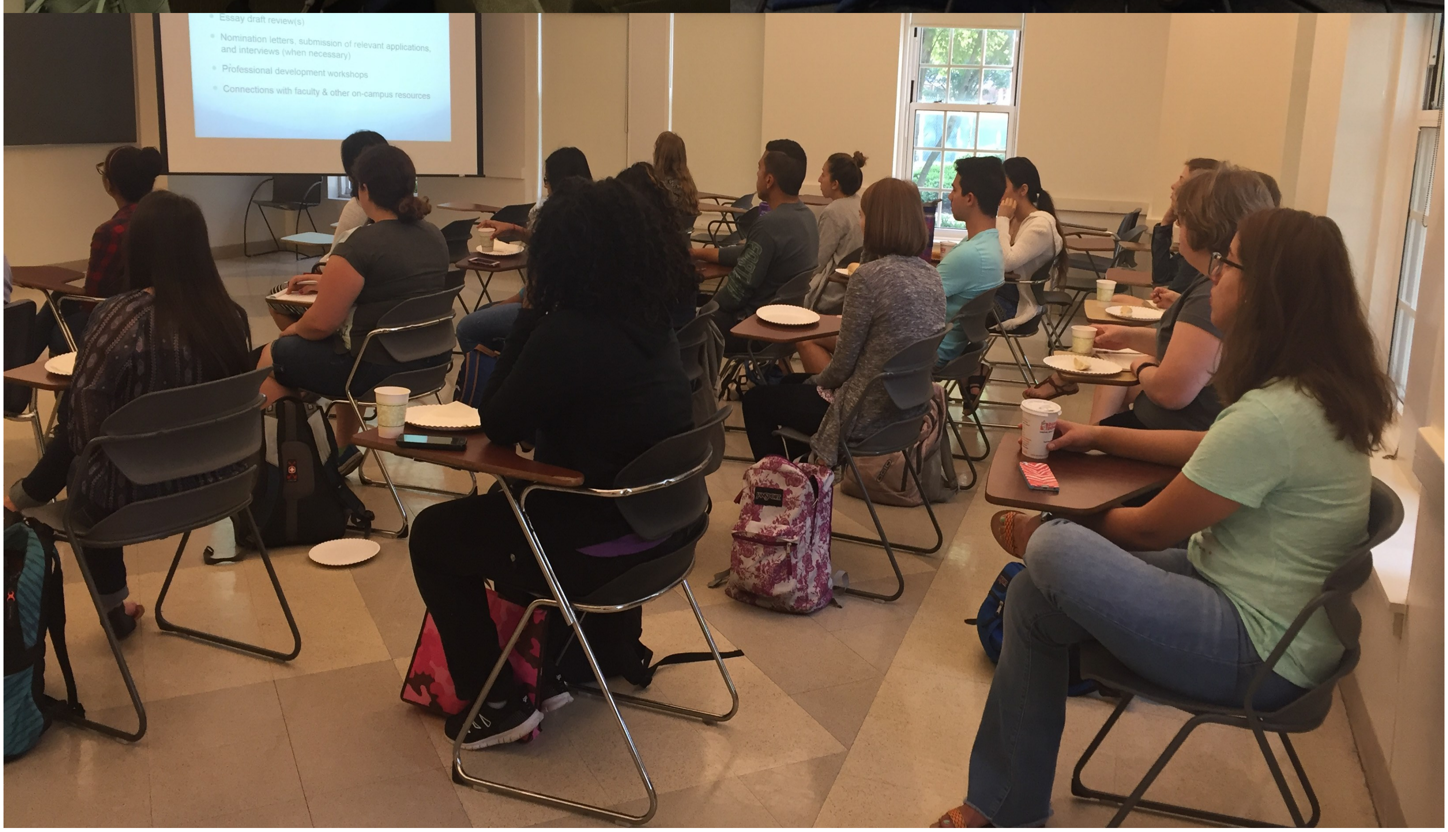
MUSE 2017

The College of New Jersey


EXIT


Essay draft review(s)
Nomination letters, submission of relevant applications, and interviews (when necessary)
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 2017 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 49 faculty members and 94 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 invaluable assistance from student worker Emma Pranschke. 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, David Vickerman, David Mazeika, Lynn Tang, 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, NASA, National Library of Medicine, TCNJ Academic Affairs, TCNJ Foundation, TCNJ School of Science, TCNJ School of Business, TCNJ School of Humanities and Social Science, and TCNJ School of Engineering.

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

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DUNKIN' DONUTS








EXIT

Paper Making & Large Scale Installation

Alyssa Herrera
Carolyn Mandracchia
Faculty Mentor: Professor Elizabeth Mackie (Art and Art History)

Projects focus on researching traditional processes of hand-made paper from Japan, Thailand, and Western Large-Format paper making techniques: laser cutting and engraving on handmade paper; organization and production of new works for upcoming exhibitions. In addition, we will be completing the Ortler Mountain project; which requires researching pulp pigmentation and cutting kettle images out of large 4'x5' handmade paper. Working in the maker space required special training to operate the machinery, and will include researching effects and variations of the laser cutter on many different types of paper, and methods of applying imagery to the paper. As the exhibition concepts evolve, we will be partaking in location visits and meetings with curators to determine gallery size and accessibility in relation to the expanding works. Following the gallery visits, we will create new works that reflect the overall exhibition theme and will create works in collaboration with curators and other participating artists.

Technological Foundation for Prototyping Lightweight Networked Art Games

Robin Friedman
Austin Merritt
Faculty Mentor: Professor Josh Fishburn
(Interactive Multimedia)

Our project aims to create a series of lightweight, networked videogames, accessible from mobile. The games will explore the ways we relate to one another and our shared world. Under the hood, we are experimenting with Node.js, Socket.io, and Phaser, a game framework. This particular combination of software allows players to send and receive information from the server, which connects to other players in the same game session. We also plan to publish the results of our technical framework for others to make use of.

School Experiences of Fathers of Children with Deaf Blindness

Marcia Schleppy
Faculty Mentor: Dr. Nadya Pancsofar (Special Education Language and Literacy)

Currently, there is very little research on the school experiences of, and support given to fathers, in particular fathers of students with disabilities. In this project, we are creating and distributing a survey investigating these experiences of fathers of children with deaf blindness.

Culturally Deaf Identities Claimed in Adulthood

Gabriella Klopsis
Samantha Ciparis
Faculty Mentor: Dr. Steven Singer (Deaf Education)

This study examines how people "become" Deaf. Specifically, this qualitative research interview study asks how deaf participants located culturally Deaf identities as adults after they exited primary and secondary education, the locations where Deaf identities are typically formed. We sought to better understand mechanisms of Deaf cultural transmission and the Deaf identity, further disrupting standard conceptions of what and how people experience Deafhood.

