those adults at The University of Alaska, and shipped the embryos back home. As they grow, they will become part of several experiments aimed at studying the evolution of behavior and morphology in stickleback.

The goal of our research is to better understand how animals can evolve to either innately recognize their predators, or instead to learn from experience that predators are dangerous. One might expect animals to evolve an innate recognition system, so that they are always prepared to identify danger. However, animals that are widely distributed, and which therefore encounter many different kinds of predators, may instead rely on learning for greatly flexibility. The threespine stickleback fish provides an opportunity to study these differences within a single species. Previous research in our lab has indicated that some populations of stickleback might rely on learning more heavily than others, so this past year we ran an experiment to directly test this hypothesis. We exposed stickleback from three different populations, which historically encounter different types of predators, to a training regime intended to assess their innate recognition of odors from a predatory trout, and/or their ability to learn to do so. We spent the majority of our time in MUSE gathering data from the videos of these experiments, and are now in the process of analyzing the data. Ultimately, we will relate the differences in behavior to differences in underlying gene expression in the brains of these fish. This work is being conducted in collaboration with colleagues at the University of Illinois.

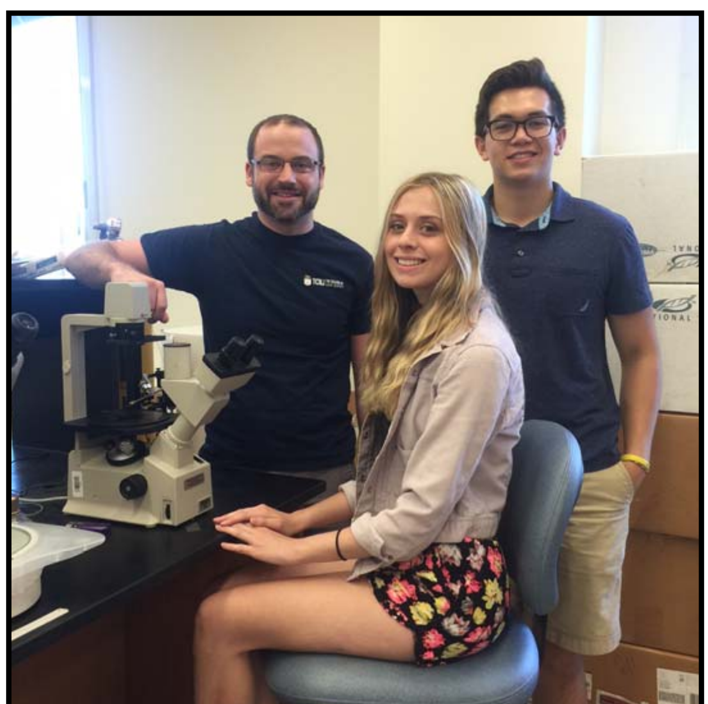
Germline Stem Cell Differentiation in Drosophila

Amanda St. Paul
Faculty Mentor: Dr. Amanda Norvell (Biology)

Stem cells, which have the ability to differentiate into multiple different cell types, must be able to self-renew. A number of factors, both intrinsic and extrinsic, control this cellular division. In Drosophila, the ovaries of wild type females contain approximately 2-3 germline stem cells (GLSC). The GLSCs divide to self-renew and to produce daughter cells that continue to differentiate into the mature oocyte. Our lab has found that females carrying mutations in a RNA-binding protein, Squid (Sqd), and a deadenylase enzyme, Twin, fail to produce eggs. We hypothesize this phenotype is a result of failure of GLSC maintenance. We further suspect that other RNA-binding proteins may cooperate with Sqd and Twin in this process. To investigate, I will quantify the numbers of GLSC in ovaries of females carrying single and double combinations of mutations in these genes. For this project, I will cross sqd and twin fly strains in order to generate flies carrying both mutations. I have also learned how to isolate RNA from tissues, set up PCR reactions, run gel electrophoresis, observe egg phenotypes, dissect female fly ovaries, and view stained GLSCs using a confocal microscope.

