24th ANNUAL

KALMAN

RESEARCH SYMPOSIUM

SATURDAY,
APRIL 5, 2025

Bucknell
UNIVERSITY

KALMAN RESEARCH SYMPOSIUM

INTRODUCTION

Spring 2025

Welcome to the twenty-fourth annual Kalman Research Symposium.

An important central element of the Bucknell experience is to offer our students in all disciplines the opportunity to engage in substantive out-of-the-classroom research and creative projects with faculty. As stated in the mission statement for Bucknell's Program for Undergraduate Research, these opportunities *allow students and faculty to participate in collaborative learning processes designed to dissolve the distinction between teaching and research, and to create a community of learners in which scholarship serves as the basis for teaching and learning*.

The symposium showcases the breadth and variety of undergraduate research taking place at Bucknell, as is evidenced by the abstracts of the projects contained herein. Visitors are encouraged to attend both the oral presentations as well as the poster session to interact with the scholars and to learn more about their work. In addition, more information can be found on the Kalman Symposium website, containing students' posters, slides and recorded presentations.

This symposium is named in honor of Ernest Kalman, who graduated from Bucknell in 1956. In addition to his service as a University trustee, Ernie's generosity to his alma mater has taken many forms, one of which was a significant gift in support of undergraduate research.

The ***Kalman Research Symposium*** features projects sponsored or supported by the following:

- Algin B. Garrett Undergraduate Research Fund in Animal Behavior
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- Mozilla Just Computing Fellow Research
- NASA Artemis Student Challenge Grant
- NASA Solar System Workings Program and NSF's S-STEM Program #1742124
- National Institutes of Health
- National Science Foundation Grant (NSF)
- Neuroscience & Human Health
- Pennsylvania Firefly Festival and the Pittsburgh Foundation
- PIC Math, a Mathematical Association of America (MAA) program funded by the National Science Foundation (NSF) and the National Security Agency (NSA)
- PPL Undergraduate Research Fund
- Presidential Fellowship
- Psychology Undergraduate Research
- Robert P. Vidinghoff Memorial Summer Internship
- Ruth Everett Sierzega Chair in Linguistics
- Schotz Family Fund
- Sigma Xi Grant-in-Aid of Research
- Stephen Glenn Hobar Memorial Research Award
- Steven E. Boyer '72 Geosciences Summer Experience Fund
- Susquehanna River Heartland Coalition for Environmental Studies
- Tague Family Fund for Undergraduate Research in Biomedical, Biological and Biochemical Sciences
- The American Chemical Society Petroleum Research Fund

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- The Katherine Mabis McKenna Environmental Internship Program
- The Pittsburgh Foundation
- The Tom Greaves Fund for Research & Curricular Development
- Thomas Spitzer Undergraduate Research Fund
- Torrey Botanical Society Undergraduate Research Fellowship
- Undergraduate Investigator Grant
- US Forest Service
- Walthour Fellowship
- Waters Family Fund for Undergraduate Research in Animal Behavior
- Wayne E. & Margaret S. Manning Internship in the Botanical Sciences
- Wendell I. Smith Endowed Internships in Psychology
- William Corrington Renewable Energy Fund

Siena Abercrombie ’25; Lilly Walsh ’25; Siena Vestri ’25

Faculty Mentor(s): Professor Nathan Smith, BIOLOGY

Funding Source: Department of Biology

Are You What You Eat? The Effect of Relative Nutrient Consumption on the Social Behaviors of Zebrafish (Danio rerio)

Obesity affects over one billion adults and children worldwide, with this number increasing each year. Along with its physical health implications, many studies have shown that psychobehavioral health issues in both social and individual settings stem from obesity-linked diets. Exploring sociality in relation to short-term modifications in relative macronutrient composition may shed light on the overall impact diet has on everyday life. Zebrafish are used as a model organism to study many aspects of human behavior because of their high genetic similarity to humans. One area of interest is the relationship between macronutrient consumption and sociality. These observations may provide insights about diets’ impact on social behaviors including anxiety and aggression. In this study, groups of zebrafish were fed diets with elevated levels of macronutrients, either carbohydrates, protein, or lipids. Behavioral video analyses including a standard mirror-biting test, novel tank diving test, and shoaling test were conducted six weeks after the fish were placed on the experimental diets, and early investigation shows a correlation between high lipid and high carbohydrate diets to elevated levels of anxiety and aggression. An increase in these antisocial behaviors demonstrates that studying groups consuming diets high in lipids and carbohydrates-which are associated with obesity-could further elucidate the behavioral impacts associated with obesity. Future studies will be conducted to determine if long – term exposure to these diets, or exposure during development, leads to life-long increases in aggression and anxiety in social settings, in addition to some aspects of morphology including weight.

Lexi Alsante ’25

Faculty Mentor(s): Professor Jimmy Chen, ANALYTICS & OPERATIONS MANAGEMENT; Professor Andrea Halpern, PSYCHOLOGY

Funding Source: Presidential Fellowship

Still “Lucky” Numbers?: Comparing Number Choices in Parimutuel and Nonparimutuel Lottery Games

Lottery games are popular worldwide, and people often have their preferred numbers to play. In some lottery games, if multiple players select the same winning number, the total jackpot is split among winners, resulting in smaller individual payouts. The purpose of this study is to investigate how people’s reported number choices differ when presented with a scenario of nonparimutuel (fixed payoff) versus parimutuel (shared jackpot) “pick-3” lottery games. Halpern and Devereaux (1989) previously analyzed actual nonparimutuel lottery data and showed that even in a game of chance, certain numbers are more frequently bet Ð particularly easy-to-retrieve, highly patterned, “lucky” numbers. This study aims to see whether people will change their betting strategies if their imagined winnings are shared and if the size of the shared jackpot is increased. A total of 2,279 survey responses were collected via Amazon Mechanical Turk across three lottery versions: nonparimutuel, parimutuel with a small jackpot, and parimutuel with a large jackpot. Participants selected a first and a second choice of three-digit numbers (000-999), and across all three versions, the most frequently bet numbers were triples (e.g. 555, 777). Chi-square tests of independence showed that selection of triples significantly depends on the lottery version. These results further suggest that people do not bet “random-looking” numbers. Further analysis investigates additional patterns (e.g. sequences, dates) to better understand betting behavior. The paper also explores the psychological reasoning for this behavior, raises new questions for research, and compares findings to those of Halpern and Devereaux (1989).

Arjun Anand ’25; Ben Vollmayr-Lee

Faculty Mentor(s): Professor Ben Vollmayr-Lee, PHYSICS & ASTRONOMY

Coarsening with an Anisotropic Surface Tension in the Dilute Limit

We consider the phase separation dynamics or coarsening of a two-component system with a local conservation law and an anisotropic surface tension, such as a quenched binary alloy. Our goal is to understand whether the surface tension anisotropy has an impact on either the coarsening power law growth exponent or the domain structure. To address this, we work in the dilute limit, employing a generalization of Lifshitz-Slyovoz theory to include an anisotropic surface tension. We consider a weak anisotropy and solve the problem explicitly within perturbation theory. We find the growth law to be unaffected by the anisotropy, but also find, in contrast to the expectations of Lifshitz and Slyozov, that the domains do not have the equilibrium Wulff shapes but rather a new one-parameter family of nonequilibrium shapes governed by the size of the drop relative to the critical size. Further, we show that the drop size distribution is dependent on the details and degree of the anisotropy.

Laura Ancuta ’25

Faculty Mentor(s): Professor Kris Trego, CLASSICS & ANCIENT MEDITERRANEAN STUDIES

Terracotta & Otherness: A Glimpse into Race and Representation in Roman Artifacts

This study presents a Roman terracotta oil lamp, featuring the stylized head of a presumed African male, investigated for its cultural, anthropological, and artistic significance. The lamp, likely produced between the 1st and 3rd centuries CE, was part of a private collection until recently cataloged. Its iconography raises questions about Roman perceptions of identity and otherness, explored through comparative analysis with similar artifacts from the British Museum and other collections. By situating the lamp within the broader cultural milieu of Roman art and material culture, this article examines its role as both a functional object and a symbolic artifact. The analysis places the lamp in the context of Roman practices of representation, stereotyping, and cultural hybridity, highlighting how everyday objects serve as reflections of societal narratives. This research contributes to ongoing discourse on material culture and the artistic expression of identity in antiquity.

