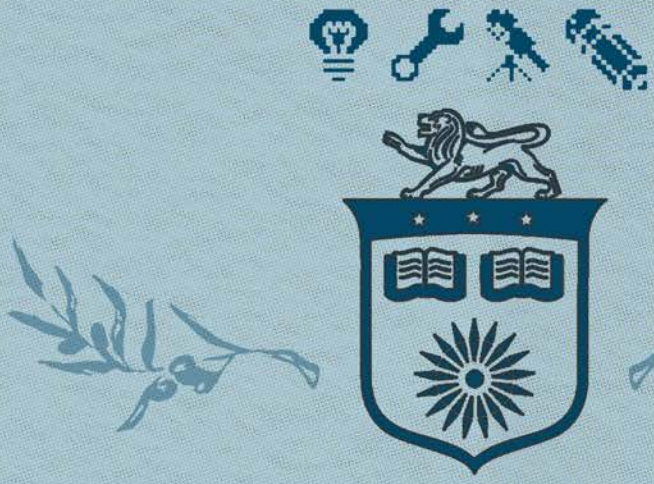

THE COLLEGE OF NEW JERSEY

MUSE 2025

Mentored Undergraduate Summer Experience

Co Directors:
Dr. Joanna Herres
Dr. Anthony Lau

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THE COLLEGE OF NEW JERSEY
MUSE
MENTORED UNDERGRADUATE SUMMER EXPERIENCE
2025

Special Thanks

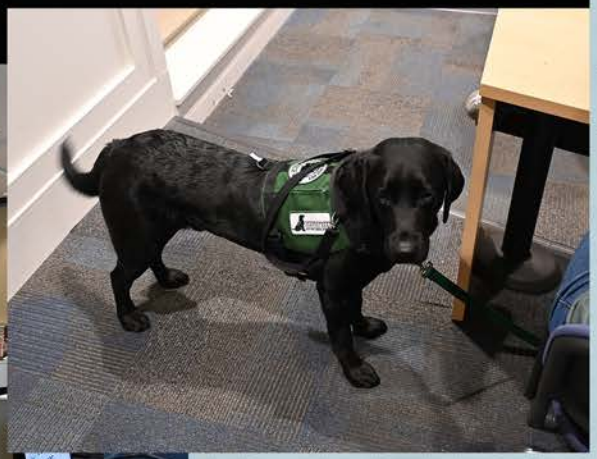
Co-Directors of Faculty-Student Collaboration:

Dr. Joanne Hennis

+

Dr. Anthony Lacz

Opening Lunch



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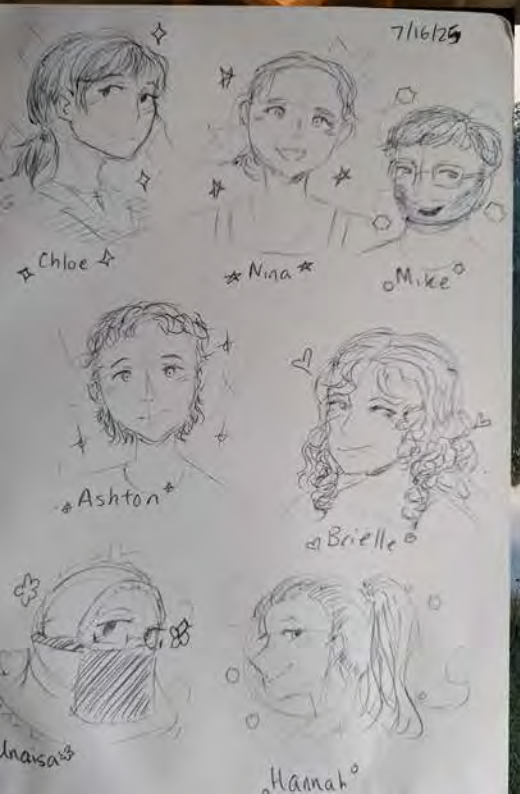


CLOSING LUNCH

Sugar Empire: Central Aguirre, Puerto Rico

Faculty Mentor: Dr. Marchelo Vera
Student Researchers: Sana Didi, Aven Vence

Through the figure of el jíbaro, the legacy of Pedro Albizu Campos, and the memory of the sugarcane fields in my family's hometown of Central Aguirre, this piece honors cultural resilience, political resistance, and labor's imprint on the land.

My research frequently engages with the history of labor and working-class immigrant experiences. In this project, I examine the legacy of the sugar industry through a series of hand-built ceramic tiles that draw upon personal and familial histories rooted in the Caribbean. The work centers on Central Aguirre, a historic sugar mill and former company town located on the southern coast of Puerto Rico. Through material and image, the tiles reflect the complex narratives of industrialized agriculture, colonial economics, and the lives of those whose labor sustained these systems.

Central Aguirre Sugar Company was one of the largest and most advanced sugar processing facilities in the Caribbean, deeply tied to U.S. colonial and corporate interests. It operated under the control of American investors and was part of a broader network of plantations and mills linked to the American Sugar Refining Company (ASRC)—later known as Domino Sugar.

Water Project-Delaware River and Local Ponds

Faculty Mentor: Dr. Elizabeth Mackie
Student Researchers: Skyler Stewart, Marisa Martinez

This summer, under the supervision and guidance of Professor Elizabeth Mackie, we refined and developed our skills by closely engaging with her advanced artistic paper-making practice. As MUSE student collaborators, we utilized and improved upon the multiple processes and forms with which Professor Mackie works, expanding our knowledge about the dyes and techniques that make each piece distinct. In doing so, we contributed to the completion of multiple projects surrounding the relationship between humans and water. Alongside Professor Mackie, we explored how we view and perceive the different aspects of varying bodies of water, the impacts of micro- and macro-pollution, and the parallels between different aspects of the human form and the unique movements of water. Under Professor Mackie's direction, we worked to portray these complex relationships through both her pre-established and newly-developed processes.

In addition to our daily execution of paper-making processes and large-scale projects, we also gained insight into the technological aspects of Professor Mackie's practice. We mimicked the movement of waves and ripples using only human hair and a photo scanner, and learned how to use a laser cutter to both etch and cut images. We also assisted in the preparation of proposals, applications, and sample works as Professor Mackie applied for different shows and residency opportunities, both nationally and internationally. A highlight of our summer was our assistance in the installation, execution, and deconstruction of Professor Mackie's recent solo show Ripple Effect, held in a Philadelphia gallery throughout June. This said, working under Professor Elizabeth Mackie throughout MUSE was a rewarding hands-on experience, rich with unique opportunities that offered us greater comprehension of how a lifelong, independent art practice is both developed and sustained.

Balancing Speech Clarity and Spatial Hearing: Evaluating Frequency Shifting

Faculty Mentor: Dr. Lynn Smith
Student Researcher: Meg Baoas

Individuals with high-frequency hearing loss often benefit from frequency-lowering techniques that shift inaudible high-frequency speech components into a frequency range where residual hearing remains effective. Although these methods enhance speech clarity, a significant concern persists that even mild spectral shifts may compromise the binaural cues—specifically, interaural time differences (ITD) and interaural level differences (ILD)—essential for accurate sound localization. Sound localization is critical for everyday activities such as safely crossing a street, responding to auditory warnings, and engaging in effective communication. Despite the widespread use of frequency-lowering features in modern devices, no comprehensive study has rigorously examined whether a "safe zone" exists in which mild to moderate shifting preserves spatial integrity while still enhancing speech audibility.

Transition to College

Faculty Mentor: Dr. Steven Singer
Student Researchers: Sydnee Carr

This project was to author an information book in the form of a nostalgic picture book for adults to gift soon-to-be college attendees. Drawing on the experiences of a student and faculty member, we explored a range of phenomenon that college attendees encounter and provide advice. We formatted the book to appear as a series of letters, including empty envelopes within for the gifter to write letters for the receiver to open when they encounter each topic.

Investigating Parents' perspectives on climate change in schools in New Jersey

Faculty Mentor: Dr. Arti Joshi & Dr. Lauren Madden
Student Researcher: Meera Bhatt

This project builds upon existing collaborative research between Drs. Joshi and Madden. Given New Jersey's unique position as the only US state with learning standards addressing climate change across all grade levels, we must understand how parents interact with their children about this topic. In the MUSE project, Ms. Batt conducted a focus group study involving interviews with faculty from The College of New Jersey (TCNJ) to explore their perspectives and experiences regarding discussions with their children about climate change. The study sought to elicit detailed examples and in-depth descriptions of parents' viewpoints within the TCNJ community. Analysis of the themes derived from the focus group data revealed a clear need for the development of a structured "discussion guide/template" aimed at facilitating substantive and meaningful conversations that are developmentally appropriate, between parents and their children on the topic of climate change.