Investigating Genes That Regulate Chromosome Segregation in Meiosis

Oscar Dawson
Erika Pianin
Faculty Mentor: Dr. David Wynne (Biology)



Meiosis is the process in which genetic information is divided in half to create eggs and sperm. Incorrect separation of chromosomes in meiosis can lead to infertility and birth defects. Despite the fundamental importance of this process, the mechanisms that ensure proper chromosome separation remain poorly understood. We are using the model organism, C. elegans, to investigate genes that regulate chromosome segregation in meiosis. The localization of proteins to specific regions on chromosomes is necessary for correct segregation. The enzyme, AIR-2, must be present in axis marking the site of chromosome separation for segregation to occur correctly. It is unknown how this localization of AIR-2 is controlled in meiosis. Our goal is to test whether two genes known to control AIR-2 in mitosis also control AIR-2 in meiosis. To test this, we will use the CRISPR-Cas9 system to create custom mutations in these genes of interest. Strains containing custom mutations will be isolated and validated and then these strains will be used to analyze the role of these genes in chromosome segregation. Over the course of MUSE we will be using a variety of recombinant DNA technologies (PCR; DNA extraction, digestion, and ligation; bacterial transformation) as well as genetic analysis of C. elegans and high-resolution fluorescence microscopy. This work will provide us with exposure to the design and implementation of a cutting-edge method of genome manipulation.

Analysis of TTLL mutant embryos and examining the effects of temperature on microtubule severing during meiosis

Monica Martinez
Faculty Mentor: Dr. Nina Peel (Biology)

Microtubles are a component of the cytoskeleton which are also involved in chromosome separation during cell division. C. elegans have 5 enzymes in the TTLL family that glutamylate tubulin. Embryos from C. elegans with mutations in all 5 glutamylating TTLL genes will be stained to examine the effects of reducing glutamylation. Female meiosis requires the MEI-1 protein. The MEI-1 protein forms a complex with MEI-2 that is localized to the polar ends of microtubules of the meitotic spindle as well as the polar ends of meitotic chromatin. Between 20°C and 25°C there is a complete reduction in embryo viability. I will examine viability and define a semi-permissive temperature using C. elegans with a loss of function mutation in the mei-1 gene.

Examining the CCPP-1 Mutation in C. Elegans

Steven John
Faculty Mentor: Dr. Nina Peel (Biology)

Practically all cells have microtubules, which are important for movement and structure of the cell. Microtubules can undergo a variety of post-translational modifications that regulate the function and organization of microtubules. One particular modification is glutamylation, which is the addition of glutamyl units to microtubules. I am working with the CCPP-1 mutation in C. elegans. The CCPP-1 gene is responsible for deglutamylating microtubules when necessary, which is important for the stability of microtubules. I will be determining what effects the CCPP-1 mutation has on C. elegans, at different temperatures, with respect to the number of offspring they have and the number of their eggs laid

Investigating the redundancy of TTLL genes in C. elegans

Pooja Shah
Faculty Mentor: Dr. Nina Peel (Biology)

Microtubules are important for many cellular functions including movement and structure. Many changes to the microtubule occur after they are assembled, including glutamylation, which is the addition of glutamate side-chains to the microtubules. Five ttll enzymes are responsible for this process. My project involves investigating redundancies amongst the ttll genes by determining the phenotypic effects of various combinations of mutations of these genes.

Computational Analysis of the FPPS Protein

Brandon Martinez
Faculty Mentor: Dr. Stephanie Sen (Chemistry)

We used a computational approach to study the FPPS protein. Analysis included docking simulations through the MOE program in order to determine the most probable ligand conformations. The most probable docks were minimized and studied to ensure a probably fit in the active site. Human and Drosophila systems were uploaded into molecular dynamics simulations, and the results were analyzed to determine stability and interaction with ligands. The trajectories were saved and used to generate fluctuation graphs for each residue. Through this analysis, regions of greater instability could be identified and compared to the protein structure.