Eowyn Andres ’27

Faculty Mentor(s): Professor Gulay Guzel, MARKETS, INNOVATION & DESIGN
Funding Source: Helen E. Royer Undergraduate Research Fund

Navigating East Asian Fashion: From Cultural Appropriation to Cultural Appreciation

The fast fashion industry has long been under scrutiny for its appropriation of marginalized cultures, profiting off of cultural designs without proper recognition or compensation. This research examines how diverse representation in fast fashion can shift from cultural appropriation to cultural appreciation. My interest in this topic stems from a desire to promote ethical fashion practices that honor and respect cultural heritage rather than exploit it for commercial gain.Building on the work of Leshkowich and Atmajda, this study integrates perspectives from consumer research, fashion studies, and Critical Race Theory. Using Nexus Lexus, 2,642 pages of media articles featuring terms such as “cultural appropriation,” “fashion,” and “Asia” were retrieved and analyzed by utilizing Dedoose qualitative analysis software. Additionally, in-depth interviews with 13 Asian-identifying individuals (ages 18-23) were conducted to explore their experiences with cultural representation.Preliminary findings indicate that perceptions of appropriation vary based on cultural identity, media exposure, and geographical upbringing. Participants from widely recognized cultures (e.g., Korea, and Japan) express pride and concern over mainstream representation, while other cultures (e.g., Mongolia, and the Philippines) report frustration over erasure. Mixed-race participants often struggle to define appropriation due to their mixed heritage.

This research informs fashion industry practices by highlighting the importance of authentic cultural representation. By combining these methods, the study aims to understand how fashion can serve as a platform for authentic cultural representation rather than reinforcing stereotypes. The central research question explores how fast fashion brands can implement diverse representation while avoiding appropriation.

Ericka Anghel ’25

Faculty Mentor(s): Professor Katharine McCabe, WOMEN’S & GENDER STUDIES
Funding Source: Douglas K. Candland Undergraduate Research Fund

Care Work in the Nursing Home: A Feminist Analysis on the Intra-Dynamics among CNAs

Over one million nursing home residents in the United States are in the direct care of certified nursing assistants or CNAs. CNAs assist elderly people with activities of daily living like toileting, bathing, and eating. With a turnover rate of about 78%, nursing homes are in a constant state of solution-seeking to keep CNAs and increase the quality of care received by the residents. One of the solutions to chronic understaffing across the nation is acquiring staff through agencies that contract CNAs to multiple facilities. This research adds to an untapped area of analysisÑhow agency staffing may be exacerbating the already impossible and underpaid labor expected of CNAs. Using feminist perspectives to inform my analysis, I explore the ways that gender, race, and class intersect to devalue care work and how these existing forms of exploitation are compounded with the complex dynamics of agency staffing that make it difficult for CNAs to have a substantial career. To understand the intricacies of caregiving, I look to the beholders of caregiving knowledgeÑCNAs. My research centers on qualitative interviews conducted with ten CNAs working at a facility in central Pennsylvania. My findings show that agency staffing is exacerbating the invisible emotional labor that CNAs perform as a part of their caregiving demands, and this labor is compounded among identity-based factors. It is paramount that we make caregiving a social priority--if we inevitably will be unable to take care of ourselves, who will?

Sheriff Anofi (Graduate Student)

Faculty Mentor(s): Professor Ryan Snyder, CHEMICAL ENGINEERING
Funding Source: Graduate Summer Research Fellowship

Impact of Droplet Evaporation on Polymorphism of Suberic Acid

As the pharmaceutical sector grows and active pharmaceutical ingredients (APIs) become more complex, polymorphism becomes increasingly important. Polymorphism in a drug compound signifies its capacity to adopt various crystal forms. Variations in polymorphic forms of drug compounds can significantly impact bioavailability, solubility, stability, and efficacy, posing substantial challenges in drug formulation and regulatory compliance. To address these challenges and enhance drug development and formulation, implementing a polymorph screening process is essential. While conducting thorough screening is costly and time-consuming, it is crucial to select the appropriate polymorph to address stability and physicochemical properties. This process involves identifying and characterizing the different solid-state forms that a drug molecule can adopt, including various crystal structures, hydrates, and amorphous forms. This research investigates the polymorphism of suberic acid, a dicarboxylic acid used in drug synthesis and as a pharmaceutical co-former, focusing on how crystallization conditions driven by the droplet evaporation technique affect polymorph formation. This work explores a potential third polymorph of suberic acid, which currently has only two identified polymorphs. Suberic acid microparticles were created using a constant-output aerosol-generating atomizer, with solvents including water, ethanol, and isopropyl alcohol introduced at varying droplet concentrations. Characterization was performed using X-ray diffraction (XRD) to examine the internal crystalline structure, differential scanning calorimetry (DSC) to analyze polymorphic transformations and thermal transitions, and thermogravimetric analysis (TGA) to assess the residual solvent content. The results indicate the presence of distinct crystalline form of suberic acid that has not been previously documented.

Rebecca Beneroff '25

Faculty Mentor(s): Professor Chris Martine, BIOLOGY
Funding Source: Department of Biology; David Burpee Plant Genetics Fund; Wayne E. & Margaret S. Manning Internship in the Botanical Sciences

Examining Root System Diversity among Australian Bush Tomatoes – Characterizing the First Record of True Storage Roots in Eastern Hemisphere "Spiny Solanums" (Solanum subgenus Leptostemonum)

The Australian "Solanum dioicum + S. echinatum Group" is a clade of ~45 bush tomato species within the "spiny solanum" group (Solanum subgenus Leptostemonum) found throughout the Australian Monsoon Tropics (AMT) subject to a narrow environmental niche characterized by periods of extreme rainfall, severe drought, and semi-frequent fire. Previous literature has shown that this clade is disturbance-adapted and prone to clonality, indicating that their root systems are likely important to their survival. Although Solanum is famous, in part, due to the enlarged below-ground storage organs (modified stems) found in potatoes (S. tuberosum) and their relatives, few other clades within the genus have been observed to have them. Much more prevalent are rhizomes (also modified stems), observed in 11 clades including the Eastern Hemisphere Spiny clade (EHS). While rhizomes generally store small amounts of water and starch, their primary purpose is to enable lateral spread by sprouting clones. Many species within the EHS clade have evolved rhizomes, but none have been found to have storage roots. At present, no true underground storage organs have been reported in any Solanum taxa of the EHS clade (including Australian taxa). An ex-situ survey of underground organs of representative taxa from the "S. dioicum complex" resulted in the discovery of what we believe to be the first record of true underground storage organs in both Australian Solanum and the EHS.

Dipesh Bhattarai '27

Faculty Mentor(s): Professors Carley Gwin & Deborah Sills, CIVIL & ENVIRONMENTAL ENGINEERING
Funding Source: The Katherine Mabis McKenna Environmental Internship Program

Bacteria Concentration Post Wet-Weather Event

This study investigated the impact of wet-weather conditions on bacteria concentration in Union County (UC) waterways and how it affects water quality and poses a public health risk. This research was conducted through Bucknell's Department of Civil and Environmental Engineering under Professors Deborah Sills and Carley Gwin.This study utilized both quantitative approaches and field sampling at fifteen locations along UC waterways during wet and dry conditions--sampling methods followed PA's DEP standards. Field samples were analyzed for key water quality parameters such as E. coli, total coliform, turbidity, nutrient content, flow rate, and various other parameters. This year's research introduced the utilization of a Hach FH950 flow rate monitor, primarily to assess the change in flow rates, post wet conditions. Results from laboratory analysis revealed that all sites consistently show bacteria concentration (such as E. Coli and Coliform) exceeding the recommended limit of 200 CFU/100 mL. Statistical analysis showcased a strong positive correlations between rainfall and several parameters, including an increase in bacteria concentrations (E. Coli and Coliform), turbidity, and flow rate during and after wet conditions; we also found correlations between total nitrogen and conductivity and between turbidity and total suspended solids (TSS)This (and previous) year's findings showcase evidence of the water pollution in UC waterways, likely stemming from runoffs via agricultural and other nonpoint sources, particularly during wet conditions. The results showcase a concern for public health of those utilizing these waterways for public recreation and the need for restoration efforts and further monitoring throughout UC.