Measuring the Mechanical Properties of Barnacle Glue and Hydrophobic Coatings & Measuring the Effect Human-Centered Design has on College Students' Attitudes about People with Vision Impairments

Samantha Moorzitz
Samantha Zanetti
Sarah Goldstein
Faculty Mentor: Dr. Manuel Figueroa (Integrative STEM Education)

Samantha Moorzitz and Samantha Zanetti are working to measure the mechanical properties of hydrophobic anti-fouling surfaces.

The overall objective of this project was to gain a better understanding of barnacle adhesion upon reattachment to hydrophobic surfaces. Substrates with varying surface energies were prepared in the lab and then used as a platform for barnacle adhesion. After barnacle removal, the morphology of the glue was characterized using a scanning electron microscope (SEM) and atomic force microscopy (AFM). Mechanical tests were also performed to gather the overall structural properties of the glue when exposed to shear forces. This information will allow us to determine how the mechanical interactions of reattached barnacles change depending on the surface energy of the substrate.
Additionally, the research content and the laboratory procedures will be the inspiration for the development of a middle school to high school lesson plan which can be integrated into STEM education classrooms.

Samantha Moorzitz and Sarah Goldstein are working to measure the effect human-centered design has on college students' attitudes about people with vision impairments.

Data was collected during the spring semester in four sections of the Creative Design Course. Every class section was tasked with developing a product to improve accessibility in a dorm room for someone with a vision impairment. To build empathy ahead of the design challenge each class section underwent a visual simulation which varied slightly: professional training on vision impairments, low vision simulation goggles, blindfolds, and an interview with a person that is blind. We hope to learn from this study how empathy can be used to improve knowledge of vision impairments and the potential use of design projects in service learning training sessions.

Investigating Additive Manufacturing Safety in PreK-12: Informing a Safer Learning Environment

Andrew Coe
Matthew Halfacre
Faculty Mentor: Dr. Tanner Huffman, (Integrative STEM Education)

We will be researching the effects that 3D printing has on classroom air quality, to better instruct teachers how on how to keep their classroom environments safe.

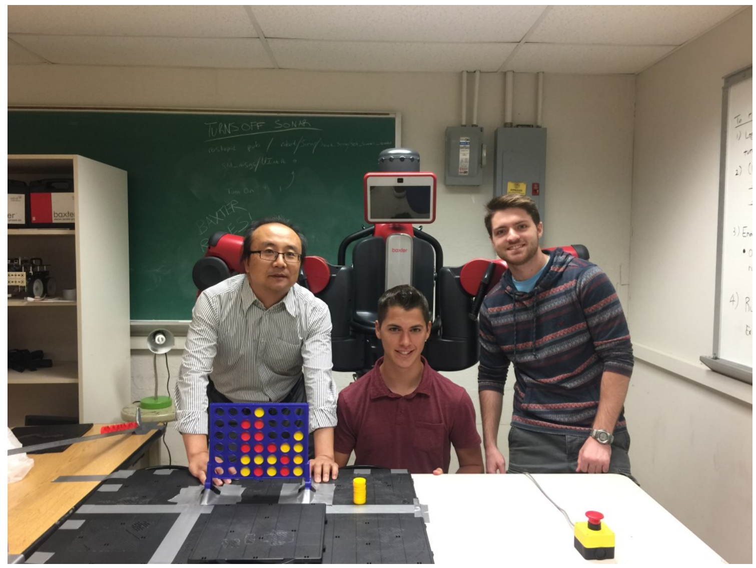
Regional Calibration of the Peak Flow Coefficient for the NRCS Dimensionless Unit Hydrograph Equation for the State of New Jersey

Ryan Gurriell
Faculty Mentor: Dr. Michael Horst (Civil Engineering)

The purpose of this project is to determine peak rate factors throughout the state of NJ used as part of the NRCS's unit hydrograph methodology. These factors assist design engineers when performing hydrologic studies used for the design or analysis of hydraulic structures such as bridges and dams.

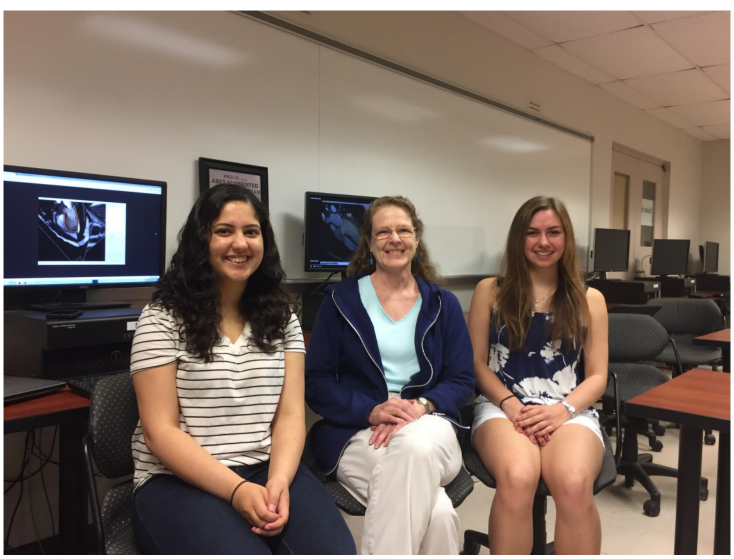
Rule and Knowledge Based Decision Making Process Using Fuzzy Timed Petri Nets

Philip Franco
Patrick Hansen
Faculty Mentor: Dr. Kim (Electrical and Computer Engineering)



Our research project seeks to accomplish the following: conduct additional literature reviews in the fields of Petri nets (PNs), Fuzzy PNs, and Time PNs; study decision making process techniques for Baxter and NAO robots; generate a specific scenario and develop algorithms for robots; design, model and simulate developed algorithms using simulation tools; and implement and test such algorithms with robots.