Enzyme-Enzyme Proximity Stimulates iNOS Activity

Katherine M. Fomchenko
Faculty Mentor: Dr. Donald J. Hirsh (Chemistry)

Nitric Oxide (NO) is a radical gas that serves many important functions in humans, inducing vasodilation and fighting infection. In macrophage immune cells, NO is produced by the enzyme inducible nitric oxide synthase (iNOS), which is expressed in response to stimuli that indicate the presence of an infection, such as lipopolysaccharides and cytokines; the NO released kills the invading bacteria. iNOS's activity is regulated by product inhibition from NO, meaning that the presence of NO slows the rate of the enzyme's activity in producing more NO. In the Hirsh group, experiments utilizing a liposome-encapsulated spin trap (LEST) assay indicate the presence of a non-linear relationship between the concentration of iNOS and its measured activity, contrary to what was expected. Specifically, doubling the concentration of iNOS more than doubled the rate of NO production, and, similarly, halving the concentration produced less than half of the rate observed at the initial concentration. We hypothesize that this effect is due to iNOS having a "self-stimulatory" effect, allowing each enzyme to operate at a faster reaction velocity when in close proximity to other iNOS enzymes. This effect could have biological significance in macrophage cells, where iNOS has been shown to be localized to the cortical actin cytoskeleton, directly below the plasma membrane of the cell, and to small intracellular vesicles called nitroxosomes. This localization, and therefore concentration, of iNOS within the cell, would allow the iNOS to produce more NO per enzyme and thus more effectively eliminate infectious agents. This project aims to confirm this effect in the LEST assay and demonstrate it independently using an oxyhemoglobin-based assay.

Investigating the interactions of ionic liquids with the bacterial adhesin protein FaeG

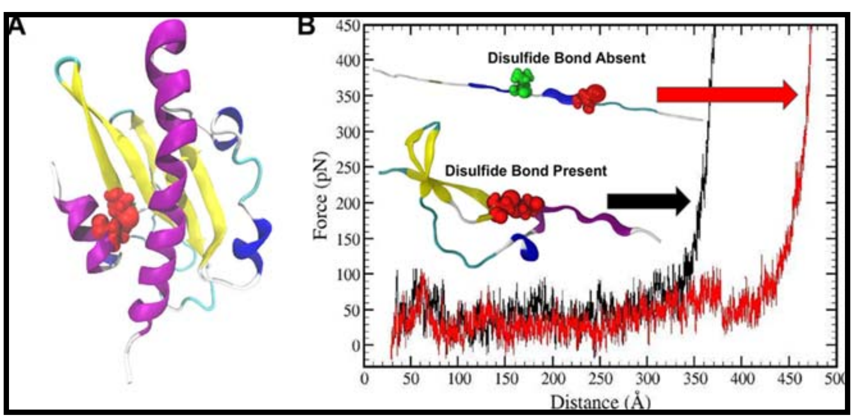
Mattheus De Souza
Faculty Mentor: Dr. Joseph Baker (Chemistry)

Bacterial adhesins are implicated in infection due to their role in attachment to host cells and surfaces. Adhesins generally form long biopolymer filaments that emanate from the surface of bacterial cells, and they “attach” to their targets through non-covalent interactions. As one example, the FaeG protein is the monomer subunit which comprises the F4 fimbriae of a strain of E. coli found to infect the intestinal tracts of piglets. This protein binds to lactose molecules present on glycolipids/glycoproteins exposed on the surface of the intestinal epithelial cells. Disrupting the ability of proteins such as FaeG to interact with their targets could help to mitigate bacterial infection. One potential strategy for disrupting the interactions of bacteria with surfaces is the use of room temperature ionic liquids (RTILs). RTILs have been demonstrated to influence protein structural stability, membrane permeability, and enzyme activity, amongst other applications. There has also been recent work in the area of ionic liquid based materials, and their ability to prevent bioadhesion. Furthermore, due to the large number of potential combinations of cations and anions, RTILs can be fine-tuned to have very specific physical properties. In this study we use all-atom molecular dynamics simulation to investigate the interactions of several RTILs with the FaeG protein, both in the presence and absence of lactose sugar in its binding site. This study will provide insights into how RTILs interact with the FaeG protein, and whether they are capable of destabilizing FaeG/lactose interactions. Specifically we have investigated three different RTILs at two different concentrations. Our initial simulation data indicates that the RTIL [C4mpy][Tf2N] leads to the most significant destabilization of lactose in the FaeG binding site over our 200 ns simulations. We also observe aggregation of RTIL molecules at several locations on the FaeG surface.