Ailsa Boger '25; Rebecca Bonomo (Graduate Student); Cory Sanderson '25; Karyna Fowler '26; Erica Delsandro; Bill Flack

Faculty Mentor(s): Professor Erica Delsandro, WOMEN'S & GENDER STUDIES; Professor Bill Flack, PSYCHOLOGY
Funding Source: Bucknell Program for Undergraduate Research

Coercion in Campus Sexual Misconduct

College women are at high risk of experiencing sexual misconduct (Graham et al., 2022), which can be classified as either assault of coercion depending on the extent of violence used in perpetration. Coerced sex is a common experience, especially among college women (Pugh & Becker, 2018), but it has not received as much attention as assault. The purpose of this research is to examine experiences and correlates of sexual coercion among college women and men.

Anna Brown '25

Faculty Mentor(s): Professor Steve Jordan, BIOLOGY
Funding Source: Department of Biology

Aquifer Stoneflies (Plecoptera) Exhibit Plasticity in Response to Warmer Temperatures

Aquifer stoneflies, of the order Plecoptera, are aquatic macroinvertebrates that have important differences from their common counterparts found in streams. They live in high abundance in some alluvial aquifers like those of the Flathead River's Nyack floodplain in northwestern Montana. Increased risk of climate change has had multiple documented effects on these environments including, most prominently, rising temperatures as well as secondary effects on the ecosystem such as decreasing oxygen availability. This research was conducted to assess the plasticity of individual aquifer stoneflies responding to such manipulated changes in temperature and oxygen levels. We collected samples from the Nyack floodplain by pumping aquifer wells. We then subjected the stoneflies to a range of conditions in the lab, including four treatment groups: manipulations of temperature (warm/cold) and oxygen level (normoxia/hypoxia). We observed survival rates over several three-week acclimation periods, with additional tests of relative growth rate, critical thermal maximum, and respirometry rates measured post-acclimation. Preliminary results suggest that warmer temperatures significantly decrease survival causing excess physiological stress. Based on low survival rates, certain changes should be implemented in

future experiments to ensure robust and reproducible data, including slower initial acclimation changes and isolation of the pumps in each tank to prevent unnecessary additional loss mortality.

Matthew Bucaloiu '26; Chris J. Boyatzis

Faculty Mentor(s): Professor Chris Boyatzis, PSYCHOLOGY
Funding Source: Department of Psychology

The Role of Trust in Parents and Others in Emerging Adults' Well-being

Trust in others is an important factor associated with well-being and relationship quality. Little psychological research has examined U.S. emerging adults' trust in their parents and how that trust is related to their general trust in others and their own well-being. With a sample of 152 undergraduate students at a northeast U.S. university, we tested the hypothesis that emerging adults' trust in their parents and in others would predict three key components of well-being: self-esteem, self-efficacy, and life satisfaction. We also predicted that parental care would positively predict well-being while psychological control would be a negative predictor. In hierarchical regressions, students' self-esteem was predicted by their judgments of others as trustworthy and their trust in their fathers (but not mothers). Self-efficacy was positively predicted by students' judgments of others as trustworthy and their willingness to trust others. Life satisfaction was predicted by their willingness to trust others and their trust in their fathers (but not mothers). When parenting variables were added to the regression model, maternal psychological control strongly predicted lower self-esteem and dropped all trust predictors to insignificance. Lower life satisfaction was predicted by students' willingness to trust others, their trust in their fathers, and mothers' psychological control. These results suggest that during emerging adulthood, students' trust in others, their trust in their fathers (but not mothers), and their mothers' use of psychological control have strong implications for their own well-being.

Christopher Bunton (Graduate Student)

Faculty Mentor(s): Professor Michael Krout, CHEMISTRY
Funding Source: Department of Chemistry; Chemistry Graduate Research Fund; Graduate Summer Research Fellowship

Synthesis of Amino Acid Conjugated Bile Acids

Primary bile acids comprise one end product of cholesterol metabolism which has many important physiological functions such as nutrient absorption, metabolite secretion, and regulation of lipid, glucose, and energy metabolism. Primary bile acids undergo further modification in the small intestine resulting in an array of secondary metabolites, including the recently discovered amino acid conjugated bile acids. Dysregulation of bile metabolites leads to disease states such as cholestasis, inflammatory bowel disease, diabetes, obesity, and alcoholic/nonalcoholic fatty liver disease. Bile acids are amphipathic molecules that form aggregates at the critical micelle concentrations (CMC) in aqueous solution and they are crucial for lipid transport, topical drug delivery, chiral separations, and disease pathology. Due to the importance of potential applications of this new class of amino acid conjugated bile acids, we have developed an efficient and scalable protocol for the conjugation of bile acids and amino acids. Our synthetic method has been demonstrated for the coupling of cholic acid and deoxycholic acid with eight different amino acids to give products in > 90% yield.

Victoria Burek '26

Faculty Mentor(s): Professor Ryan Snyder, CHEMICAL ENGINEERING
Funding Source: Kalman Fund for Undergraduate Research in the Sciences

Solvent and Concentration Effects on Polymorphic Forms of Glutaric Acid

Glutaric acid, a five-carbon dicarboxylic acid, is known for its polymorphic properties, characterized by the ability to crystallize in multiple distinct forms. Polymorphism, the phenomenon where a single chemical compound can adopt different crystalline structures, plays a significant role in determining the physicochemical properties of substances. A notable example is carbon, which can manifest as either graphite or diamond. The polymorphic behavior of glutaric acid is particularly relevant in pharmaceutical applications, where the specific polymorph can profoundly impact a drug's bioavailability, stability, and therapeutic efficacy. Glutaric acid predominantly exhibits two polymorphs: the metastable alpha form and the stable beta form.In this study, we investigated how using different solvents at varying concentrations affects the polymorphic outcome of glutaric acid. Particles of glutaric acid were generated by using an atomizer and dried using two different drying media: silica gel and zeolite when water was employed as the solvent, and charcoal and zeolite when alcohol was used. The resulting particles were collected on an X-ray diffraction (XRD) disk in a PIXE Cascade Impactor, with any residual particles being captured on a NeoPore filter. The collected samples were subsequently analyzed using powder X-ray diffraction (pXRD). Data analysis was performed using MATLAB and Excel to determine the polymorphic composition of the samples. The results show that the choice of solvent impacted the polymorph that was present, and that the water based experiments displayed polymorphism that isn't found through other methods of water crystallization.

Riley Cahill '26; Maria Pisciotta '25; Morgan Benowitz-Fredericks

Faculty Mentor(s): Professor Morgan Benowitz-Fredericks, ANIMAL BEHAVIOR, BIOLOGY
Funding Source: Douglas K. Candland Fund

Nature vs. Nurture: What Drives Aggression and Siblicide in Seabird Chicks?

In this study, I investigate behavioral interactions between first-hatched (A-chicks) and second-hatched (B-chicks) in Black-legged Kittiwake (Rissa tridactyla) nests. In kittiwakes, the A-chick typically has a developmental advantage over its younger sibling, the B-chick, which can lead to competition for food and, in extreme cases, siblicideÑ the killing of one sibling by another. Previously, we established that aggression levels are already high by the time the A-chick is five days old, but it

remains unclear whether this aggression is driven by factors established before hatching (such as genetics or prenatal environment) or by experiences during the first few days of post-hatching life. To investigate this, I analyzed video footage of kittiwake nests recorded at Middleton Island, Alaska, capturing sibling interactions in a natural population. Using video footage from Middleton Island, I quantified aggression (e.g., pecking, pushing), begging (e.g., vocalizing, posturing), feeding, and submissive behaviors one day after hatching when the A-chick was three to five days old. No prior studies have examined sibling interactions this early-on between A – and B-chicks, leaving it unclear whether A-chick aggression occurs independently of B-chick behavior and competition. This study tests two hypotheses regarding aggression and siblicide development. The predetermined aggression hypothesis predicts that aggression is established prenatally, while the environmental influence hypothesis suggests that aggression develops in response to food availability and competition. By comparing aggression levels in nests where supplemental feeding was provided versus those relying solely on natural parental provisioning, this study contributes to understanding factors influencing chick survival.