Modeling Blood flow and Heat Transfer in Blood Surrounding a Pulmonary Artery Catheter used for Continuous Hemodynamic Monitoring in the Intensive Care Unit

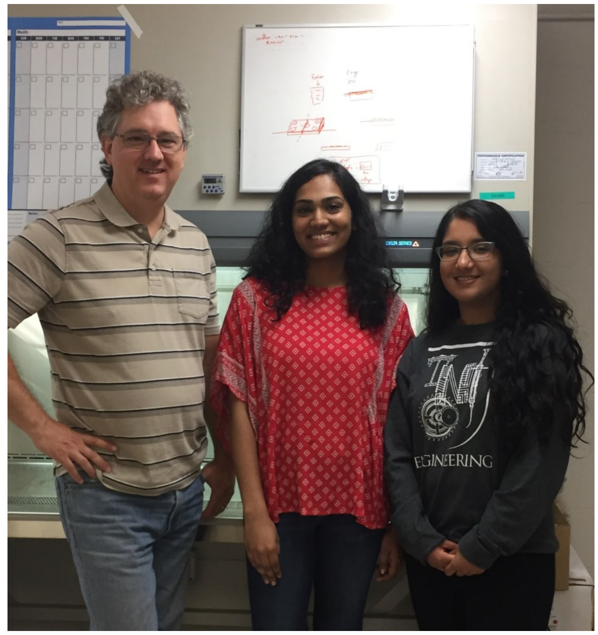


Marisa Palmeri
Merin Kalapurackal
Faculty Mentor: Dr. Connie Hall (Biomedical Engineering)

The primary objective of this project is to develop an anatomically realistic model of a catheterized right heart and pulmonary artery and predict the blood flow and temperature field for clinically relevant input parameters. An anatomical form of the heart will be formed from medical imaging data using MaterialiseTM by Mimics, a software tool utilized to convert imaging data to a geometric file that can be imported into software used for calculating blood flow and temperature (CFD-ACE from ESI). This will be performed in parallel to development of all clinically relevant model input parameters, such as the time dependent flow and pressure of the cardiac cycle, and known boundary conditions. The two models will come together to build the anatomically and fluid mechanically relevant model.

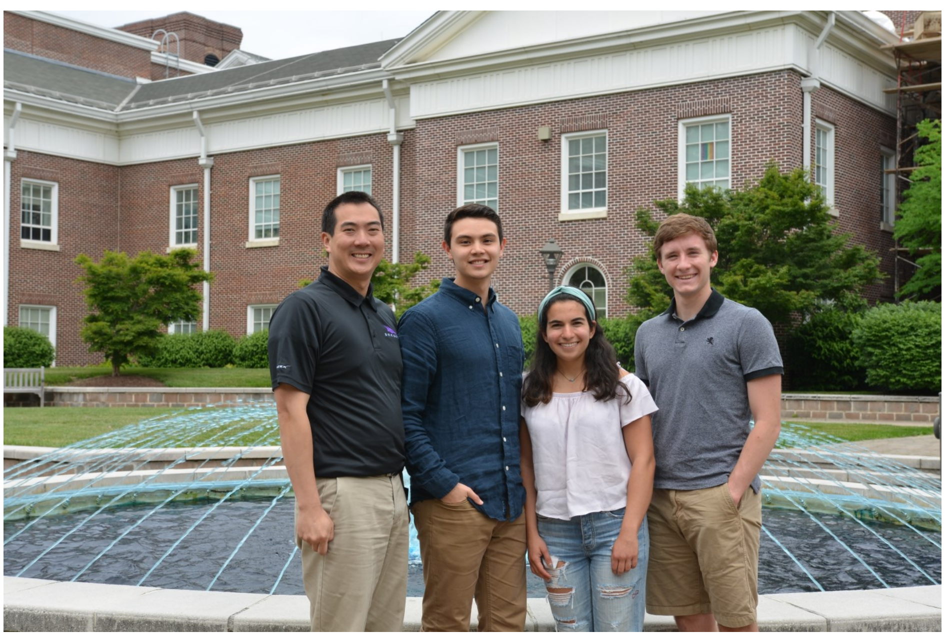
Material Characterization and Analysis of Scaffolds for Tissue Engineering Applications

Amulya Veldanda
Saveetha Raghupathi
Faculty Mentor: Dr. Christopher Wagner (Biomedical Engineering)



The objective of our research is to investigate the mechanisms involved in mesenchymal stem cell (MSC) differentiation in response to mechanical stimulation. This understanding is important in developing orthopedic soft tissues (tendon and ligament) using tissue-engineering approaches. There were two separate projects incorporated into the summer research plan. The first project analyzes strain variations within 3D scaffolds using a common in vitro mechanical stimulation model. ANSYS computer aided engineering simulation is used to model and solve strain profiles within scaffolds as a function of desired target strain. This work is important since a common assumption in mechanical differentiation studies is that strain develops uniformly within a 3D scaffold. Prior work from our lab shows this uniformity does not hold in some models, which may lead to result variation and inconsistency across labs and experiments. The second study experimentally analyzes MSC differentiation in response to mechanical signals transduced through an extracellular matrix (ECM) scaffold. The project initially involves designing, fabricating, and verifying a cell culture fixture to uniformly seed MSCs onto ECM scaffolds, thereby eliminating distribution variation from surface tension effects. Finally, such seeded ECM scaffolds are exposed to strain and MSC differentiation monitored by RT-PCR analysis for tendon and ligament specific markers. These studies explore strain level, strain duration, and cycle frequency as independent variables in an effort to identify critical cell-matrix interactions. The research allows the students to gain experience with cell culture, genetic analysis using RT-PCR, and computational investigations using ANSYS.

Effects of Space Radiation and Disuse on Bone Strength



Rose LoPiano
Dale Johnson
Matthew Sanseverino
Faculty Mentor: Dr. Anthony G. Lau (Biomedical Engineering)

We are using computational finite element modeling and biomechanical testing to investigate bone strength change in rats that were exposed to varying doses and types of space radiation. We are also looking at bone strength changes in mice in a disuse model where the hind limb is immobilized with a cast.

Human Testing of a 5-Digit Assistive Exoskeleton for the Hand

Emily Triolo

Faculty Mentor: Dr. Brett BuSha (Biomedical Engineering)

Over 795,000 Americans suffer from disorders, such as arthritis and stroke, or injuries to the hand that result in decreased grip strength and/or the ability to hold objects. The main objective of this research is to design and produce a wearable device to augment the pinching and grasping efforts of the wearer. We are improving the design of an orthotic five-fingered powered exoskeleton for the human hand previously developed in this laboratory. A new control system is being integrated into the device in order to improve the functioning of battery-powered electric motors that can independently augment the movement of each of the five fingers. After the basic performance of the device is verified experimentally, human testing of the device will commence. The electrical activity of muscles in the forearm will be recorded to provide a quantitative measure of the effectiveness of the device to reduce the hand muscle activation necessary to produce grasping and pinching efforts. We hypothesize that while using the orthotic device, as compared to barehanded efforts, subjects will use significantly decreased muscle efforts during pinching and grasping movements.