Probing the stability of the C-terminal domain of type IV pilins under external force

Rebecca B. Goncalves
Faculty Mentor: Dr. Joseph Baker (Chemistry)

Type IV pilins are “ladle-shaped” proteins that assemble into long bio-filaments called type IV pili, which emanate from the surface of bacterial cells. These filaments are involved in a variety of functions for bacteria, including surface adhesion, twitching motility, and infection. The C-terminal domain of type IV pilin subunits is the adhesive domain that allows the filament to directly interact with its environment. Therefore, the structural stability of the C-terminal domain of type IV pilins is of critical importance for the proper functioning of these bacterial filaments. Type IV pilin subunits utilize a number of strategies for stabilizing their C-terminal domains. The most prevalent stabilization strategy is a disulfide bond that attaches the pilin C-terminus to the rest of the C-terminal domain. Other C-terminal stabilization strategies include metal ion coordination, hydrogen bond networks, and specific water molecules. / / In order to probe the role of disul-



fide bonds or hydrogen bond networks in pilin C-terminal stabilization, we carry out implicit solvent all-atom molecular dynamics simulations of type IV pilin subunits from two organisms (the GC-pilin of N. gonorrhoeae and the pilin PilA1 from the NAP08 strain of C. difficile). Steered molecular dynamics (SMD) is used to stretch on wild type systems and systems in which the disulfide bond (or hydrogen bonds) have been disrupted through amino acid substitution. For both systems, we observe the breakdown of both secondary and tertiary structure as the pilin proteins are stretched out. Force-extension curves obtained from SMD simulations provide insight into the role of disulfide and hydrogen bonds on the stabilization of each pilin's C-terminal domain. Therefore, these simulations can lead to new insights into the role of specific interactions in pilin subunit stability.

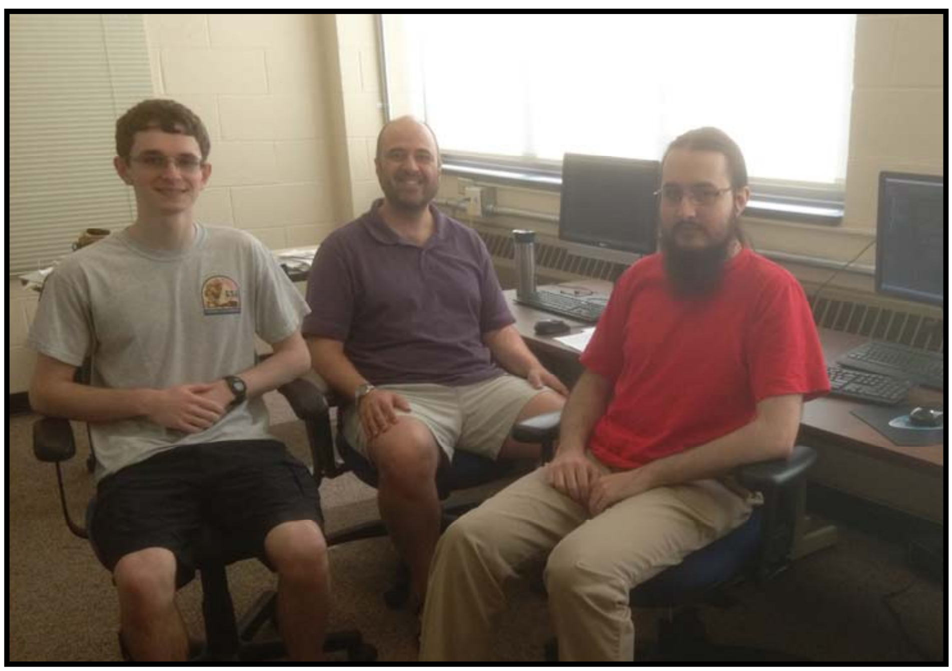
Optimizing Peptides with Activity as Next Generation Anti-Thrombosis Agents