Khanh Cao '27; Mohamed Elzarkouny '24

Faculty Mentor(s): Professor Vaji Farhadi, ELECTRICAL & COMPUTER ENGINEERING
Funding Source: Bucknell Program for Undergraduate Research

Optimizing 5G Network Slicing for Smart Grids Using Q-Learning

This study explores the application of reinforcement learning for dynamic resource allocation in 5G networks, with a focus on the application of the proposed solution in monitoring and controlling smart grids. This task involves fitting frequency-time slices to the 5G (Orthogonal Frequency Division Multiplexing) OFDM resource grid. Each end-user's request to a slice has specific requirements, including priority (weight), throughput, computational resources, and latency (deadline). When possible, these requests are fulfilled using the available resources over the desired duration. Given that each allocation decision can temporarily reduce resource availability for future requests, a myopic solution is insufficient. Therefore, we propose a Q-learning method designed to maximize network utility by optimizing the total weight of approved network slicing requests over time, while adhering to multiple network and computational constraints. Our findings demonstrate that reinforcement learning significantly improves 5G network utility compared to other baseline methods. Moreover, our solution demonstrated effective performance as user numbers grow.

Tori Chace '26; Jack K. Dziubek '25; Sarah E. Chapman '25; Nicole A. Joseph '25; Kayla E. Lichtner (Graduate Student); Robert A. Mauck; Patricia L. Jones; Mark F. Haussmann

Faculty Mentor(s): Professor Mark Haussmann, BIOLOGY
Funding Source: Department of Biology

Parental Feeding Patterns and Offspring Corticosterone Levels in Leach's Storm-Petrels

During the reproductive season, pelagic seabirds balance time between care for their offspring and foraging flights. On any given night during the chick-rearing period, Leach's Storm-Petrel (Hydrobates leucorhous) nestlings may be fed by one, both, or no parents, resulting in relatively unpredictable periods of fasting punctuated by intense feeding bouts. The natural variation in food delivery caused by biparental feeding may affect corticosterone levels, a hunger and satiety regulating hormone. We explored how the duration of the fasted periods and the amount of food provided during the fed periods affect corticosterone levels. To determine feeding frequency, chicks (n=20) were massed daily from day 8 to 30 post-hatch. Plasma corticosterone levels were measured using an enzyme-linked immunosorbent assay from blood samples on days 10, 20, and 30. When chicks were not fed (30.2% of nights), they lost – 4.0±1.3g, when fed by one parent (47.6% of nights), they gained 3.6±1.0g, and when fed by both parents (22.2% of nights), they gained 12.3±1.5g. We will discuss how the length of the fasting period and the amount of food delivered affects nestling plasma corticosterone levels. The substantial natural variation in both the timing and amount of food delivered to pelagic seabird chicks provides the opportunity to study how a range of feeding patterns affect nestling physiology.

Sarah Chapman '25; Tori J. Chace '26; Nicole A. Joseph '25; Kayla E. Lichtner (Graduate Student); Patricia L. Jones; Robert A. Mauck; Mark F. Haussmann

Faculty Mentor(s): Professor Mark Haussmann, BIOLOGY
Funding Source: Department of Biology

The Role of Chick Development on Early-life Telomere Dynamics in a Long-lived Seabird

The conditions experienced early in life can have physiological effects in both the short and long-term. TelomeresÑthe protective, terminal caps on chromosomesÑmay act as a physiological indicator of how early-life environment can affect cellular health and biological aging. In certain studies, early-life telomere loss serves as an indicator of lifespan, highlighting how early-life conditions can impact long-term fitness outcomes. Beyond germ and stem cells, telomere length has traditionally been thought to decline over time. However, increasing evidence suggests that telomeres may lengthen in some young individuals. In this study, we examine how chick growth affects early-life telomere dynamics in Leach's storm-petrels (Hydrobates leucorhous), a long-lived species. In the field, chicks were massed daily after and wing length was measured weekly after reaching 8 days post hatch. Blood cells' telomeres were measured on day 10 and day 30 post hatch using the telomere restriction fragment

assay. While there was no effect of change in chick mass on change in telomere length, there was an inverse relationship between wing length growth rate and change in telomere length over the twenty day period ($F_{1,16}=5.3$, $p=0.03$). Further, telomere length increased in all individuals over the study period ($F_{1,16}=30.2$, $p<0.0001$). While telomere length is relatively stable over time in adult animals, telomere's change more quickly during development. This study improves our understanding of how chick development affects growth and telomere dynamics during early-life, which may have long-term implications on organismal physiology.

Cara Christensen '27

Faculty Mentor(s): Professor Paolo Morales, ART & ART HISTORY

Artistic Manipulation of Nature (Building Photographs)

My project focuses on the creation of a photograph using the artistic process and elements from the natural world. I aim to show the dichotomy of human-made creation within traditional artistic mediums and the unpredictability of nature itself. In my work, I bring the artistic process outside into nature to create photographs emulating paintings. I also extract pieces out of nature and use them to build compositions using mostly paint and some other mixed medias. This project aims to explore elements of design, the creative process, and the unpredictability of the natural world, along with ideas of human manipulation of nature and the idea of building a photograph. With these photographs, I hope to answer the question "What elements of design are found in nature and how can we harness them in combination with traditional artistic mediums to create unique photographic compositions?"

Samuel Chu '27

Faculty Mentor(s): Professor Yan Choi Lam, CHEMISTRY
Funding Source: Walthour Fellowship

Computational Study of Reorganization Energy in Proton Transfer Reactions

In this project, we investigated the protonation of transition metal complexes using organic acids to form metal hydrides. Using Density Functional Theory (DFT) calculations, both the inner and outer sphere reorganization energies associated with several such proton transfer reactions were explored. One of the key findings of this study was that rigid ligands facilitate smaller reorganization energies, which in turn lead to more kinetically favorable proton transfer processes. This computational approach provided insight into the electronic and geometric changes that occur during these reactions which contribute to a deeper understanding of their thermodynamic and kinetic properties.

Michael Churikov '25; Christopher G. Daniel; Chris R.M. McFarlane

Faculty Mentor(s): Professor Christopher Daniel, GEOLOGY & ENVIRONMENTAL GEOSCIENCES
Funding Source: Steven E. Boyer '72 Geosciences Summer Experience Fund

In-situ Laser Ablation Rb/Sr Muscovite Ages from the Tusas Mountains, New Mexico: Evidence for Picuris Age (ca. 1.4 Ga) Regional Metamorphism and Deformation and Subsequent Hydrothermal Alteration

Preliminary, in situ Rb/Sr muscovite analyses from Proterozoic rocks in the central Tusas Mountains, New Mexico help constrain the timing of regional deformation, metamorphism and possibly resetting of the Rb/Sr systematics due to younger hydrothermal fluids. Muscovite from the Burned Mountain metarhyolite (MC24-02) yields an Rb/Sr isochron age of 1297 ± 10 Ma (MSWD = 3.7, n =30). Two micaceous quartzite samples from the Big Rock Formation about 1.5 km south of the metarhyolite yield isochron ages of 1451 ± 4 Ma (MSWD = 5.8, n = 31, MC24-09) and 1218 ± 5 Ma (MSWD = 3.3, n = 22, MC24-10).Sample MC24-02 yields an isochron age of 1451 ± 4 Ma which is similar to previously reported Lu-Hf dated garnet growth ages of 1405-1419 Ma, representing the approximate timing of regional metamorphism and deformation associated with the Picuris Orogeny. The younger ages of 1297 and 1218 Ma likely indicate resetting of the Rb/Sr isotopic system in muscovite due to hydrothermal fluids. Regional evidence for hydrothermal fluid alteration includes kyanite deposits resulting from kyanite formation. Muscovites are aligned in regional S1 foliations and are axial planar to macroscopic F1 folds.The Rb/Sr age results for the muscovites are similar to those that were dated in past studies for the Tusas Mountains area. The ages are reflective of the Mesoproterozoic Picuris Orogeny which reflects a time of intense metamorphism and deformation that this area went through.