Evacuation Route and Bridge Analysis Using Anonymous Probe Vehicle Data

Anthony LaRegina

Ashley Hyde

Jennifer Puschak

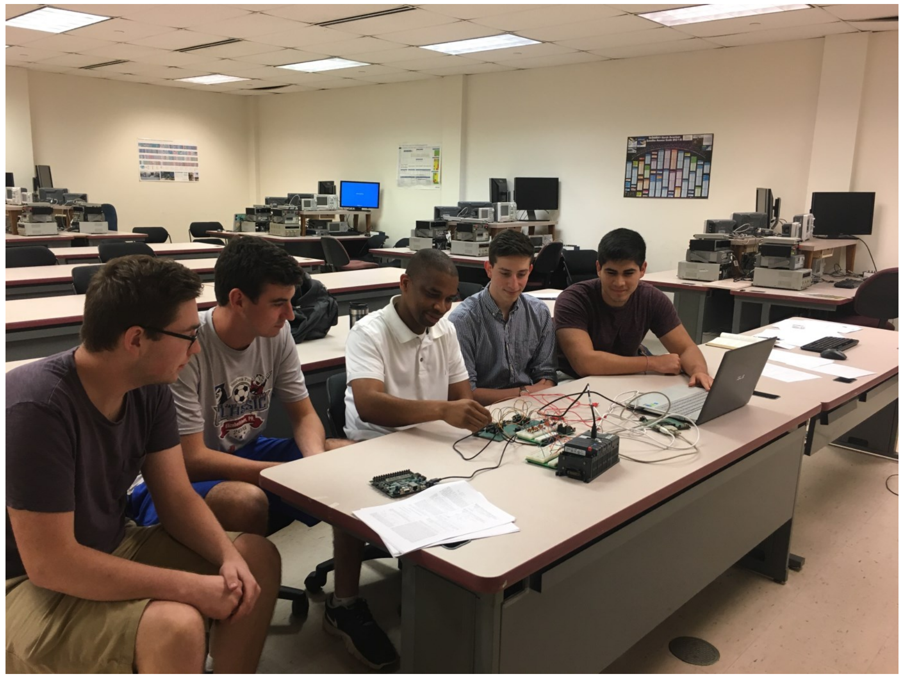
Erin Lafferty

Faculty Mentors: Dr. Brennan and Dr. Bechtel (Civil Engineering)

This project focused on incorporating speed data to analyze evacuation route resiliency and characterizing bridge functional obsolescence using congestion performance measures.

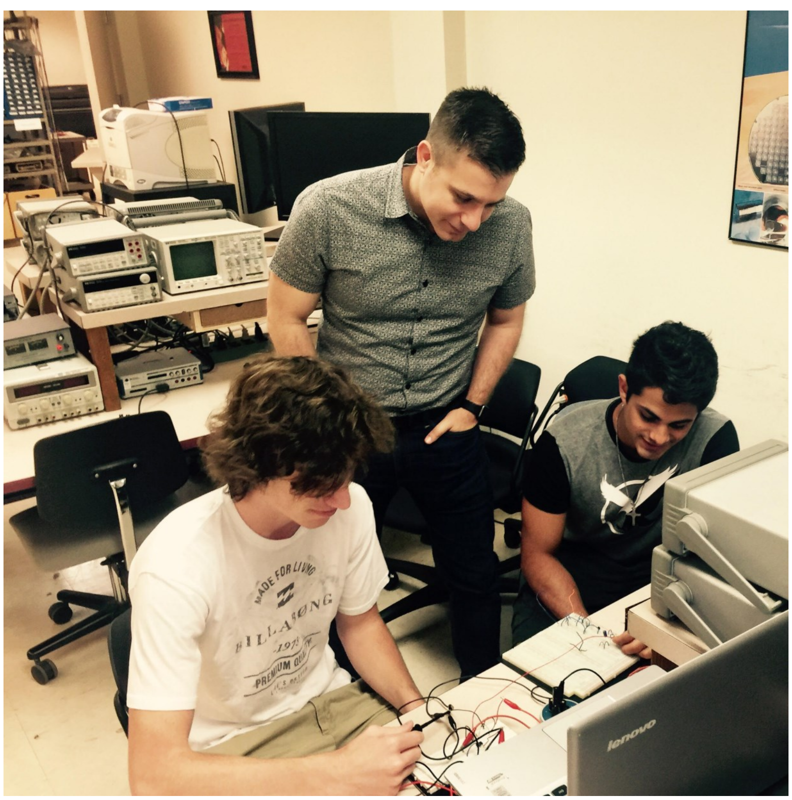
Ultra Fast Neuromorphic Circuit for High Speed Control and Decision

Richard Bustamante
Terrence Skibik
Daniel Walsh
Jeffrey Sabo
Faculty Mentor: Dr. Ambrose Adegbege (Electrical and Computer Engineering)



The main essence of this team's research revolves around the concept of solving complex mathematical programming problems using low-power and high-dense circuits that emulate the neural architecture and computational dexterity of the human brain. Such problems have wide applications in machine learning, in artificial intelligence, in power electronics and in high-speed optimal control. The goal is to quickly solve these problems where speed is more important than precision. The computational circuit will be realized in the analog domain using both a Field Programmable Analog array (FPAA) and a CMOS-based integrated circuit, and in the digital domain using a Field Programmable Gate Array (FPGA) and a Programmable Logic Controller (PLC).

Home Automation and Internet of Things Technologies to Improve Energy Renewability and Sustainability.



Carlos Duarte-Molina
Derek Arnheiter
Faculty Mentor: Dr. Anthony Deese (Electrical and Computer Engineering)

The objectives of this project are to provide students with an improved circuit simulation, prototyping, testing, and fabrication skills as well as to generate an AC/DC power supply. This power supply will feature an automatic low input voltage shut-off if input voltage is below the nominal threshold. It will potentially be used in ELC 333 by giving students in the class an opportunity to work with a pre-fabricated printed circuit board as well as to learn skills such as soldering. Another objective of this project is to design innovative hardware that employs an AC/DC power supply as a primary input for a different project which is a capacitive touch drum machine powered by an arduino based microprocessor. This drum machine will be programmed be programmed in C and will feature a record/loop function.

School of Humanities and Social Sciences

Do Infants Learn Selectively from Individuals who Produce Surprising Outcomes?

Emma Pranschke

Larissa Woods

Faculty Mentor: Dr. Aimee Stahl (Psychology)

The last several decades of research have uncovered that even young infants have sophisticated expectations about the world around them. Because infants and children have limited cognitive resources, directing these resources to events that violate (rather than accord with) prior expectations could potentially boost learning efficiency. Previous studies suggest infants selectively attend to and learn about objects that behave surprisingly. This summer we investigated whether infants also preferentially learn from and imitate the individuals who produce surprising outcomes, compared to individuals who produce expected outcomes.