Alexis Oldfield
Faculty Mentor: Dr. Danielle Guarracino (Chemistry)

Both heart attacks and stroke continue to be the leading causes of death in America and both can be attributed to pathogenic blood clots. As arteries become damaged by atherosclerotic plaques collagen becomes exposed; this collagen binds to the blood protein von Willebrand Factor (vWF). This vWF attracts platelets to the damaged area and initiates cross-linking, which can then lead to thrombosis. The main goal of this project is to develop a cyclic peptide that can target and inhibit and the initiation of the clot formation. Building off of previous work, this project consists of substituting unnatural amino acids into our expanded rings; this will improve the potency. The ability of the peptides to inhibit the vWF-collagen interaction will be tested, along with their stability of their structure against degrading factors. Our main goal is to improve on our cyclic peptides to create highly stable and higher potency compounds that displace vWF from collagen. In order to test these capabilities two different assays will be used; Enzyme-Linked Immunosorbent Assay (ELISA) and a protease degradation assay. ELISA quantifies the cyclic peptides' abilities to displace vWF from binding collagen. The protease assay quantifies the peptides' stability in a cellular-type environment. Along with these assays, this project includes synthesizing peptides and purification techniques. /

Algorithms and Tools for Maximum Parsimony Compact Phylogenetic Trees

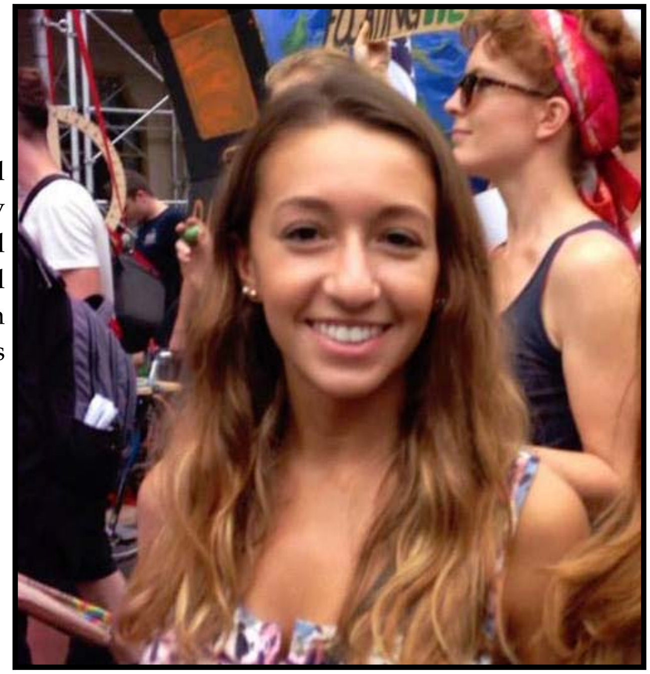
Edward Kennedy
Jan-Lucas Ott
Faculty Mentor: Dr. Dimitris Papamichail (Computer Science)



The project aims to develop algorithms and computational tools for the construction of compact most parsimonious phylogenetic trees. Phylogenetic trees represent the evolutionary history of a set of species. These trees are scored using the metric of parsimony, where mutations are assigned a cost and trees with the smallest cost (most parsimonious) are favored. This project focuses on phylogenies where ancestors can be present among the input species, which is the case in domains such as virology, paleontology, linguistics, and phylogenetic stemmatics. Our methods seek to determine the most compact of the most parsimonious trees, minimizing the number of unknown ancestors without modifying the parsimony score of the tree. The project will investigate various methods for determining the parsimony of a tree, for both fixed and variable weight mutations. It will also consider other metrics for scoring trees, such as maximum likelihood, where the probability of mutations is considered. Our ultimate goal is to develop efficient algorithms and tools that can be used to apply these methods to datasets from various fields.