Christina Clarke (Graduate Student); Douglas Collins

Faculty Mentor(s): Professor Douglas Collins, CHEMISTRY
Funding Source: Chemistry Graduate Research Fund; Graduate Summer Research Fellowship

Surface-bound Disinfection Byproducts from Multiphase Hypochlorous Acid Reactions with Phenolic Compounds found in Wood Smoke

Increased global temperatures and extended dry spells have led to increased biomass burning in the form of wildfires, releasing air pollutants such as particulate matter, volatile and semi-volatile organic compounds which have been attributed to respiratory and cardiovascular conditions. When chlorine bleach is used to disinfect an indoor space, hypochlorous acid (HOCl) partitions to the gas phase and can react with surface films, including phenolic compounds that are found in wood smoke residue. Indoor multiphase HOCl chemistry likely leads to the formation of chlorinated and/or oxidized byproducts that would transform the complexity and perhaps the health-relevance of organic films on

building surfaces. The samples were prepared in a glass flow reactor where HOCl(g) was passed over thin film samples deposited on glass slides. Films were prepared using pure phenolic compounds found in wood smoke (catechol, creosol and eugenol), chlorinated catechol standards, and smoke released from the pyrolysis of Pinus ponderosa captured on PTFE filters. All compounds were dissolved/extracted in isopropanol, pipetted onto glass slides and dried under nitrogen to create a thin film. Photochemical effects were probed using 350-450 nm light exposure in tandem with HOCl(g). Reaction of HOCl(g) with all three pure phenolic compounds produced chlorinated monomers, dimers, and trimers. Using Liquid chromatography mass spectrometry (LC-MS) analysis and HOCl reactions with chlorinated catechol standards, all isomers of monomeric chlorinated catechols were identified. Product abundance evolved as a function of HOCl exposure, provides mechanistic information about the formation of oligomeric and chlorinated products from HOCl multiphase chemistry.

Caiden Covell '25; Ben Wheatley; Chulhyun Ahn

Faculty Mentor(s): Professor Benjamin Wheatley, MECHANICAL ENGINEERING
Funding Source: Presidential Fellowship

Implementation of Topological Data Analysis to Estimate Muscle Motor Fatigue

Muscle fatigue is a subjective internal sensation, thus posing challenges in determining robust, objective measures of fatigue, although muscle motor fatigue (a reduction in the force-generating capability of muscle) is one viable definition. This study utilizes topological data analysis (TDA) with traditional frequency domain-based methods to estimate a muscle motor fatigue surrogate from surface electromyography (sEMG) data. Previous work collected sEMG data from the first dorsal interossei muscle of thirty subjects during a 5-minute isometric contraction at 50% of maximum voluntary contraction (MVC) force. Data was segmented into two second segments and analyzed using median frequency of sEMG power spectrum and TDA. Results were correlated with contraction time (a fatigue proxy), showing R2 values as high as 0.95. An expansion on this work collected sEMG data from the same muscle on nineteen subjects. Data was collected for 30 second intervals with 20, 40, 60, and 80% MVC, and validation trials were performed for each subject by doing each %MVC contraction for 15 seconds back-to-back and out of order. 60 second rest periods were taken between contraction trials. Data collected is currently being processed in similarly to the original data sets.

Ally Cruz-Flores '26; David Rovnyak

Faculty Mentor(s): Professor David Rovnyak, CHEMISTRY
Funding Source: Walthour Fellowship

Sodium Naproxen: A Planar Amphiphile with Mass-action Self-aggregation Dynamics that Interrogate its Properties in Aqueous Solution and Sera

As a part of a need to detect and quantify APIs in complex mixtures such as patient sera, we found that naproxen, a popular NSAID, undergoes self-aggregation in aqueous solutions and is a useful platform for pursuing several related questions. First, by contrasting spectra of naproxen in patient sera with concentration-dependent studies in solution, we were able to address whether such aggregation could influence its action. We show that no significant self-aggregation occurs in concentrations found in standard-of-care sera. Next, since prior databases report naproxen NMR spectra at higher concentrations and in non-aqueous solvents, we obtained reference spectra to permit quantifying naproxen in sera; we further investigated the potential to distinguish among known metabolites in complex metabolomic NMR spectra of sera. Finally, as naproxen had only previously been reported to interact with SDS micelles and its self-aggregation is not characterized, we conducted a biophysical analysis utilizing NMR, diffusion, and calorimetric methods. The mass-action model is shown to apply well to these data and yielded the aggregation number and critical concentration. While self-aggregation of bioactives is known in the drug development pipeline, a broader point of interest is that naproxen is a planar amphiphile and may warrant further investigation to characterize its other properties such as nucleation mechanisms and guest-host chemistries.

Kade Davidheiser '28

Faculty Mentor(s): Professor William Scott, MECHANICAL ENGINEERING
Funding Source: James L.D. and Rebecca Roser Research Fund

Design, Fabrication, and Testing of a Legged Soft Robot that can Walk and Jump

This poster showcases the design of a quadruped robot equipped with legs made from a thermoplastic polyurethane (TPU) material known as FilaFlex. This material choice enables the robot to jump around 1 to 2 cm currently. The innovative leg design allows the robot to wind the legs into a fully flexed position. A separate motor then releases an actuation system, enabling the robot to leap upwards effectively. The robot's design integrates LEGO bricks and gears with 3D-printed components made from PLA and FilaFlex, along with DC motors, to enhance performance. Through extensive modeling and simulations using MATLAB, OnShape, and SolidWorks, the robot successfully overcame the presented obstacle.The final design, constructed from laser-cut materials, proved robust enough to handle the internal forces generated during operation and achieve its intended task. This work highlights the ongoing advancements in soft robotics and demonstrates the potential for robots to navigate diverse terrains. Future developments will focus on building a body that is lighter and can support a higher load. This will allow it to jump higher and over bigger obstacles.

Susan Deering ’26; Sarah Lower

Faculty Mentor(s): Professor Sarah Lower, BIOLOGY
Funding Source: Department of Biology, National Science Foundation Grant (NSF); Presidential Fellowship

Identification and Analysis of 325 Novel Odorant Receptor Genes in Firefly (Coleoptera: Lampyridae) Genomes Reveal Gene Duplication Mechanisms Underlying the Evolution of Smell

Gene families are collections of genes that originate from a common ancestor and typically share a similar biological function. Studies of gene families across the tree of life have provided tremendous insight into fundamental processes of gene families in humans, including those associated with cancer, immunity, and metabolism. An excellent model to study gene family evolution is one of the largest and most diverse gene families in insects: the odorant receptors (ORs), that enable odor detection. To better understand the diversity and evolution of ORs in beetles, we annotated putative OR genes in four firefly species (Coleoptera: Lampyridae) with publicly available or newly generated high-quality genome assemblies. Iterative BLAST followed by manual curation of OR intron/exon boundaries identified 325 novel OR genes: 103 in Abscondita terminalis, 99 in Photinus corruscus, 83 in Pyrocoelia pectoralis, and 33 in Lamprigera yunnana. Phylogenetic analysis revealed that most OR genes in these fireflies evolved since the species diverged from a common ancestor. Further, ORs in most species were located on large tandem arrays (i.e. groups of related genes located directly next to each other on a chromosome). However, ORs in L. yunnana–the species with less than half as many ORs as othersÐwere more frequently located as single genes than in tandem arrays. This suggests tandem duplication has contributed to the diversity and evolution of ORs in fireflies. Continued genome studies of this charismatic beetle group may provide insight into relationships between ecological niche, OR gene family size, and gene duplication mechanisms.