Bone Health during Spaceflight

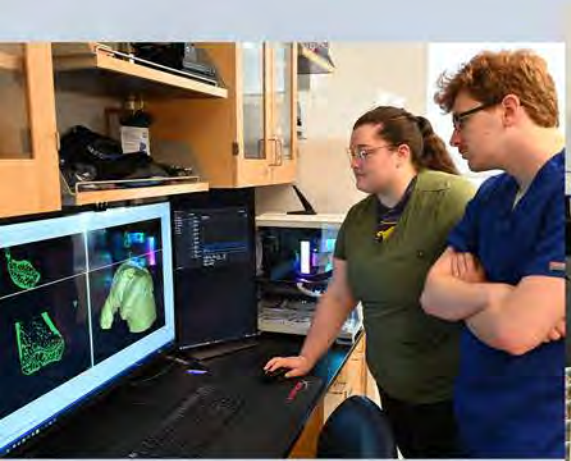
Faculty Mentor: Dr. Anthony G. Lau
Student Researchers: Ren Wolstenholme, Stephanie Frolio,
Jeremy Liegner, Nina Kolodchak, Abby Cole

Experimental:
We developed experimental dissection skills to prepare mice femur bones for biomechanical structural testing. We investigated the bone strength in mice that flew in space aboard the International Space Station, as well as simulated microgravity through a ground based model of hind limb unloading, where the mice are held up by their tails to take the weight off of their hind legs to mimic the absence of gravity. The bones were broken to investigate the structural properties and evaluate connections between sex, loading conditions, and duration of exposure to different environments. Material properties were also calculated from spherical mircroindentation testing, a controlled "poke" of the cross section of the femur cortical bone. Working with the actual specimen gave perspective to the size difference of rats and mice. This hands-on experimentation exposed us to new avenues for understanding theory, and fueled our interest for bio and injury mechanics.

Medical Imaging:
This summer, we also used our new microCT scanner to perform high resolution 3D Imaging of the bone microstructures for rats exposed to Proton Radiation as well as Minipigs Skulls exposed to X-Ray radiation. We performed quantitative analysis of bone microarchitecture of the rat proximal tibia bone these image data.

Computational Modeling:
Computational Finite Element Modeling was performed from the high resolution microCT image scans of the bones. This summer, we worked to increase the size of our computational FE models and run them on TCNJ's ELSA Computing Cluster to use 1.25TB of RAM to complete our simulations.

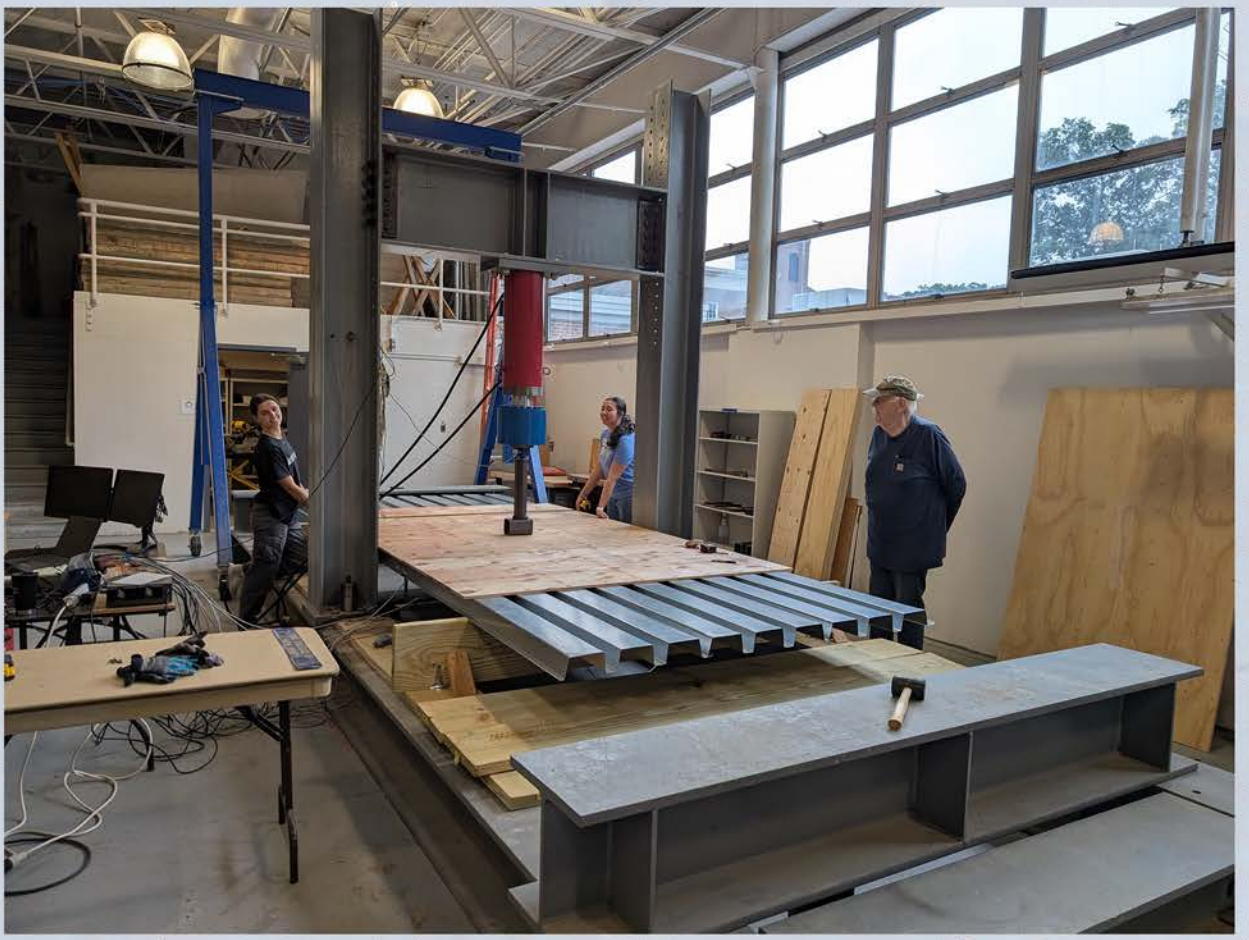
We also started a new collaborative project with TCNJ faculty in Psychology to investigate how cage enrichment and alcohol consumption affect bone health in rats using the bone strength assessment methods from our research lab.



Load Distribution in Cold-Formed Steel Roof Deck

Faculty Mentor: Dr. Andrew Bechtel
Student Researchers: Elizabeth Barlow, Jasmyn Watson

Over the summer we performed an experimental study, sponsored by the Steel Deck Institute (SDI), on the load distribution behavior of cold-formed steel roof deck systems subjected to concentrated loads. The goal was to understand how point loads spread laterally across adjacent ribs, and how factors such as deck geometry, footprint width, and material type influence stiffness and load-sharing. This is critical for developing a distribution factor (DF) model useful for industry design.



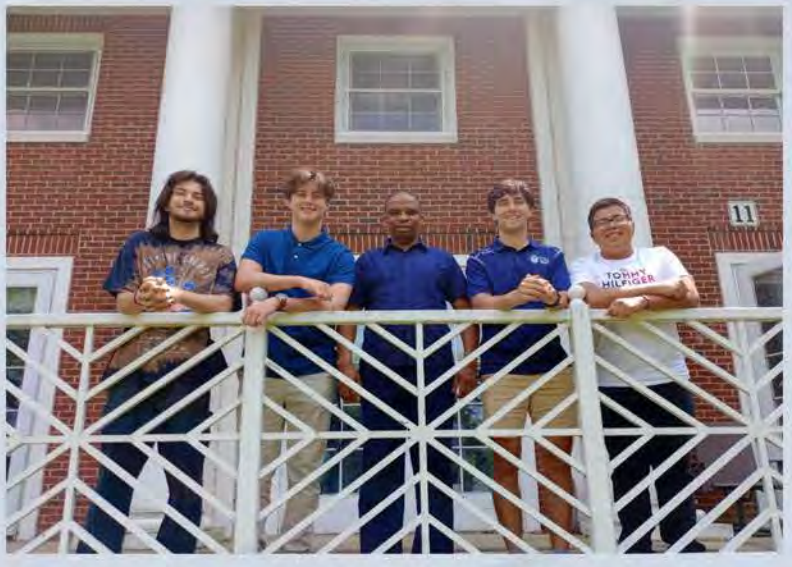
Control of Flying Robots

Faculty Mentor: Dr. Ambrose Adegbege
Student Researchers: Jose Peralta, Gabriel Burgos,
Mason Rabztow, Francis Aldridge

The overarching objective of the summer research is the development and implementation of robust control algorithms for the stable and reliable operation of robots. The sophisticated behavior of robots and the complex dynamics governing their movements requires advanced control strategies for effective motion planning and obstacle avoidance. To offer a holistic solution, the control algorithm must optimize all possible future sensor and actuator changes while minimizing energy consumption and ensuring efficient constraint management, resource allocation, and overall performance enhancement. The research is accomplished under four different tasks as follows:

1. Jose Peralta-MUSE Sponsored
Research Title: Enhancing Drone Flight Performance-MPC vs PID Control.
In this project, Jose explored different strategies and open-source platforms for the control of small-scale drones. The main goal is to establish a testbed for quadrotor drone testing which will allow for evaluation of various control algorithms and assessing different capabilities, such as autonomous navigation, swarm operations, and sensor fusion. This work will support future research initiatives in the future.