Justice in Contemporary Anglophone Literature

Lauren Muccilli

Faculty Mentor: Dr. Mindi McMann (English)

This project seeks to research the relationship between justice, ethics, and political reconciliation in literature. The information collected will eventually be used in the chapter titled “Justice” in Dr. McMann’s book, Ethical States. The book seeks to apply theory by Jacques Derrida and Emmanuel Levinas to literature, illustrating how the abstract philosophies concretely function in various narratives of conflict. The project will build off of Dr. McMann’s current research on justice and political reconciliation, expanding the topic from South Africa to regions such as Northern Ireland and Sri Lanka. Topics explored in the research will include the difference between justice and law, the function and effectiveness of truth and reconciliation commissions, and the nature of guilt in those who are passive or complicit in times of oppression. By combining political theory with literature and applying it to the ethics of political reconciliation, this research will reveal the ways in which oppressed voices are marginalized and silenced by certain methods of political reconciliation.

Mapping the Southern Underground Railroad

Kashana Ricketts

Sarah Stratton

Faculty Mentor: Dr. Mekala Audain (History)

We are researching and mapping fugitive slave routes from Texas into Mexico.

FIRSTS Research Project

Fidel Diaz
Horacio Hernandez
Faculty Mentor: Dr. Gazley (Sociology)

We are researching a summer bridge program for incoming STEM majors by doing ethnographic research with hopes to understand ways to improve retention rates.

Making the Connection: Exploring the Linkage between the Trial and the Appeal

Joshua Riley
Faculty Mentor: Dr. Tao Dumas (Political Science)

Political science law and courts scholars devote considerable attention to appellate courts, and the body of trial court research, while considerably smaller, is growing. Although a trial must occur before an appeals court may review a case, appeals court decisions are rarely studied in connection to the trial court that initially adjudicated the case. Scholars almost exclusively study trial and appellate courts in isolation from each other. The resulting dearth of scholarship in this area means that we know relatively little about the factors that cause unsuccessful parties in trial courts to seek an appeal. When does the losing party in a trial appeal the verdict? This research is intended as a first step in beginning to address this significant deficit in the literature. The analyses rely on an original data set of all reported civil jury verdicts rendered in Alabama courts of general jurisdiction from 2001-2009 (over 2,000 verdicts). We then coded each case for whether or not an appeals court reviewed the decision and the outcome on appeal. The goal of this research is two-fold: This research first seeks to shed light on the factors that lead to an appeal, and secondly, to facilitate better understanding of the factors that lead appeals courts to overturn trial court verdicts.

Is The Uncanny Valley Really so Uncanny? Testing the Limits of Human Perceptions of Other Minds

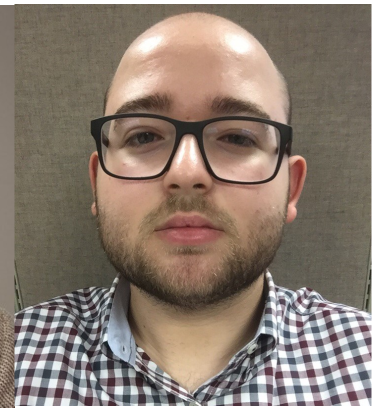
Carter Campbell
Faculty Mentor: Dr. Consuelo Preti (Philosophy)

We have chosen to study artificial intelligence through a philosophical and neuroscientific lens. We will be working to create a survey in order to produce confirming or disconfirming evidence for the theory of the uncanny valley. The uncanny valley is the alleged effect of revulsion when confronted with a simulation of a being that is very close to seeming genuinely human, but is also quite obviously not human. We will be working from a set of criteria that we believe can help to determine the qualities needed for one to attribute consciousness to another human, nonhuman organism, or other object, and we will be investigating how we differentiate between a human or other natural being and an artificial intelligence.

International Trade Restrictions and Endangered Species Populations: An Econometric Analysis

Jonatan Moukh

Faculty Mentor: Dr. Subarna Samanta (Economics)

We examine the effects of endangered species trade restrictions enacted by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) on species' population trends over time. The purpose of the econometric analysis is to measure the outcomes of international conservation methods.

The Effects of Foreclosure-driven Vacant Properties on Crime in Trenton

Felix Aidala

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

This project investigates the relationship between foreclosure driven vacancies, and crime in Trenton, NJ. Using crime and foreclosure data from 2012 to 2015, we analyze if foreclosure-driven vacancies lead to higher rates of violent and non-violent crime in the block the vacancy is located.


School of Science

Reversible Light-Induced Mass Transport in Azobenzene Films

Nick Bolle

Jan Krüger

Trois Henley

Dr. McGee (Physics)

Light-induced mass transport can be used to create diffraction gratings in polymer films; we use films that allow this process to work more than just once. Thus we investigate ways to modify gratings, such as by translation, rotation, and erasure.

Using Molecular Modeling and Simulation to Investigate Several Biological Systems (Type IV Pilli, ComP, and Ionic Liquids)

Kristen Vogt
Maria Fairfield
Bryan Bogin
Faculty Mentor: Dr. Baker (Chemistry)

This summer, researchers in the Baker group have been using molecular modeling and simulation to study several different biomolecular systems. Bryan Bogin's project involves modeling long protein biopolymers called type IV pili that emanate from the surface of many microorganisms, and which can withstand extremely large tension forces (10,000 times the bacterial bodyweight). Under these larges forces, type IV pili can extend to three times their length and become 40% narrower, yet amazingly this transition is fully reversible. There is no known molecular structure of what this stretched state looks like. Since these filaments are very large, it is challenging to simulate every atom in the system, so Bryan's approach involves "coarse-graining" the filaments to make the computation more tractable. Using coarse-grained simulation methods, Bryan has been able to calculate biomechanical properties of the filaments, including their stiffness and flexibility. Maria Fairfield's project involves using computational methods to understand how bacteria can acquire genetic information from their external environment. Specifically, Maria is studying the interactions between an adhesive protein called ComP, which bacteria can use to recognize and "stick" to double stranded segments of DNA, which they can then bring into the bacterial cell. Maria's approach involves simulating an all-atom model of the ComP/DNA complex, calculating electrostatic and Van der Waals interaction energies between the protein and DNA in order to identify strong interactions with specific amino acids, and then running new simulations of ComP mutants to determine how point mutations influence protein/DNA binding. Maria also used a method called MM-PBSA to calculate the change in binding free energy of the complex due to the mutations, and was able to use these calculations to make a prediction about an amino acid that might be important for binding that had not yet been reported on in the literature. Kristen Vogt's project involves using modeling and simulation to understand the interaction of room temperature ionic liquids with lipid membranes. Room temperature ionic liquids (ILs) have been proven to have a range of biological applications, from influencing protein folding and structural stability, to affecting enzyme activity, to modifying the permeability profile of lipid bilayers. Kristen used the ionic liquid choline geranate (CAGE) in her studies, as this ionic liquid has proven effective at eradicating bacterial biofilms and at increasing the permeability of biofilms to antibiotics and other small molecules. Kristen has been using a computational method called adaptively biased molecular dynamics to measure the free energy associated with the motion of the small molecule mannitol through lipid bilayers in the presence and the absence of CAGE in order to understand the influence of CAGE on mannitol diffusion. The next phase of this project will be to study the transport of small pharmaceutical compounds through lipid bilayers in the presence of CAGE.