Realyn Del Campo ’26

Faculty Mentor(s): Professor Moria Chambers, BIOLOGY
Funding Source: Department of Biology

Characterizing an Unknown Bacterial Isolate from a Local Firefly Species, Photinus pyralis

The microbial communities linked to luminescent organisms, like the common firefly Photinus pyralis, provide important information on ecological relationships. The identification of an unidentified bacterial isolate from the firefly species Photinus pyralis is the main goal of this study. The identity of the bacterial isolate is important for ongoing studies on firefly immunity, given the possibility that some fireflies may carry bacteria in their hemolymph where it can influence their immune response. In the summer of 2022, this bacterial isolate was cultured from an uninfected control firefly collected near Lewisburg, Pennsylvania. An overnight culture of the isolate was used to generate a stock that has been stored in the – 80¼C freezer since. I have been characterizing this isolate using a variety of traditional microbiological methods. Results so far suggest that this is a Gram-negative bacterial species, meaning that it has a thin cell wall and an outer membrane. The isolate can grow on a wide-range of bacterial media and grows best at room temperature. Additionally, this species can ferment trehalose which is a sugar commonly found in insect hemolymph. I am currently isolating bacterial DNA, which will allow me to sequence the 16SrRNA gene and determine the genus and potentially species this isolate belongs to. The identification of this bacteria may shed light on the ways in which fireflies’ microbial communities may affect their immunological responses to new pathogens. Once isolate has been determined, future directions include testing virulence in other species such as the common fruit fly, Drosophila melanogaster.

Gabby Diaz ’25

Faculty Mentor(s): Professor David Rojas, LATIN AMERICAN STUDIES
Funding Source: Bucknell Program for Undergraduate Research

The Cruel Optimism of Diversity, Equity, and Inclusion Efforts

Beginning in 2045, the argument goes, Americans who self-identify as White will cease to be the demographic majority, invariably leading to all sorts of spacesÑhigher education institutions includedÑbeing more diverse. In my project, I draw on scholarship that problematizes this framing which outlines a self-driven process of seamless diversification to the benefit of everyone involved. I study what scholar Sarah Ahmed calls “diversity work,” which includes: programming, diversifying predominantly white spaces, etc., and Lauren Berlant’s notion of “cruel optimism” to provide a granular understanding of the ways diversification works in an elite higher education institution. Berlant writes that cruel optimism alludes to relationships that exist “when something you desire is actually an obstacle to your flourishing.”_ My project examines how the overwhelming majority of this diversity work is carried out by students, faculty, and staff of color. Moreover, being a particularly arduous and exhausting kind of labor, diversity work requires marginalized groups to invest significant amounts of time, economic resources, and energy. Through semi-structured interviews, we ask how people of color at an elite liberal arts institution endure these challenges and the extent to which they see their diversity work as benefiting them and others like them. Our research indicates that diversity work can turn into an additional form of exploitation that may undermine the efforts of people of color to thrive in higher education institutions. Findings indicate a need to discuss strategies groups are pursuing to minimize the attrition that diversity efforts have on their lives.

Max DiCerbo ’25

Faculty Mentor(s): Professor Jessica Pouchet, ENVIRONMENTAL STUDIES & SCIENCES
Funding Source: Douglas K. Candland Undergraduate Research Fund

Inequitable Access to Outdoor Recreation: The Role of Mentorship in Guiding

Like any employee in any industry, rock climbing guides must learn the skills that make guides successful if they are to make a living. The way that knowledge is often transferred in rock climbing is through mentorship relationships, typically informal ones. Mentorship can serve as both a positive and negative to diversifying climbing and guiding. It has massive potential to open up climbing as a sport to many different kinds of people by bridging gaps in demographic disparities. On the opposite end of the spectrum, it can be a huge source of inequality that reinforces the homogeneity present in climbing and guiding. Therefore, this research looks at many of the ways in which mentorship in climbing creates, exacerbates or dismantles barriers in diversifying rock climbing. Through interviews with established climbing guides and participant observation of rock climbing in California, I identified themes that represent how mentorship functions in the guiding world. I drew on past connections of climbing friends and guides to interview and used snowball sampling beyond that in order to expand my network of interviewees. The beginning section of the analysis outlines the ways in which mentorship exists in the climbing world. What follows are ideas that discuss common barriers to receiving mentorship as a new climber, and guide perceptions of mentorship in relation to broader society. What I found holds value in thinking about the general culture of mentorship in the industry of guiding and its potential to shape access to climbing and guiding careers.

Athaliah Elvis ’26

Faculty Mentor(s): Professor Meenakshi Ponnuswami, CRITICAL BLACK STUDIES, ENGLISH
Funding Source: James L.D. and Rebecca Roser Research Fund

Navigating the Blaxploitation of Black Womanhood in Literature

This project, Navigating the Blaxploitation of Black Womanhood in Literature, explores how political movements like the Black Power Movement of the 1970s and feminism between 1955 and 1972 shape contemporary Black playwrights’ engagement with narratives of Africa, Africanism, and Black womanhood. My research examines how race and gender intersect in literature and theater, challenging long-standing American narratives. Through intensive readings, film analysis, and historical research, I investigated how Black women writers’ stories are often overlooked when they deviate from stereotypical depictions of Black female characters. This erasure influences the kinds of narratives Black women produce. Under the guidance of Professor Meenakshi Ponnuswami Associate Professor of English, Affiliated Faculty in Critical Black Studies and Theatre & Dance, who specializes in Black theater, I traced the lineage of Blackness from the transatlantic slave trade to modern movements like the Civil Rights Movement, Black Power, Black Nationalism, and the Black Arts Movement. These sociopolitical shifts continue to shape Black artistic expression, influencing how writers engage with themes of race, resilience, and identity in a digitized age of Black violence and pop culture. Literature and theater allow Black creators to reclaim narratives and challenge perceptions of racism. By engaging with these materials, I developed a deeper understanding of the forces that influence Black feminism literature and theater, from historical struggles for liberation to modern digital-age realities of Black violence, resilience, and pop culture. At the conclusion of this project, I produced an annotated bibliography, a literature review, and a creative journal reflecting my engagement with these themes.

Grace English ’25; Cooper Sentz ’26; Ellen Chamberlin; Jeffrey Trop

Faculty Mentor(s): Professors Ellen Chamberlin & Jeffrey Trop, GEOLOGY & ENVIRONMENTAL GEOSCIENCES
Funding Source: The American Chemical Society Petroleum Research Fund; Undergraduate Investigator Grant

Morphological Analysis of Main and Chute Channel Discharge, Scroll Spacing, and Migration Rates Along the Kantishna River, Alaska

Channel migration in meandering rivers is influenced by hydraulic geometry, bank strength, and bend curvature, allowing the deposition of scroll barsÑcurved sediment ridges on the inner bank. In some systems, migrating chute channels also deposit scroll bars, providing a natural laboratory to test the role of local channel size in lateral migration and sediment deposition. We investigate main and chute channel migration rates and scroll bar spacing at two sites on the Kantishna River, a sinuous, chute-dominated river in the Alaskan subarctic, to test whether scroll bar spacing correlates with lateral migration rate and discharge. We collected discharge and bathymetry data from main (MC) and chute channels (CC) using a Teledyne RiverPro ADCP with a GNSS Hemisphere and mapped scroll bar spacing with a laser rangefinder. Annual migration rates from 1984-2020 were calculated using Google Earth Engine satellite images processed with RivMap, a MATLAB package for channel centerline changes. Preliminary results show ADCP-measured discharges of 144m_/s and 191m_/s for MCs at sites 1 and 2, while CCs have 28m_/s and 31m_/s, indicating MCs carry 5x the flow. MC widths are 146m and 163m, while CCs are 86m and 102m. MC migration rates are 4.1m/yr and 4.9m/yr, compared to 5.6m/yr and 13.3m/yr for CCs. Scroll bar spacings average 5.4m and 13.6m for MCs, and 7.6m and 14m for CCs. Maximum migration rates occur in different years for MCs and CCs. Despite CCs having 5x lower discharges, migration rates and scroll bar spacings are similar within each bend. This suggests scroll spacing is linked to migration rate rather than discharge, implying factors like bifurcation angle or local slope may play a larger role.