2. Gabriel Burgos-MUSE sponsored.
Research Title: Analog Implementation of Fixed-Time Step Optimization Solvers
In this project, Gabriel investigated the fixed-time computation of convex optimization problems using analog circuits. He developed a prototype analog solver for the homogeneous complementarity problem utilizing a Field Programmable Analog Array (FPAA). This work bridged theoretical concepts and hardware implementation by translating mathematical optimization algorithms into physical analog circuits.

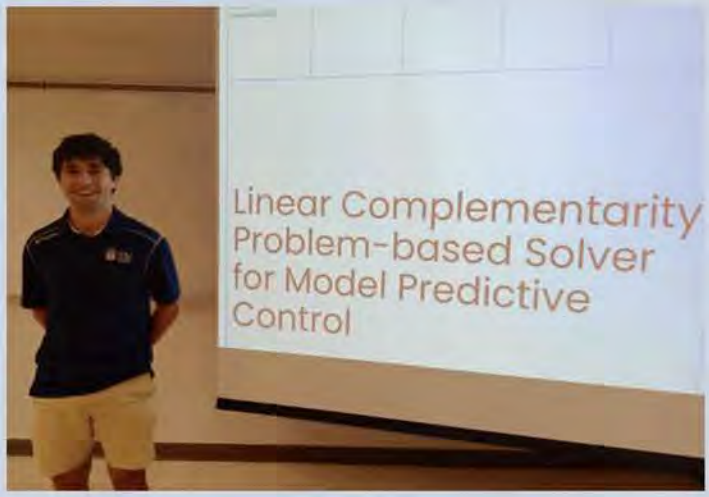


Control of Flying Robots

Faculty Mentor: Dr. Ambrose Adegbege
Student Researchers: Jose Peralta, Gabriel Burgos,
Mason Rabztow, Francis Aldridge

3. Mason Rabztow-NASA/NJSGC Sponsored
Research Title: Linear Complementarity Problem-Based Solver for Model Predictive Control
In this project, Mason explored direct solution methods to Model Predictive Control. By reformulating the underlying quadratic program problem into a Linear Complementarity Problem (LCP), Mason investigated guaranteed convergence of the LCP via the use of vector-partitioning, Lemke's algorithm, and an augmented n-step vector. The existence of an n-vector guarantees that the LCP can be solved at most in n-pivot steps. Additionally, he investigated pre-processing the problem through partitioning to shrink the problem. This involved separating different sections of a matrix and determining which sections were violating the constraints of the problem, allowing only those portions to require solving.

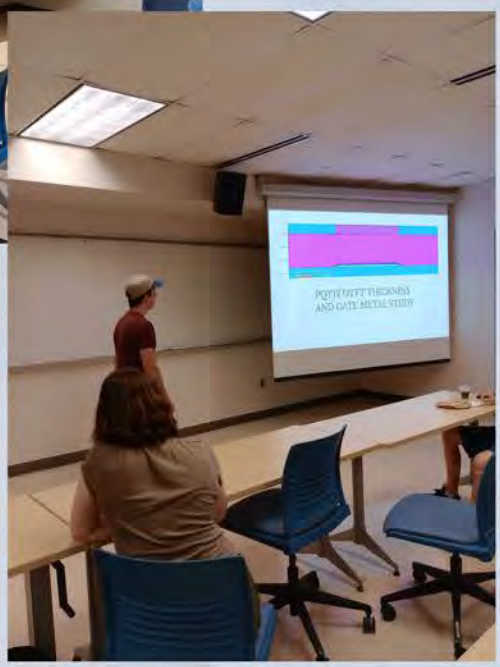
4. Francis Aldridge-NASA/NJSGC Sponsored
Research Title: Programmable Logic Controller Implementation for Model Predictive Control
In this project, Francis successfully implemented a computational method for Model Predictive Control on a rather unconventional embedded device. Programmable Logic Controllers (PLCs) have become an industry standard for automation and control, but with their strong computational abilities and continued proliferation, these industrial computers could become a viable option for complex control problems and applications. With the completion of the Uzawa algorithm and state estimator for optimization, prediction, and control in the Beckhoff CX-9020 PLC, an experiment involving a coupled quadruple water tank system is currently being investigated.



Thin Transistor Simulation Study for Sensor Applications

Faculty Mentor: Dr.Wudyalew Wondmagegn
Student Researchers: Ryan Cangiano, Nicholas Schwing

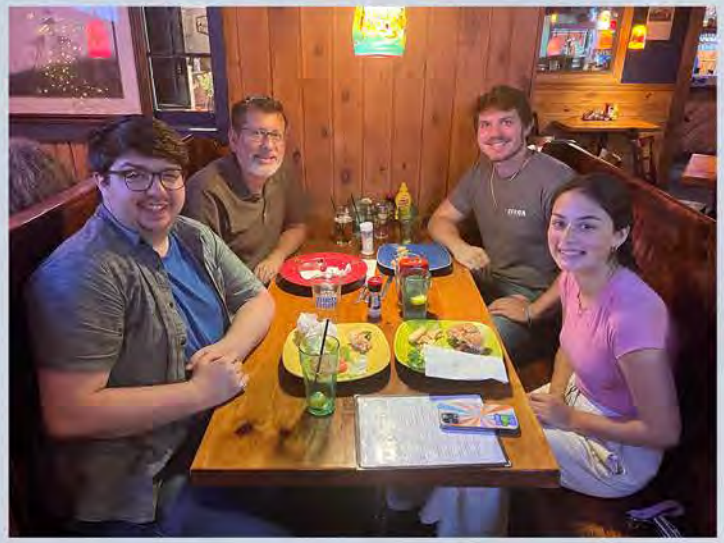
This study, conducted as part of the MUSE project, investigates the relationship between transistor performance and key design parameters through comprehensive simulation. The parameters analyzed include the thicknesses of the semiconductor and insulator layers, source/drain metals, source/drain thicknesses and widths, gate metal types, and channel length variations. A detailed evaluation of these factors enabled the design and testing of an optimized transistor configuration. Additionally, simulation data were generated for use in machine learning applications. Specifically, data were collected from a transistor-based gas sensor exposed to various gases at a concentration of 5 ppm. This dataset is intended for training machine learning models capable of classifying different gas exposures.

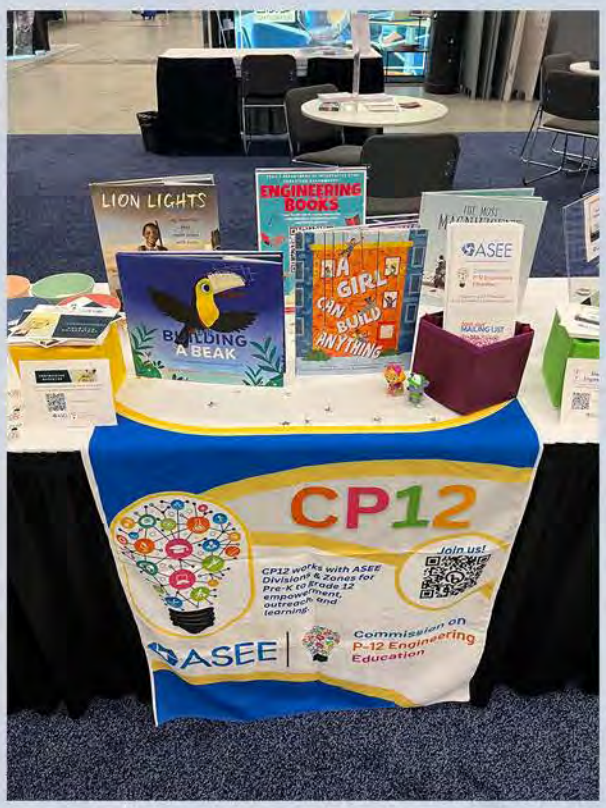


Exploring Engineering Habits of Mind and the Engineering Design Process in Children's Picture Books

Faculty Mentor: Dr. Manuel Figueroa
Student Researchers: Katherine Spuckes, Michael Zeringue

Every year the National Science Teachers Association (NSTA) publishes a list of the BEST STEM books to use in a classroom. This is a valuable resource, as elementary school teachers can use the recommended books to read out loud in the class and develop engaging activities for their students. However, a guide to teach engineering concepts has never been developed. This summer, Katherine Spuckes and Michael Zeringue spent their time reading over 50 engineering specific K-5 picture books to develop a rubric that teachers could use to identify high quality engineering themed children's books. They determined that books that focused on the engineering habits of mind, the iterative design process, and career exposure and awareness served as excellent tools to introduce engineering at the K-5 grade levels.