Toward Artificial Proteomics: Design of Combinatorial Protein Libraries

Kseniya Rychkova
Faculty Mentor: Dr. Dimitris Papamichail (Computer Science)

Our project aims to design algorithms and develop computational tools that utilize synthetic biology advances in DNA synthesis to design combinatorial protein libraries, which minimize the cost of synthesis while balancing library size with quality.

New Air and Water Stable Iridium Catalysts for Transfer Hydrogenation: How Do They Operate under Base-Free Conditions?

Shaziya Ahmed
Allison Smith
Faculty Mentor: Dr. Abby O'Connor (Chemistry)

Reactions known as reductions are of great interest in chemical industry and academia and are used for the synthesis of fine chemicals in many areas including fragrances, flavors, and pharmaceuticals. One example of this is coal liquefaction, the process of reducing coal to liquid hydrocarbons such as petrochemicals and liquid fuels. This process is typically expensive and requires a lot of energy, but transfer hydrogenation can serve to make it more environmentally friendly. In general, reductions involve decreasing the oxidation number of a compound or removing oxygen from that compound. Transfer hydrogenation utilizes an alternate source of hydrogen, often from a more renewable resource, and a metal catalyst to break bonds between atoms, most commonly carbon and oxygen. These different hydrogen sources are less toxic and dangerous than the typical addition of hydrogen gas. Catalysts increase the speed of the reaction by offering an alternative pathway to make a product and adhere to the principles of Green Chemistry by providing safer and more sustainable methods. However, most catalysts used in the literature for transfer hydrogenation require a base-additive as an auxiliary substance which leads to the creation of excess waste, therefore making the process less sustainable and less “green”. Over the past few years, our lab group has successfully developed new iridium catalysts, which are unique because they perform transfer hydrogenation in a base-free environment, a previously unaccomplished feat that decreases waste, making the reaction “greener.” However, we do not know how the catalysts operate under these reaction conditions. There are different possibilities for the mechanism of this reaction and our goal for this summer is to determine the mechanism through kinetic and mechanistic studies, so that we can better understand how our catalyst works in order to develop new, more active catalysts and extend these complexes to be used in other reactions.

Transformation and Study of FPPS Protein

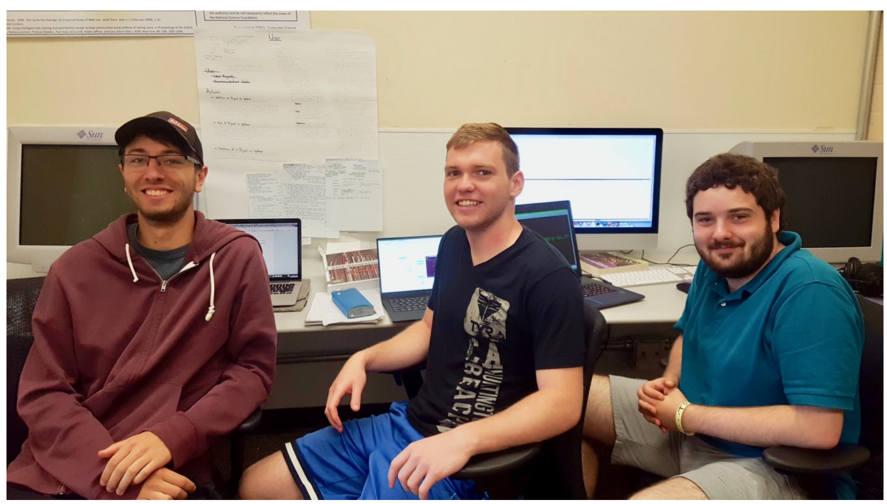
Eliana Aerts
Faculty Mentor: Dr. Sen (Chemistry)

Our objective was to get E. Coli cells to manufacture the Lepidopteran insect protein FPPS. Once E. Coli is accurately producing protein, we can purify it in order to conduct further studies on FPPS without having to extract it from insects themselves. This was accomplished by placing the sequence for the cleaved proteins, delta 8 and delta 24, into the Pet30b vector and transforming into Nova Blue cells. Hopefully, the study of this protein and it's counterparts, IPPI and Transport Protein, will allow us to develop a highly exclusive insecticide.

An Investigation into Data Integration, Reliability and Integrity

Alex Cretella
Ryan Hackett
Tyler Reich
Faculty Mentor: Dr. Monisha Pulimood (Computer Science)

We are investigating the challenges of integrating data available in disparate formats from a variety of sources into data-dependent applications. We are also investigating the feasibility of leveraging the collective intelligence of large numbers of humans to improve the reliability and integrity of data, and the sustainability of such applications. We are redesigning and implementing our solution for data integration into two existing applications, in order to demonstrate our findings.



Characterizing an Unknown Protein in Acinetobacter baylyi

Holly Torsilieri
Nikhila Veguru
Faculty Mentor: Dr. KT Elliott (Biology)

We have been working over the summer to characterize an unknown protein YqgF in Acinetobacter baylyi. We study protein interactions via a two-hybrid system and co-transcription by performing RT-PCR.

Examining the Role of CYP72A Enzymes in Chemical Defenses against Environmental Stress

Nisha Sanghani
Kanza Tahir
Faculty Mentor: Dr. Leeann Thornton (Biology)

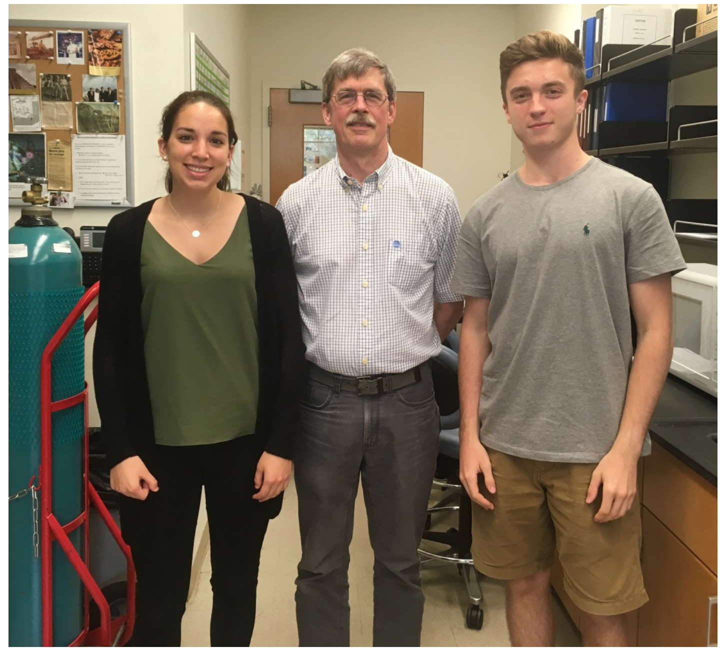
We study how plants respond to environmental stresses. CYP72A enzymes (a type of protein) produce chemicals that protect plants from these stresses. We are comparing plants with disruptions in genes that encode CYP72A enzymes to normal plants to determine their function.