Nicole Fernandez '25

Faculty Mentor(s): Professor Jasmine Mena, PSYCHOLOGY
Funding Source: Psychology Undergraduate Research

Parenting Practices in Latinx Families

Parenting practices are strongly influenced by contextual factors and cultural values, especially among Latinx families in the United States. This literature review investigated how Latinx parenting is influenced by cultural values such as familismo and respeto, gender norms derived from marianismo and machismo, and larger sociopolitical factors such as immigration status and socioeconomic tensions. This review integrated findings from 31 peer-reviewed studies, analyzed through NVivo coding, to identify key themes in Latinx parenting research. The findings revealed that Latinx parents integrate warmth and discipline in a practice known as protective parenting; however, issues such as deportation and acculturative stress show an impact on family dynamics and parent-child interactions. In addition, parental expectations, particularly those surrounding masculinity and academic aspirations, play an important role in determining child development.

Karyna Fowler '26; Matthew Bucaloiu '26; Chris Boyatzis

Faculty Mentor(s): Professor Chris Boyatzis, PSYCHOLOGY
Funding Source: Psychology Undergraduate Research

Naturalistic Observation of Parent-Child Interaction in the United States and Italy

We tested cultural differences in physical closeness and affection between parents and young children in the U.S. and Italy by naturalistically observing mothers and fathers with young children in public spaces in both countries. Contrary to prediction, mothers did not differ in their close physical contact, affectionate touches, or attention with their children. U.S. fathers spent more time than Italian fathers in close physical contact with their children and were marginally more attentive.

Nora Frederick '25

Faculty Mentor(s): Professor Ronald Ziemian, CIVIL & ENVIRONMENTAL ENGINEERING
Funding Source: College of Engineering

Investigation of Aluminum Hollow Shapes Subject to Torsion

The Specifications for Aluminum Structures (SAS) provides standards for structural engineers to follow when designing with aluminum. The specification covers various loading conditions, such as tension (stretching), compression (squishing), and torsion (twisting), and their corresponding strength limit states. Members subject to twist can experience strength limit states that include material failures and/or local buckling of the cross section. For more stocky cross sections, which is the focus of this research, material failures often occur well before buckling. Material failures can include (1) yielding, which is the loss of material stiffness and a resulting inability of the member to resist any additional torque, and (2) fracture, which results in the member being unable to provide any resistance to a torque. With regard to yielding, the current SAS provisions for torsion only allow engineers to design up to the first yield of the member's cross section. The first yield means that the material furthest from the centroid of a circular cross-section has effectively lost its stiffness. Given that the remainder of the cross-section has not yielded and the majority of the cross-section can still effectively resist any additional torque, this provision significantly underestimates the full strength of the member. New SAS provisions, including design equations, will be proposed that define the limit state strength according to full yield; the safety of such provisions will be justified by the experimental and computational studies performed.

Xochitl Granados '25

Faculty Mentor(s): Professor D. Bret Leraul, COMPARATIVE & DIGITAL HUMANITIES
Funding Source: Bucknell Humanities Center

From War to Walls: U.S. Intervention and the Rise of Carceral Society in El Salvador

In January 2023, El Salvador, the smallest country in Central America, opened Central America's largest prison, the Centro de Confinamiento del Terrorismo (CECOT). The facility was primarily built to address the country's escalating gang violence which had become one of the most significant security threats by the early 2000's.The history of its development has its roots in the 1980's when the United States played a significant role in the political and military landscape of El Salvador during the Salvadoran civil war. The involvement of the U.S. government, initially focused on counterinsurgency efforts and the suppression of left-wing movements in Latin America, helped stabilize the Salvadoran government and military during the war. However, it also fostered an environment of state violence and repression that prompted the rise of powerful gangs in the United States, as a result of increased immigration, which then spread to El Salvador through the mass deportation of undocumented immigrants in the 1990's.Through the study of primary and secondary sources, including historical and legal documents from both the U.S. and Salvadoran government, I examine the historical and cultural significance of the foreign relations between the United States and El Salvador, in an attempt to provide an understanding about how U.S. intervention has shaped current security measures and the political landscape of the country, including the establishment of CECOT. CECOT has dramatically changed the country's policing and carceral system, since its establishment, in an attempt to address the long-term consequences of American foreign influence.

Jade Gregg '25

Faculty Mentor(s): Professor Brian Smith, CHEMISTRY
Funding Source: Department of Chemistry; National Science Foundation Grant (NSF); Presidential Fellowship

Flexibility of 3D Crystalline Covalent Frameworks

Covalent organic frameworks (COFs) are porous crystalline networks with high internal surface areas and potential for a variety of applications. In particular, three-dimensional frameworks (3D COFs) are fully-covalently linked and crystallize in an interpenetrated network of multiple polymers. Historically, COFs were thought of as rigid

crystalline structures with potentially two different forms; however here we demonstrate how COFs are much more "breathable" than anticipated. Recent studies have shown how additives introduced during and post synthesis can impact the interpenetrated network structure. Here, we specifically show that exposing premade COF-300 to vapor-phase organic solvents and then subjecting it to heat and vacuum generate novel intermediate forms of the crystalline network that relate to the structure of the guest vapor. These captured-guest forms are easily monitored via powder X-ray diffraction (PXRD). Ultimately, determining the underlying structure of these intermediate COFs fits more pieces into a challenging synthetic puzzle, and has broad potential applications including gas storage, sensing, gas separation, and catalysis. In this way, improving how we understand and control framework structure leads to the development of next-generation materials.

Ella Grenci '25

Faculty Mentor(s): Professor Anna Paparcone, LANGUAGES, CULTURES & LINGUISTICS

Imperial Roman Art and Ideologies in Pre-Fascist Colonial Italy: (D)evolution of the Treatment of Afro-Italian Women

When considering the impact of the Roman Empire, its tyrannical government is regarded as unsurpassed. However, Rome's seemingly brutal rule must be evaluated in other facets besides the physical violence perpetrated against the conquered territories. Drawing on 19th and 20th-century visual publications, funerary portraits, denari (coins), and monumental architecture of Imperial Rome, this presentation examines the nature of North African provincial integration into the Roman canon and pre-fascist colonial Italy's lack thereof. Although the original imperial imaginary, the so-called "Hannibal prototype", defined the North African powers as threats, it evolved into one that called for the integration and persistence of provincial customs. Through a close analysis of the depiction of provincial women in art relative to Rome's primary enemies, the Dacians and the Parthians, I demonstrate how the African woman is not artistically abstract, rather she is depicted through a cohesive combination of Italian-Roman and African provincial artistic conventions. Conversely, the art of 19th and 20th-century colonial Italy reveals the fetishization and exoticization of African women. Italian Unification and the Scramble for Africa accompanied by aestheticization and futurist primitivist rhetoric barbarized the African woman and rendered her as an object of power and an object that gives power to colonists. Although I draw parallels between the violent physical nature of pre-fascist colonial Italy and Imperial Rome, the presentation affirms that the former's paradoxical attraction and repulsion socially excludes and dehumanizes North African women, and therefore distorts and adversely surpasses the Roman Empire's original and integrative imaginary they sought to replicate.

Jackson Greninger '27

Faculty Mentor(s): Professor Todd Schmid, COMPUTER SCIENCE
Funding Source: College of Engineering

Cocomposer – A Generative Approach to Electronic Music

The rapid advancement of hardware and software technologies over the past few decades has significantly influenced the evolution of electronic music, empowering producers to leverage these tools in crafting innovative rhythms, sounds, and patterns. Visual programming languages like Max/MSP have been utilized to create algorithmically generated sprawls that challenge the conventions of rhythm and structure to redefine the definition of music. In this context, this paper introduces Cocomposer, a novel framework and algorithm designed to facilitate the generation of non-deterministic electronic music that diverges from conventional music production paradigms. At its core, Cocomposer utilizes a state-based machine to schedule musical events, enabling users to generate MIDI notes through state transitions defined by the user. These transitions are constructed entirely from scratch, utilizing traditional MIDI note parameters while remaining fully mutable, offering real-time flexibility for the user. By assigning probabilities to state transitions, the framework allows for dynamic progressions from one state to another, accompanied by the playback of user-specified notes. This probabilistic approach creates generated music with an organic and algorithmic quality, as the output evolves in a manner that is both unpredictable and influenced by the user-defined parameters. Consequently, Cocomposer represents a significant step forward in the realm of algorithmic music composition, bridging the gap between structured creativity and emergent musical expression.