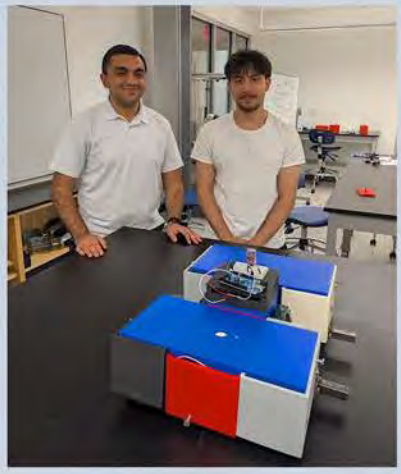


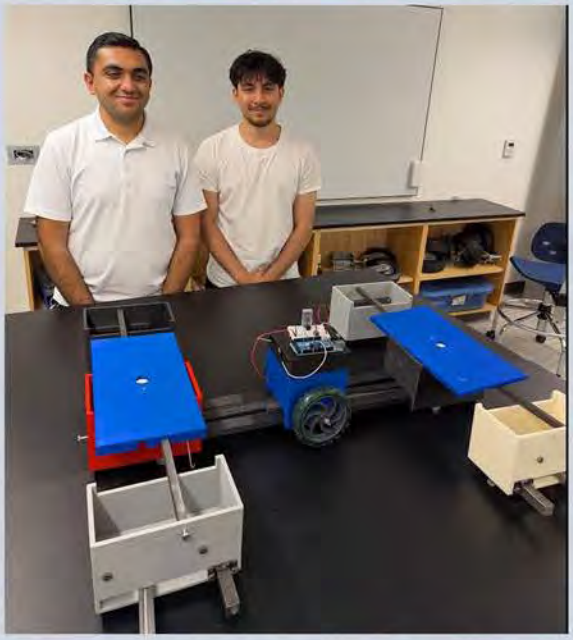


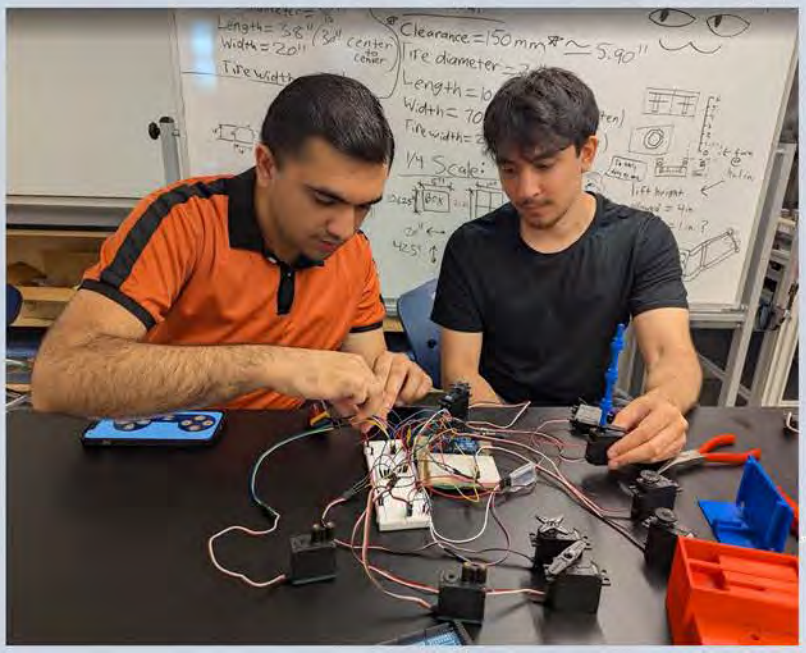
Retractable Parking Robot

Faculty Mentor: Dr. Jennifer (Yunfeng) Wang
Student Researchers: Asid Khadam, Andrew Kromidas

Robotic valet parking systems are a promising solution to car parking challenges in major cities. The current models, known as board-based systems, lift and transport cars but are large and limit efficiency gains.This MUSE project is to develop a Retractable Parking Robot (RPR) that is much more compact. This new design would take up only a quarter of the space of current robots, allowing four of the new robots to be stored in the space of one old one. This innovation would significantly improve parking garage efficiency and storage capacity.



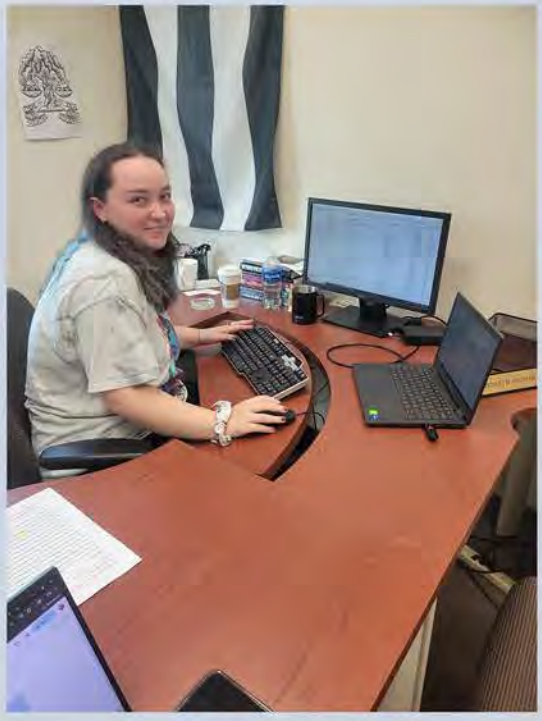




Whose Lived Experience Matters?: An analysis of Criminology s Exclusion of Convict Criminological Research

Faculty Mentor: Dr. Jennifer M. Ortiz
Student Researcher: Elissa Paranich

Established in 1997, Convict Criminology (CC) is a subfield of Criminology composed of researchers and academics with direct and vicarious lived experiences (LE) with the criminal legal system. CC aims to amplify and infuse the voices of incarcerated and formerly incarcerated people into criminology's understanding of crime and punishment, and into larger policy discussions. Our project sought to analyze how CC research is cited in the growing LE criminology movement that arose in the 2010s. We developed an original database of 264 articles published between 2009-2025 that collected original data (e.g. surveys, ethnographies) on the lived experience of incarcerated or formerly incarcerated people. We collected publicly available data on author demographics, methodology, journal prestige, and citation patterns. We found that despite the increase of LE criminology publications since 2008 and the nearly 30-year history of CC, LE researchers rarely engage with existing CC research. Over forty six percent of LE publications do not cite CC research. We also found that when scholars do engage with CC research it is largely the work of three dominant white males, two of whom did not directly experience incarceration. The purposeful exclusion of the field of CC in the growing LE movement serves to further marginalize the work of formerly incarcerated and system-impact individuals who overcame all obstacles to earn doctoral degrees.



"The Murder of Lidice": International Response to Genocide

Faculty Mentor: Dr. Cynthia Paces
Student Researcher: Grace McHugh

Propaganda shaped both public opinion and political action during World War II. One instance where this played out was the Allied Powers' response to the massacre of Lidice on June 10, 1942. An entire village in occupied Czechoslovakia was erased in response to the assassination of a high-ranking Nazi official. All men and boys over 15 were murdered, the women were sent to the Ravensbrück concentration camp, and the children were either selected for Germanization and then adoption or were killed. After the Nazis proudly reported what had occurred at Lidice, the rest of the world picked up the story, printing the details in newspapers or discussing it in radiocasts. The US and Great Britain used what occurred at Lidice in their propaganda and messaging to legitimize their actions in the war and the fight against the Nazis. They engaged poets and artists to respond to the massacre and encouraged communities to rename themselves in honor of Lidice. Coverage of the relatively small Lidice massacre even obscured news of Nazi actions against European Jews. While the name of Lidice spread all over the world at the time, it has largely been lost in the larger historical narrative, and there exists no singular English language monograph that provides a comprehensive historical narrative of the event and its global impact.