Cryptic Genetic Variation in Threespine Stickleback Fish

Mari Angel Rodriguez
Katie Kearney
Faculty Mentor: Dr. Matthew Wund (Biology)

We are studying the possibility of cryptic genetic variation in marine Threespine Stickleback fish raised in varying salinities to mimic both their natural marine environment and the freshwater environment they so often colonize. Cryptic genetic variation describes the emergence of phenotypic diversity in a population under novel environmental conditions. The newfound variation allows natural selection to enhance traits that are best suited for the new environment eventually leading to adaptive radiation. Our research is continuing the work of colleagues of Dr. Wunds'.We are photographing 2000 of their preserved fish using a high-resolution fluorescent microscope to capture additional details in the skulls of these fish not usually captured. We are then using image j and tps morphometric programs to mark with precision, characteristics of the skull to eventually perform analyses on. Once we quantify the morphological changes, specifically in the heads, we can further analyze using statistical tests, the developmental changes that were incurred as a result of the selective pressures present in the novel environment. Cryptic genetic variation has been observed in these fish by the original researchers in terms of body size, however, we hope to expand upon these data and show a larger morphological trend in evolution, specifically in the skull shape.

Nicotine Exposure During Prenatal Development; Effects on Postnatal Maturation of Respiratory Control in a Serotonin-Deficient Context



Sam Palahnuk
Jack Trubiano
Faculty Mentor: Dr. Erickson (Biology)

Our research uses a multi-level approach to define the cardiorespiratory characteristics of neonatal mice exposed to nicotine in a serotonin-deficient context. This summer we are working on two main projects: in vitro brainstem-spinal cord preparations and in vivo whole animal respiratory response studies. These projects may ultimately provide insight to the etiology of SIDS, which has been linked to a serotonin deficiency in the CNS.

Synthesis and Characterization of Smart Polymers

Kyra Herman
Celine Mileham
Faculty Mentor: Dr. Heba Abourahma (Chemistry)

Our project is focused on the synthesis and characterization of thin films of a polymer joined to an azobenzene dye derivative by noncovalent interactions, specifically hydrogen bonding. These polymer-dye complexes are spun out into a thin film on a glass substrate to be irradiated with light and analyzed by the optics lab in the physics department. When azobenzene dyes are irradiated with light, the molecule undergoes a reversible trans-cis isomerization which changes the shape of the molecule from linear, rod-like to a more spherical structure. The photoisomerization of the dye consequently causes a mass migration in the thin film resulting in a corrugated surface that can be observed using an atomic force microscope. Our research is attempting to understand the effect of varying the substituent on the azobenzene dye and the concentration of azobenzene dye on hydrogen bond strength, and hence the corrugation of the film. Overall, this has intriguing applications in optical data storage, diffractive optics, photonic signal processing, and many other fields of optics.

Pulling Apart the History of Fusion in Honeysuckles (Lonicera)

Evelyn Kulesza

Nicole Tineo

Faculty Mentor: Dr. Wendy Clement (Biology)

Lonicera, or the honeysuckles, is a group of woody trees, shrubs, and vines that include over 180 species. We are studying the evolutionary history of Lonicera, to describe how members of this group are related to each other, and to describe the evolution of special features of Lonicera, such as fusion in leaves, flowers and fruits. Our project began with the collection of over 50 individuals of Lonicera at the Arnold Arboretum in Boston Massachusetts. Back at TCNJ, we are preparing these samples to study using light microscopes and SEM. Also, we are optimizing protocols to prepare samples for next generation sequencing.

Variation of Heart Rate in Different Temperatures and Salinities of Margaritifera margaritifera

Allie Clapp

Archana Menon

Faculty Mentor: Dr. Elderkin (Biology)

We are using surgical techniques to measure the heart rate of mussels from different populations in the surrounding area to see how they respond to different temperature and salinity conditions.

Understanding the Marginal Value of Additional Training Data for Machine Learned Systems

Tomer Aberbach

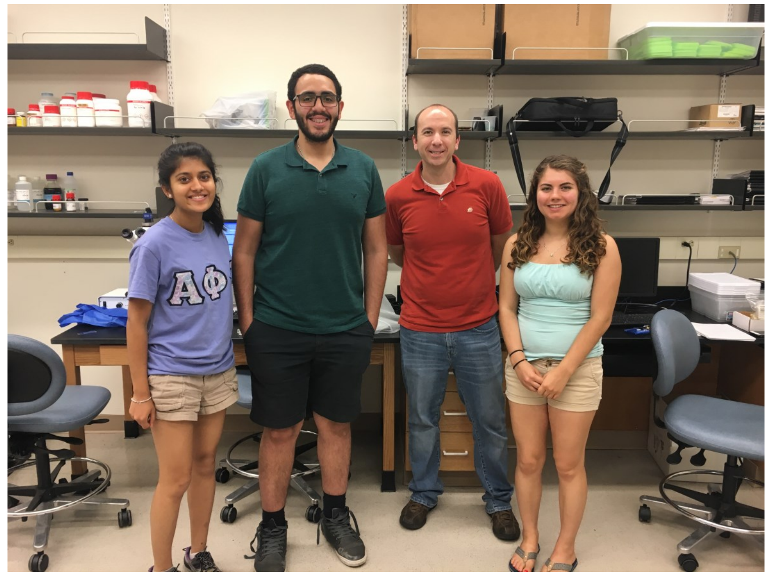
Garrett Beatty

Faculty Mentor: Dr. Michael Bloodgood (Computer Science)

We're investigating how the performance of machine learned systems changes in response to additional training data.