Causal Modeling of Cancer Signaling

Elizabeth Eisenhauer
Faculty Mentor: Dr. Michael Ochs (Mathematics)

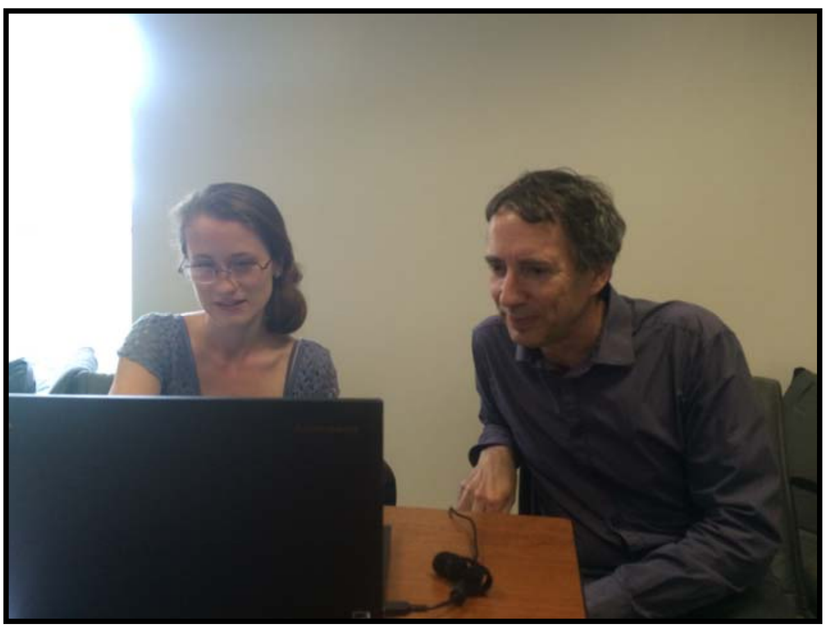


This project involves creation of structural equations and graphical models to try to understand the limits of learnability of cell signaling networks based on high-throughput biological measurements. The focus is on cell signaling networks in head and neck squamous cell carcinoma. The Tetrad program from Carnegie-Mellon is utilized to solve the structural equations from the data simulations and from the real data.

GESSA Tumor Growth

Danielle Demateis
Faculty Mentor: Dr. Michael Ochs (Mathematics)

The goal of the GESSA Tumor Growth Project is to combine two models for biological simulation, the cellular automaton macroscopic growth model and the stochastic model of intracellular biochemical networks. The cellular automaton model simulates spatial and temporal growth, starting with a few cells initialized and then growing the tumor mass with based on an ordinary differential equation algorithm. The stochastic model simulates gene expression in response to external signals to a cell driving a signaling network. We will simulate the growth of heterogeneous lung cancers using this model.