"Looking the Part:": Women Lawyers, Experiences of Nonbelonging, and Political Ambition in the U.S.

Faculty Mentor: Dr. Tao L. Dumas
Student Researchers: Esmeralda M. Regalado

Although women now outnumber men in U.S. law schools, many markers of inequality persist in the American legal profession and are particularly acute for women of color. Gendered and raced stereotypes about who "looks like" a lawyer can result in women lawyers experiencing frequent messages of nonbelonging from fellow attorneys, clients, judges, and court staff, such as being mistaken for non-lawyer, lower status jobs. It is important to understand both the challenges and the coping strategies used by different groups of women in the legal profession, particularly given the important role of the law as a pipeline for judicial and political office. This chapter draws on focus group and survey findings to explore how women lawyers' experiences contribute to their desire to persist and advance in the legal profession and to pursue opportunities to become judges and other elected officials.

Building Capacity for Equitable Research on STEM Learning Processes Using Quantitative Ethnography

Faculty Mentor: Dr. Adaurennaya C. Onyewuenyi
Student Researchers: Ashton Calo, Kendra Wireko-Brobby

The Quantitative Ethnography (QE) Institute at the University of Wisconsin-Madison addresses a critical need by expanding access to advanced research methodologies for underrepresented STEM education scholars. By combining rigorous in-person training with quarterly virtual professional development sessions, the Institute equips scholars to conduct innovative QE studies that explore complex educational problems. The program fosters a supportive Community of Practice, where participants' expertise is not only validated but centered, creating a collaborative space for developing and sharing QE skills. This project examines the Institute's short- and long-term impact on participants' research productivity and career trajectories, as well as their ability to sustain and grow QE within their academic and professional networks. By using a participatory QE approach, the study aims to highlight how underrepresented STEM education scholars navigate and transform systemic inequities through their work. The findings will inform strategies for scaling similar NSF-supported training initiatives, broadening participation in cutting-edge research, and advancing equity in STEM education. This project underscores the societal importance of empowering diverse voices in STEM, with implications for educational innovation and addressing persistent disparities in the field.

The Influence of Active and Passive Leisure on Distress as Moderated by Escapism Motives

Faculty Mentor: Dr. Joanna Herres
Student Researchers: Mikayla Renzi, Chloe Yadav

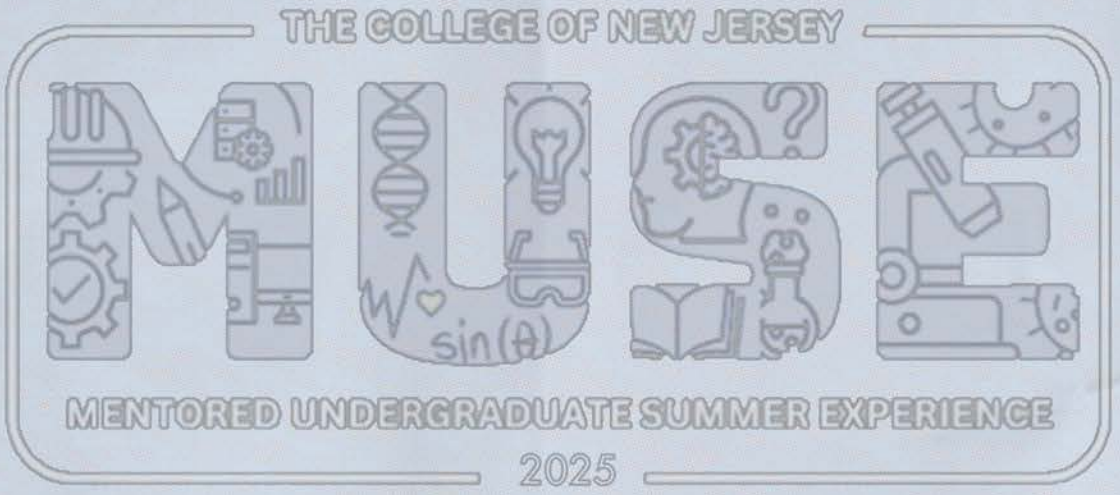
College students report increasingly high levels of psychological distress. Students' engagement in either active leisure (e.g., physical activity) or passive leisure (e.g., reading, screen time) may help to reduce distress by serving as a temporary escape. As such, the impact of these activities on distress may depend on students' underlying motives for engaging in them. The dualistic model of escapism suggests that individuals are driven by either self-suppressive (maladaptive) or self-expansive (adaptive) motives when choosing these activities, and these motives may influence the extent to which different types of leisure activities impact college students' distress levels. This MUSE project entailed designing a study to assess college students daily on escapism motives, engagement in various types of leisure activities, and distress levels. We hypothesize that students who engaged in more active leisure would report less distress at the end of the day, controlling for prior day distress. Additionally, we expect self-expansion motives to predict less distress, while self-suppression motives would predict more next-day distress. Lastly, we hypothesize that the impact of both passive and active leisure activities on distress would be moderated by the individual's escapism motive.

Under the mentorship of Dr. Joanna Herres and Chloe Yadav, Mikayla Renzi drafted and submitted an IRB proposal for a survey study to be conducted in Fall 2025. Study participants will be recruited via email to complete an initial online survey measuring different types of leisure activities, students' motivations, sleep quality, trauma history, and distress. Participants will also have the option to participate in a 10-day daily survey to measure their levels of distress, engagement in different types of leisure activities, and motives for engaging in activities each day, as well as sleep quality, distress tolerance, avoidance behavior, and trauma history. Findings may provide insights into the importance of motives in understanding the impact of leisure activities on distress among college students.

The role of disfluency on recognition memory

Faculty Mentor: Dr. Andrew P. Leynes
Student Researchers: Christian Noguchi

We analyzed existing data to prefect ways to quantify and analyze event-related potential data obtained during masked priming studies of recognition memory. We then applied these new methods to understand how disfluency (more difficult processing) affects recognition memory and the measures of brain activity during remembering.



Campus as a Living Lab

Faculty Mentor: Dr. Miriam Shakow
Student Researchers: Sydney Eltringham, David Kraidman

Our research this summer focused on the Campus as a Living Lab, a TCNJ program to facilitate hands-on learning about environmental sustainability via campus projects. We created a sustainability literacy and culture survey; designed a series of indoor and outdoor signs to educate the TCNJ community about our campus geothermal and solar energy, native pollinator gardens and meadow, and the ecological challenges raised by the overpopulation of deer in this region. We also researched potential grants and other sources of funding for the Living Lab.

Protecting People in and Around Cars: Projects in Partnership with Kids and Car Safety

Faculty Mentor: Dr. Elizabeth Borland
Student Researchers: Jenna Needham

This MUSE project is focused on using statistics to identify meaningful patterns that can inform public policy. It is part of the Justice and Blameworthiness Lab (JABLab) at TCNJ, in partnership with the national nonprofit Kids and Car Safety (KACS). JABLab researchers have supplemented and coded over 400 U.S. "hot car death" cases involving parents who unknowingly left their child in a vehicle. Over the summer, we used R in order to investigate patterns related to socioeconomic status related to hot car deaths, as well as new analysis with national data on submerged vehicle awareness. As climate change drives more extreme weather and flooding, vehicle submersion emergencies are becoming an urgent public safety issue. Yet many people remain unsure how to respond in these life-threatening situations.

Using nationally representative data from the 2024 Cooperative Election Study (CCES), we surveyed 1,000 U.S. adults with questions developed by JABLab researchers. We assessed respondents' confidence, beliefs about timing, preferred escape strategies, and decisions involving children in submersion scenarios. Our analysis explores how knowledge varies across gender, race, education, region, age, parental status, and more.

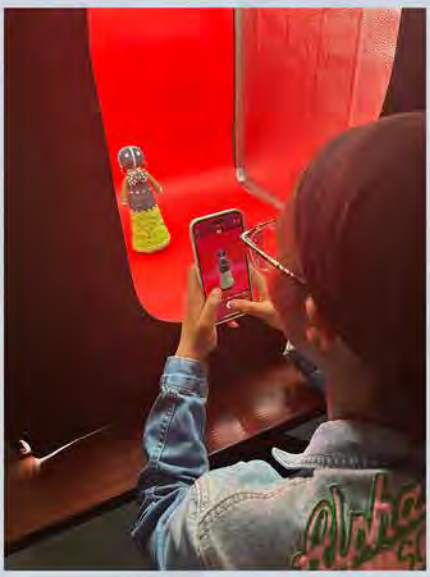
By identifying gaps in preparedness and patterns of overconfidence, this project supports the development of targeted, evidence-based safety campaigns. Our findings will help bring life-saving information to those who need it most.