Marine Animals in the Future Ocean: Assessing the Impact of Ocean Acidification

Sanjana Saksena
Kerstin Baran
Ahmed Mahmoud
Faculty Mentor: Dr. Dickinson (Biology)



Our lab studies the effects of climate change on shell formation in barnacles, crabs, and corals. Specifically, we assess the structural and mechanical properties of shells of animals exposed to conditions that simulate predicted warming and acidification of seawater. Mechanical properties (hardness and toughness) of the shells are tested by measuring how resistant the shell sample is to force. Thickness is measured using a materials microscope. Fine structure and elemental content is assessed using an electron microscope. Current research projects include samples from the deep sea, Arctic, and Antarctic. Our research is relevant in assessing susceptibility of these species to climate change in our ever-changing environment.

Synthesis and Biochemical Testing of Next Generation Peptide Inhibitors of Thrombosis

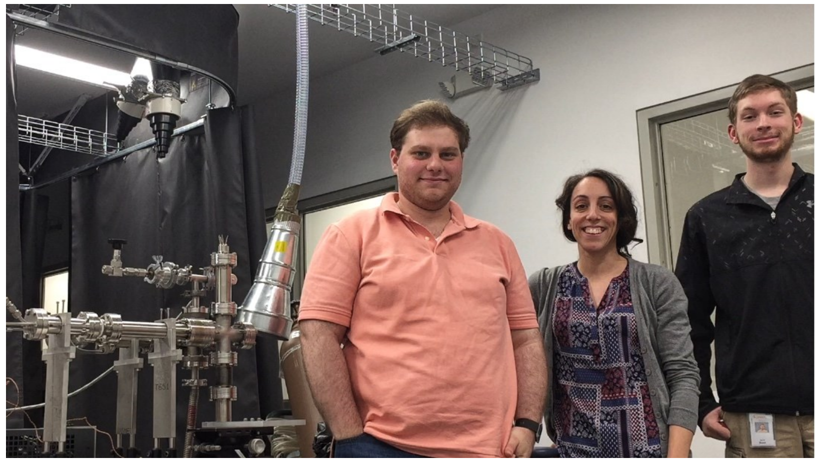
Gianna Barreto
Christopher Kouba
Faculty Mentor: Dr. Danielle Guarracino (Chemistry)

When a blood vessel becomes damaged, several processes take place to repair the damage. The first interaction at the damaged site is between multimeric glycoprotein von Willebrand Factor (vWF), a protein found naturally in the blood,

and collagen that is now exposed. The binding of vWF enhances the rate of platelet binding at the site of injury resulting in the first steps towards blood clot formation. The purpose of the research is to synthesize a cyclic peptide that can compete with vWF to bind to collagen with the ultimate goal of preventing the formation of a blood clot. In order to create an effective peptide, it must be able to compete well with vWF for binding collagen and must be able to maintain its structure under physiological conditions. In order to determine its ability to compete for binding collagen, Enzyme-Linked Immunosorbent Assays (ELISA) are used. Protease assays are used to mimic physiological conditions and determine the stability of the peptide when exposed to such conditions. This research utilizes twoan unnatural amino acids to make the peptiderotein less susceptible to degradation within the body and increase the likelihood of binding collagen. Our main goal is to improve previous cyclic peptides by having a higher stability and being a better competitor for collagen.

Plasma-Materials Interactions

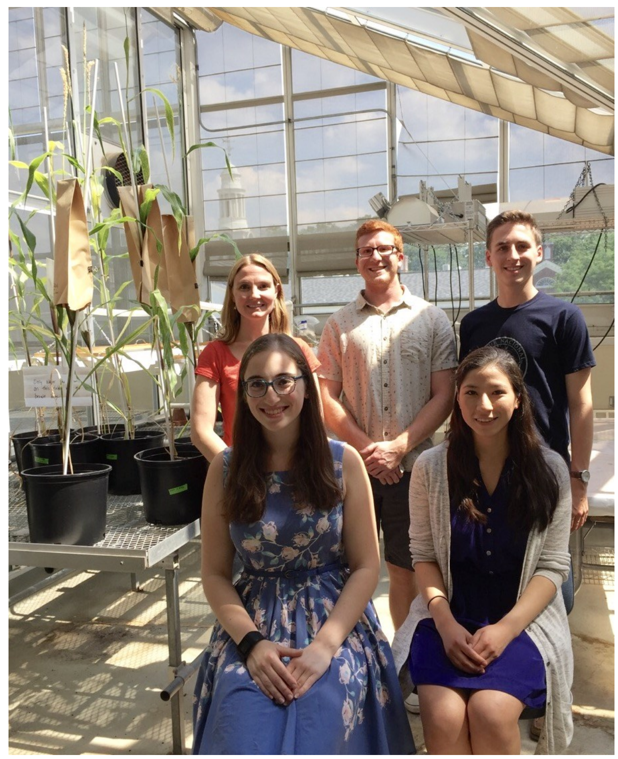
Andrew Trippiedi
Ian Reed
Faculty Mentor: Dr. Angela Capece (Physics)



The focus of our laboratory work this summer is on plasma-materials interactions. We are conducting two experiments in collaboration with the Princeton Plasma Physics Laboratory to study the evaporation of nanoparticles from a metal crucible and to measure secondary electron emission from liquids. The results are applicable for plasma-synthesis of nanoparticles.

Investigating the Coordination of Multiple Steps in Gene Expression

Thomas Gunning
Jessica Kopew
Adriana Mendizabal
Lawrence Palfini
Faculty Mentor: Dr. Tracy Kress (Biology)



All eukaryotic organisms have the ability to modify the expression of their genes (DNA) to produce unique proteins necessary for life. Gene expression requires that a "messenger RNA" copy of a gene is produced, chemically processed and modified, and then this processed, modified RNA is used to direct they synthesis of protein. The Kress lab examines the roles of RNA synthesis proteins on the processing and modification of pre-messenger RNA in brewer's yeast (Saccharomyces cerevisiae). One key step in processing and modification of pre-messenger RNA is known as RNA splicing. Previous research shows us that RNA synthesis and splicing are steps in gene expression that happen simultaneously and, importantly, can influence each other. The mechanisms that allow for coordination (a.k.a. coupling) of RNA synthesis and splicing are poorly understood. In many eukaryotes, the protein NuA4 impacts RNA synthesis by chemically modifying the DNA-associated histone proteins, in turn influencing the efficacy of RNA synthesis. Whether NuA4 can impact the RNA splicing step is not known. This summer our lab is studying mutations in lysine residues of these histone proteins, as well as the catalytic subunit of NuA4. Our goal is to observe how these mutations impact RNA synthesis and splicing in an effort to better understand the roles of these proteins in coupling RNA synthesis and RNA splicing. We will be using the mutant yeast strains that we have created, along with genetic and molecular biology experiments to explore the coupling of these dynamic processes.





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