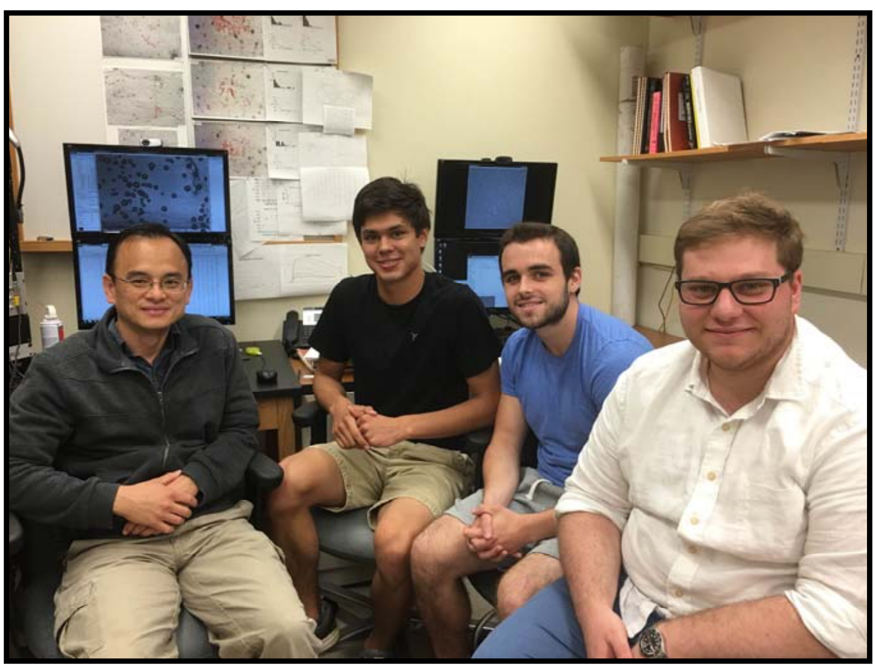
Analysis and Imaging of Lab-Grown and Cirrus Cloud Ice Crystals Through Scanning Electron Microscopy

Lucas Bancroft
Manisha Bandamede
Katie Boaggio
Kevin Hurler
Faculty Mentor: Dr. Nathan Magee (Physics)

We capture high-resolution cryo-scanning electron microscopy images and microanalysis of cirrus particles via high-altitude balloon launches and recoveries. Cirrus ice particles are captured and sequestered in a balloon-borne cryo-preservation cell that returns to earth by parachute, is retrieved though GPS-tracking, and is then transported and transferred into the SEM. High resolution images (up to ~10 nm resolution at high magnification), 3D measurements of surfaces, and energy-dispersive spectroscopy chemical analyses (EDAX Octane) are presented, revealing complex 3D surfaces in various states of growth and sublimation, including examples of previously unseen particle-scale morphologies and microscale structures. These results offer a glimpse of cirrus ice particles in unprecedented detail, offering new clues to understanding physical cirrus cloud processes and new information to help improve cloud models and satellite cloud-property retrievals. We also image ice crystals and analyze for a range of temperatures and saturation conditions, and originating from several nucleation modes. If observed surface topography on lab-grown crystals is also characteristic of atmospheric ice particles, it would have significant implications for modeling the scattering of light by cirrus and for accurately measuring cirrus properties by satellite.

Mapping Larger Networks for the Study of Synchronized Neuronal Activity

Kyle Barrie
Nicolas Bolle
Andrew Tripieddi
Faculty Mentor: Dr. Tuan Nguyen (Physics)



Our project for this summer is to work on mapping networks of neurons for the purpose of gaining a deeper understanding of their synchronous activity. We rely on in-vitro models of cortical neurons harvested from pre-natal rats. Using a combination of Photostimulation and Calcium Imaging, we are able to observe and investigate network activity. A specific aim for this summer is to code programs that successfully allow for analysis of the networks in real-time. These studies of the activity of neurons grown in vitro will help better understand the more complex systems at work in living organisms, but in a simpler more controlled way, in the spirit of physics.

Investigating the Coordination of Multiple Steps in Gene Expression

Ruth Sanchez de la Rosa
Faculty Mentor: Dr. Tracy Kress (Biology)

All organisms have to be able to turn on and off genes in response to environmental changes. In the pathway of gene expression we are interested on investigating the coordination of two critical steps: transcription and RNA splicing. Transcription produces an RNA copy of the gene and splicing is a process that cuts out the non-protein coding pieces out of the RNA so that the processed RNA is competent to direct the synthesis of a protein. Transcription can be regulated by chemical modification of the DNA-associated histone proteins. Rph1 and jhd1 demethylate the histones in front of the enzyme that carries out transcription, RNA polymerase II, and affects transcription. We are interested in investigating whether histone methylation can coordinate splicing with transcription and thus we are currently testing whether blocking the function of the demethylases impact splicing.

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