Digitizing Apartheid Heritages Project

Faculty Mentor: Dr. Marla L. Jaksch
Student Researcher: Ebony Riley

The Digitizing Apartheid Heritages Project, which seeks to build upon the creation of a digital archive from a small but important physical collection in order to preserve and share the legacy of apartheid in South Africa. This project contributes to and significantly expands critical approaches to the digital humanities. Critical Digital Humanities is an emerging, intersectional field that emphasizes questions of power, social justice, and critical theory in making and analyzing digital technologies. This is a version of digital humanities that places anti-racist, decolonial, feminist, and queer/trans/non-binary work at its core, and which understands our current historic shift in digital technology as an opportunity for social and political transformation. Further, Critical Digital Humanities foregrounds creative praxis, co-creation, public engagement, and community-based research. The overarching goals of the Digitizing Apartheid Heritages Project includes the cataloging of a small physical collection of extant cultural heritage and collected ephemera. The documenting, organizing, digitizing and preserving of these materials collected over the last fifteen-years into a cohesive, accessible format.

The Digitizing Apartheid Heritages Project seeks to address inequities in access to under-utilized and understudied source materials, of which the history of apartheid is a part. This project speaks to the challenges of representing history and heritage at places characterized by ephemerality, absence, or both. History and heritage may disappear through age and degradation, intentional political suppression, contradictory narratives, and uncertainty and knowledge gaps. In response, this project combines texts, objects, architecture, maps, and consideration of human action to create a layered means of accessing primary- and secondary-source materials.



Exploring the Psychosocial Effects of a 12-week Group-Dance and Education Intervention in Mothers of Childbearing age at Risk for Depression.

Faculty Mentor: Rahshida Atkins PhD, APN-C, PNF-BC, PMHNP-BC
Student Researchers: Megan Majewski, Simranjot Mann, Natasha Patterson

The effects of a 12-week group physical and activity and education intervention on depression prevention is being tested using a quasi-experimental research design and a community based participatory research (CBPR) approach. The impact of the intervention on predictors of depressive symptoms including self-esteem, social support, anger, perceived stress, perceived racism and physical activity levels will be tested utilizing well validated and reliability instruments and a control group. Completed activities include collaborative meetings with community partners and preparation of online and in-person recruitment and data collection materials including questionnaires for the main study variables, screening forms, demographic data sheets and informed consent documents.

Nurses Perspective on Family Care Competencies: A Global Focus Group Study.

Faculty Mentor: Dr. Connie Kartoz
Student Researcher:: Michael Hamm

The purpose of this MUSE project was to contribute to a revision of the International Family Nurses Association (IFNA) position statements on competencies for family nursing practice. The first phase of the project took place prior to MUSE and involved locating competencies statements for nursing practice from a representative sampling of countries. During MUSE, along with a team from IFNA, we analyzed if, and to what extent family nursing is a component of national nursing competencies. Those findings were presented at the IFNA biennial meeting in Perth, Australia. The next phase of the project was to conduct focus groups with members of IFNA to explore their perceptions of family nurse competencies and of the existing position statement. Our project is continuing and findings will inform an international standard for family nursing care.

Medical Mistrust and the Impact of Policy on an Impoverished Society

Faculty Mentor: Dr. Vicki Brzoza
Student Researcher: Elyse Ryan

This study examined the perspectives of people experiencing homelessness in New Jersey and their perceived challenges in obtaining breast cancer screenings, education, and healthcare. Reluctancy in utilizing healthcare services due to prior adverse experiences was a recurring theme within the research study and literature search. Policy and social changes may contribute to the public's level of mistrust in the healthcare system.

Medical mistrust reinforces a substandard depiction of healthcare, thus leading to poorer health outcomes and limited assurance in preventative services for breast cancer. The purpose of this study was to identify key themes related to individuals' perceptions of mistrust when seeking healthcare. Such findings can serve as implications for oncological nursing practice.

Postpartum depression/maternal mental health and well-being

Faculty Mentor: Dr. Tracy Perron
Student Researcher: Jasslin Cruz

The aims of this pilot study are to determine the experiences of adolescent mothers in relation to their mood and sleep when using SNOO after giving birth and for up to 6-months postpartum.
The primary research questions will determine:
How do adolescent mothers describe their mental health when using SNOO (depression, anxiety, mood)?
How do adolescent mothers describe their sleep (duration, fragmentation, fatigue) and their infant's sleep (duration, fragmentation, fussing, crying) when using SNOO?
What impact do adolescent mothers perceive SNOO having on their mood?
The secondary aims of this study are to explore sleep practices, mother-infant bonding, self-efficacy, and to evaluate the feasibility of using SNOO in adolescent mothers who are participating in a community-based education program. The secondary research questions are:
What sleep practices do adolescent mothers engage in with their infant (bed sharing, use of loose blankets, prone vs. supine sleep position of baby) when using SNOO and when not using SNOO?
How do adolescent mothers describe infant bonding when using SNOO?
How do adolescent mothers describe their self-efficacy when using SNOO?
What impact does using SNOO have on adolescent mothers who are participating in a community-based education program (satisfaction, retention/-drop-out rates, return to school program, attendance/absenteeism)?
What are the strengths and limitations to using SNOO in a community-based education program?

THE COLLEGE OF NEW JERSEY
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2025

Legionella, A Survival Story: Persistence and Rebound Events and Chlorine and Heat Treatment.

Faculty Mentor: Dr. Alexis Mraz
Student Researchers: Aidan Morales, Tanvika Gudisey

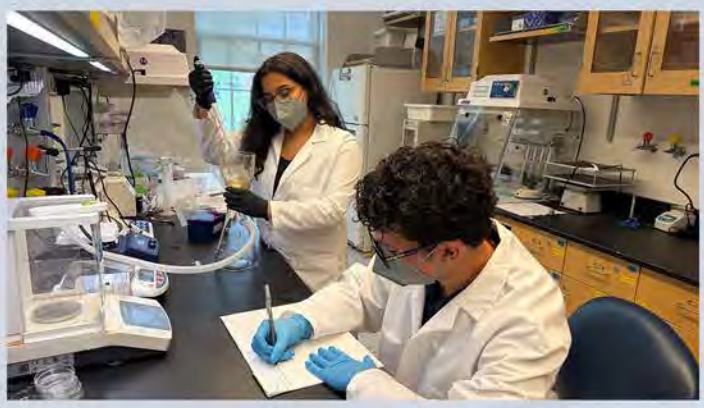
Legionella is the leading cause of drinking water outbreaks in the US costing over $400 million annually. Legionnaires' disease has a case fatality rate of 10% for the general population and up to 25% for healthcare-associated cases, compared to ~1.8% for COVID-19. One of the challenges in managing Legionella in large premise plumbing systems, such as hospitals rebound events which have been noted roughly two weeks after common treatments, such as hyperchlorination and heat flushing.

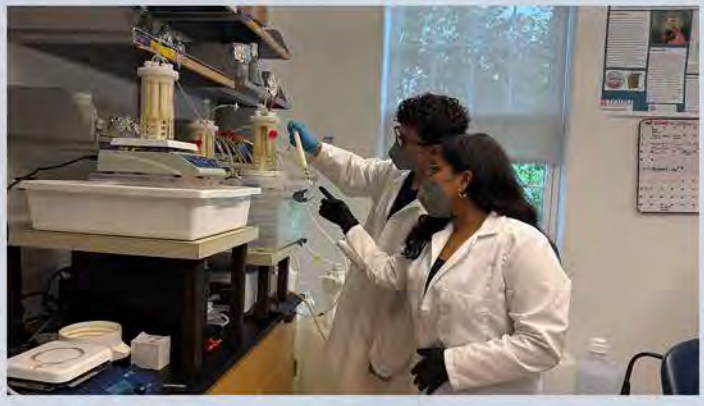
Objective

We hypothesize that the pathogen is utilizing the biofilm for protection during the oxidative and/or thermal stress of treatment events, and when the stress dissipates Legionella migrates back into the bulk water, causing the treatment event to have a temporary effect on the pathogen's presence in the premise plumbing system. Understanding the kinetics of Legionella during and after treatment will be beneficial in managing the pathogen in large premise plumbing systems and reducing morbidity and mortality in healthcare settings.

Methods

Biofilms were developed using three CDC bioreactors on common plumbing materials, copper, PVC, and stainless steel for 6 weeks from tap water. Hyperchlorination (30 mg/L of chlorine at 20 L/hour for 2 hours) and heat flushing (70⍰ at 20 L/hour for 2 hours) occurred two weeks after Legionella spiking.





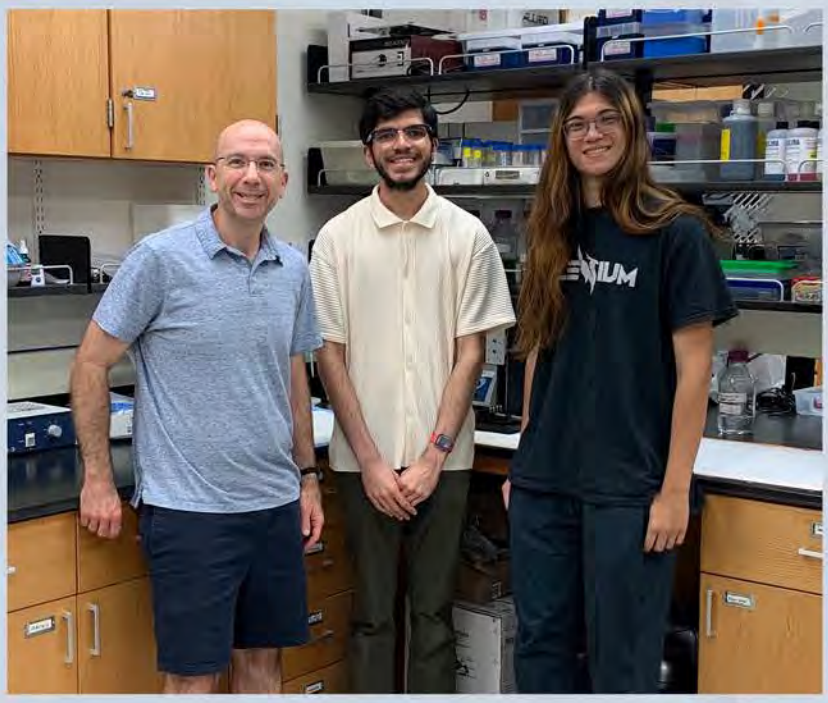
Results/Conclusion

Legionella concentrations in the bulk water were drastically reduced directly after the treatment events, but were not significantly changed in the biofilms. Legionella concentrations slowly increased in the bulk water within two weeks of treatment, supporting our initial hypothesis.

Crabs in a Changing Ocean: Exploring how Molting affects Susceptibility to Ocean Acidification

Faculty Mentor: Dr. Gary Dickinson
Student Researchers: Sameer Kamal & Corin Hoppe

Research in the Dickinson lab focuses on the question of how animals like crabs and barnacles build their shell and how climate change will affect mechanical and structural properties of those shells. For MUSE 2025, we studied two economically important crustaceans: Arctic Tanner crabs and the intertidal barnacle Amphibalanus amphitrite. We focused on two aspects of shell formation. In crabs, we assessed how molting (a process in which the crab sheds its old shell and builds a new, larger shell) affects properties of the crab shell. We were interested in determining if the molting process increases the crabs' susceptibility to predicted future ocean conditions. In barnacles, we studied how barnacles interact with living substrates in the ocean (for example the shell or bone from another animal). We tested the hypothesis that barnacles can erode away living material as they stick and grow.



Examining how CYP72A9 confers stress resilience in Arabidopsis thaliana

Faculty Mentor: Dr. Leeann Thornton
Student Researcher: Samantha Pacera

The Thornton lab is interested in the genetic basis of how plants acclimate to adverse environments, such as high temperature, drought, cold, and soil contaminants. We use a small plant (Arabidopsis thaliana) to test genes that are also found in crop plants, such as corn. We are trying to determine how specific versions of a gene help the plant acclimate to stress while similar genes have other roles in plant growth and defense.

Investigating interplay withing the tubulin code in C. elegans

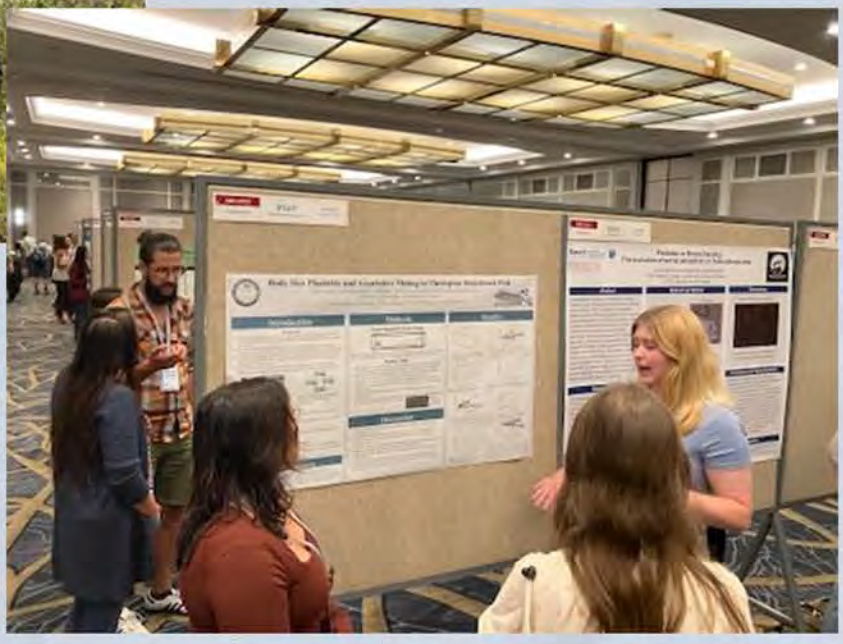
Faculty Mentor: Dr. Nina Peel
Student Researchers: Amanda Khoury, Mathew Senn

Changes to microtubule function are associated with acquired resistance to some cancer chemotherapeutics, and with human diseases such as ciliopathies and neural degeneration. In a typical textbook image, a microtubule it is made up of generic alpha- and beta-tubulin building blocks. In reality however, microtubules are much more interesting with different versions of the alpha- and beta- tubulin incorporated and a variety of modifications adorning the surface. This so called tubulin code is thought to modify microtubule function by altering the interaction between the microtubule and other proteins. Our lab is focused on understanding the contribution the modification glutamylation makes to modulating microtubule functions. Increased levels of glutamylation lead to cilia defects and reduced fertility. We are investigat-

Phenotypic Plasticity and the Origin of Species in Threespine Stickleback Fish

Faculty Mentor: Dr. Matthew Wund
Student Researchers: Katie McGee, Isha Patwardhan

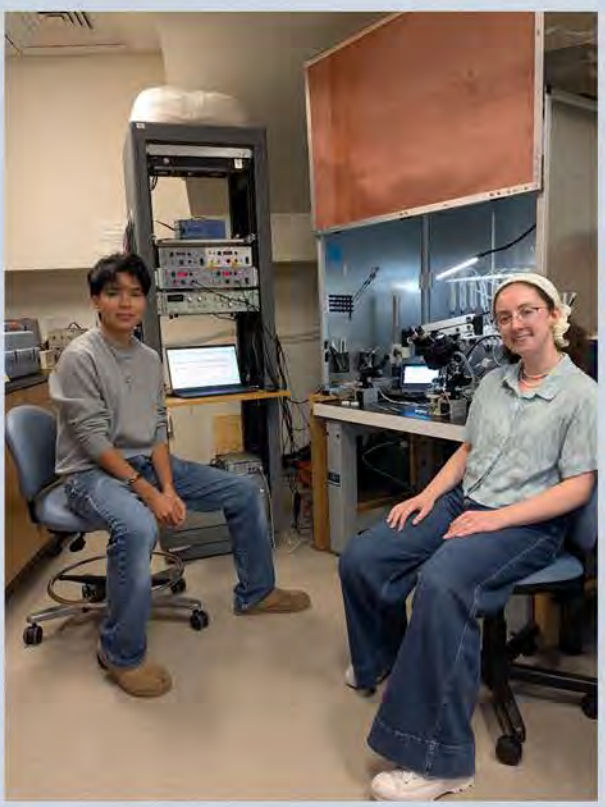
We are testing hypotheses about the early stages of how new species form. To do so, we are studying recently-established freshwater populations of stickleback fish that occur in several Alaskan lakes that formed following the construction of a coastal highway. During the breeding season, these lakes contain both migratory marine stickleback and much smaller, freshwater residents that have recently descended from the marine migrants. We propose that environment-dependent differences in body size leads causes the two forms not to recognize each other as viable mates, facilitating the formation and eventual maintenance of separate species. We are using a combination of field observations in Alaska, mate choice experiments on laboratory-reared fish from these populations, and genomics to explore the dynamics of genetic divergence between these marine stickleback and their recent freshwater descendants.



Using an in vitro electrophysiologicalapproach to investigate central respiratory drive in neonatal serotonin-deficient mice

Faculty Mentor: Dr. Jeffery Erickson
Student Researchers: Madelyn Murphy, Adan Godoy

The focus of this project was to use a newly developed "split-bath" in vitro electrophysiological recording system to investigate the underlying neural mechanisms responsible for impaired breathing behavior in neonatal serotonin-deficient Pet-1 knockout mice. Previous work from my lab using whole-animal in vivo physiological methods has shown that the loss of Pet-1 gene function, which results in a selective 70% loss of brainstem serotonin neurons, compromises normal breathing behavior in neonatal knockout mice. The breathing deficits in these mice are similar to those associated with Sudden Infant Death Syndrome (SIDS) in humans, a disorder correlated strongly with a deficiency of brainstem serotonin. Fully understanding the neural mechanisms responsible for these breathing deficits requires an analysis of the brainstem circuits within the medulla oblongata that generate respiratory rhythm. We therefore developed an electrophysiological recording system to measure and compare "fictive breathing" from brainstem-spinal cord preparations isolated from neonatal wild type and Pet-1 knockout mice. Our objective during MUSE 2025 was to gain experience using this system in preparation for in-depth pharmacological studies aimed at understanding the neural mechanisms that underlie the Pet-1 knockout breathing abnormalities.



From Nature's Glue to Nasty 'Superbugs': Using Supercomputers to Build the Future of Science

Faculty Mentor: Dr. Joseph Baker
Student Researchers: Daniela Agne, Sara Kuwar, Kashish Sood, Khusi Patel, Christina Medina, Emily O'Keeffe, Tanzim Didar

This summer, the Baker Lab research team harnessed the power of ELSA (the Electronic Laboratory for Science and Analysis), TCNJ's campus supercomputer, to dive into the invisible world of molecules. Using sophisticated computer simulations, the interdisciplinary team (which included chemistry, biology, computer science, biomedical engineering, and mathematics and statistics majors) worked to find solutions to pressing global issues in environmental science and human health. By building virtual models of complex proteins at the scale of every atom in the system, we can watch them move, bend, and interact in ways that are impossible to see in a traditional lab, providing critical insights that drive science forward.

Our research tackled two major areas: understanding the natural world and combating dangerous bacteria.

One project explored the secrets of barnacles. These tiny creatures can cause massive problems for the shipping industry by sticking to hulls, increasing fuel consumption and pollution. Daniela Agne and Sara Kuwar simulated a key protein, bsf, that barnacles use to build their incredibly strong shells. By pulling the protein apart on the computer, they discovered its remarkable strength and potential "self-healing" properties, paving the way for developing new insights into how to keep surfaces free of barnacle aggregation.

From Nature's Glue to Nasty 'Superbugs': Using Supercomputers to Build the Future of Science

Faculty Mentor: Dr. Joseph Baker
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Another major focus was on the growing crisis of antibiotic resistance. Kashish Sood, Emily O'Keeffe, Christina Medina, and Tanzim Didar investigated the tiny tube-like structures, called pili, that bacteria use as molecular grappling hooks and to share resistance genes with each other. By simulating the individual protein building blocks of these pili from several infectious bacteria, our team (1) compared different types of pili to find their unique strengths and weaknesses, (2) investigated how a unique circular pilin protein increases in stability by interacting with lipid molecules, and (3) measured the precise force needed for the bacteria that cause urinary tract infections (UTIs) to cling to human cells.
The ultimate goal of this work is to find new ways to break these bacterial structures, leading to novel drugs that can combat infections and disarm antibiotic-resistant superbugs.

Finally, we also spent time working on building tools that future scientists can use. Beyond specific biological problems, one of our students, Khusi Patel, worked on making molecular computational science more accessible to new students. Learning the complex software for running the simulations to study small molecules can be a major hurdle for new researchers. To solve this, we are developing ChatMD, a custom AI assistant designed to be a "smart tutor" for the molecular dynamics simulation workflow. This tool will help guide future undergraduate researchers through their projects, generate code, and explain complex concepts, ensuring that TCNJ students remain at the forefront of computational discovery.

www.bakercompchemlab.com

RU A RADICAL? — SYNTHESIS AND REACTIVITY OF RU-COMPLEXES

Faculty Mentor: Dr. Giovanny Parada
Student Researchers: Sean Sprague, Moncher Le

We studied ruthenium molecules capable for stabilizing, otherwise very reactive, carbon-centered intermediates. The studies inform about the thermodynamics of formation and cleavage of the basic hydrocarbon unit, a C–H bond.

Comprehending Cybersecurity attacks using LLMs

Faculty Mentor: Dr. Prerit Datta
Student Researcher: Ryan Wojciechowski

This project explores using the large language models (LLMs) to simplify cybersecurity attacks and descriptions into simple terms. This can be helpful to convey the consequences of cyberattacks for various stakeholders involved in decision making, who may not have a background in cybersecurity.

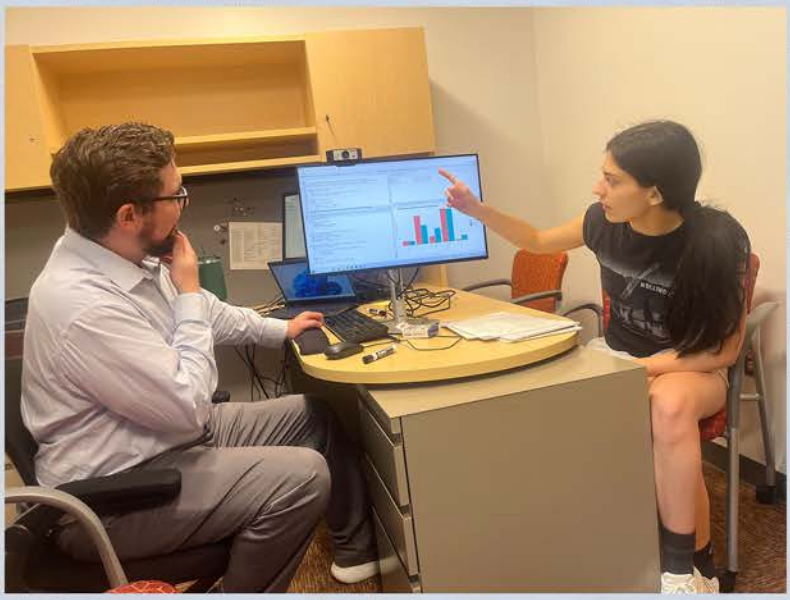
by: Anthony DePrimo

High Structured Guided Practice (HSGP) Outcomes

Faculty Mentor: Dr. Zachary Kline
Student Researchers: Bhumi Shah, Gabby Chipelo

This study examines the relationship between success in general chemistry and performance in organic chemistry, with a focus on how High-Structure Guided Practice (HSGP) impacts students' progression through STEM sequences. Using institutional data from The College of New Jersey we analyzed outcomes for students who completed both general and organic chemistry.

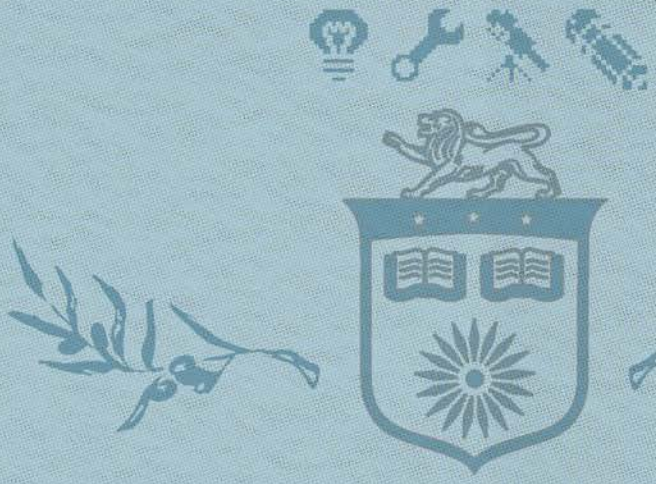
Students were placed into academic performance categories based on final grades, and comparisons were made between those in HSGP and traditional courses, while also considering other performance predictors such as math placement and race/ethnicity to understand how different groups move through the sequence.



Nanoparticle Synthesis in Ionic Liquids using a Plasma Source

Faculty Mentor: Dr. Angela Capece
Student Researchers: Jon Spricigo, Maria Owens, Calista Toussas

This project's goal is to synthesize nanoparticles in ionic liquids by using a DC plasma source, which eliminates the involvement of toxic materials, such as capping and stabilizing agents. To do this, a silver salt is mixed with an ionic liquid before being exposed to a plasma source, where a reactive plasma species reduces the salt to nanoparticles. We then analyze the shapes and sizes of these particles with the SEM and UV-VIS spectrophotometry. In our work, we examine the effects of plasma current, exposure time, silver salt concentration, and the plasma's polarity on nanoparticle formation.



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Brochure created by MUSE 2025 Program Assistants:

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