Adam Hanselman '27; Dominic Gonzalez '26; Kate Suslava

Faculty Mentor(s): Professor Kate Suslava, ACCOUNTING & FINANCIAL MANAGEMENT
Funding Source: Freeman College of Management – Department of Accounting and Financial Management

When CEOs Speak, Markets Move

CEOs are central to corporate decision-making and the primary voices in earnings callsÑcritical moments that shape investor sentiment and market reactions. Our research applies natural language processing techniques to analyze thousands of earnings call transcripts, aiming to uncover how the linguistic choices of CEOs influence market behavior. We focus on key textual measures: tone, complexity, verbosity, and the numerical count of CEO speech. Our findings indicate that a positive tone in CEO discussions is associated with favorable immediate market reactions. Additionally, while investors generally prefer lower complexity in management discussions, market responses are inconsistentÑreturns tend to improve when linguistic complexity is moderately high

but decline at mid-range levels. We also find that the market reacts negatively to excessive verbosity, with lower word counts yielding more favorable outcomes. Lastly, we observe that when CEOs incorporate more than 24 numbers in their speeches, the specific count beyond this threshold becomes largely irrelevant to the market's response, suggesting a plateau effect in investor perception.

Michael Harman '26; Kat McSorley '26; Bryan Crowell; Rosie Behr; Ellen Chamberlin; Ellen Herman

Faculty Mentor(s): Professors Ellen Chamberlin & Ellen Herman, GEOLOGY & ENVIRONMENTAL GEOSCIENCES
Funding Source: Walthour Fellowship; Geology Marchand Fund

Interpreting Depositional Environments of Coarse Clastic Sediments in Butler Cave, Virginia

This project employs observation, field sedimentology, and photography to physically characterize and map the unique clastic sediment facies within Butler Cave, VA. Evaluating these deposits presents a valuable insight into the depositional history in the cave and the processes that may be driving cave formation. Previous research has classified these deposits as diamicton facies. We reassess that classification by interpreting the depositional environments of the lithofacies and evaluating the potential influence of periglacial processes on their origin. Analysis of several sites within the cave revealed five fluvial facies and one potential debris flow.The units within Butler Cave show six distinct sedimentary units, each unlithified. Five of the six units are interpreted to be fluvial (deposited by streamflow) due to grain rounding, imbrication, cross-stratification, moderate or better sorting, and the absence of clay matrix. One of the six lithofacies, unit CmB, is interpreted to be a fluid-rich debris flow due to the angularity of clasts and the clay matrix. We analyzed the source lithology of gravel-sized clasts in these deposits and identified only local bedrock sources, indicating that the sediment-rich stream flows entering cave openings were washing in from local slopes. Periglacial slope processes outside the cave may have made these coarse clastic sediments available, but there is no clear evidence of periglacial deposits entering the cave directly. Overall, understanding the deposition of coarse clastic sediment in cave systems is important for understanding the local cave history and has implications for studying the role of physical abrasion in cave formation.

Morgan Haros '25

Faculty Mentor(s): Professor Kris Trego, CLASSICS & ANCIENT MEDITERRANEAN STUDIES

Following the Light

The Samek Art Museum contains a collection of ancient Mediterranean lamps as part of the Turnure Collection. In my research, I first focused on a specific mold-made lamp, lamp TD2020.12.29, which I identified as belonging to an Ephesian style originating from the Eastern Mediterranean. However, further analysis of the lamp revealed that it is not of Eastern Mediterranean origin, leading me to investigate how the Ephesian style transformed throughout the Mediterranean. I started to look at similar later lamps in Italy, which then prompted me to start considering North African red-glaze pottery. Expanding my study, I explored two additional lamps in the Turnure collection, TD2020.12.38, and TD2020.12.28, which may represent two different periods of the lamp's stylistic development. My research on the stylistic shifts then led me to look at the makers-mark on lamp TD202.12.28, which provides a connection between Italian lamp workshops and those in North Africa.

Morgan Haros '25

Faculty Mentor(s): Professors Kevin Daly & Stephanie Larson, CLASSICS & ANCIENT MEDITERRANEAN STUDIES

Integral but Forgotten: Metics in Ancient Athens

Every civilization has contained foreign residents, and Ancient Athens was no exception. In Classical Greece (489-323 BCE), these foreign residents and freed slaves were known as metics. The "metic" label came from the tax they had to pay: the metoikion, or metic tax. While foreign resident status most likely existed throughout city-states across Greece, Athens is the location best documented. Many of these documents come from wills and court cases, giving glimpses of the daily life of Athen's non-citizen residents. Metics commonly worked as craftsmen, bankers, and people of commerce. A large number of philosophers also lived as metics, including Aristotle. Yet, although Athenians allowed metics to live and work in their city-state, metics faced numerous legal restrictions, limiting their rights and reinforcing their status as outsiders.

Joshua Hauck '26

Faculty Mentor(s): Professor Greg O'Neill, MECHANICAL ENGINEERING
Funding Source: James L.D. and Rebecca Roser Research Fund

Design and Analysis of Energy Recovery Methods for Reduced Aircraft Emissions

Aircraft flights are becoming an increasingly popular mode of transportation. However, their harmful impacts on the environment are a growing concern. To combat this issue, most engineers have focused on developing fully electric aircraft. Although these aircraft are much more sustainable, they encounter severe limitations imposed by current battery technologies. One alternative route engineers have taken is the development of energy recovery methods (ERM). These methods reduce the fuel consumption of aircraft without significantly changing their structure and functionality, making them an excellent short-term solution. The goal of this research is to add to the existing pool of ERM and analyze their performance to identify the most successful methods. To do so, we generated CAD models of common aircraft, as well as the new and existing ERM, using SolidWorks. We then tested these models with computational fluid dynamics software to measure their drag as speed and altitude change. Lastly, we used MATLAB and Excel to develop a mathematical model that utilizes principles of thermodynamics and kinematics to simulate fuel consumption during a typical flight pattern. This project is currently in progress; however, the analyses performed so far have promising results for the success of the included ERM.

Grey Hauenstein ’26; Brianna Bolorin ’24; Sarah J. Smith

Faculty Mentor(s): Professor Sarah Smith, BIOCHEMISTRY/CELL BIOLOGY
Funding Source: Walthour Fellowship; Department of Chemistry; Presidential Fellowship

Designing α-Helical Metallopeptides to Inhibit RpiB

I worked with Professor Sarah Smith in the Chemistry Department to design metal bound peptides to inhibit ribose-5-phosphate isomerase B (RpiB). RpiB is a protein vital to Leishmania protozoan parasites which cause the neglected tropical disease Leishmaniasis. RpiB is only active in its homodimer form, so designing a peptide that can bind to the RpiB monomer can prevent the formation of the homodimer, deactivate RpiB, kill the parasite, and stop the disease. Ideally, this peptide should have an α-helical secondary structure because α-helicity has been shown to improve proteolytic stability and protein binding affinity of peptides. I have designed peptides that will become α-helical upon metal binding. I synthesized and purified the peptides I had previously designed. I confirmed the synthesis of the correct peptides and their purity before using them in subsequent experiments.

In order to determine the secondary structure and stability of each peptide when bound to metal, I added cobalt, copper, nickel, or zinc to a solution containing the peptide. I also measured the structure and stability of metal-free peptides as a control. I determined the secondary structure of each peptide using circular dichroism spectroscopy, and the proteolytic stability using trypsin digests, where the products were analyzed by HPLC. Thus far, the peptides designed to inhibit RpiB (RBPXs) have shown _-helicity when bound to metal. Currently, the proteolytic stability of these peptides is being assessed. After structure and stability data is fully collected, the peptides will be analyzed for their protein binding affinity and inhibition abilities.

Teagan Hawes ’26

Faculty Mentor(s): Professor Gulay Guzel, MARKETS, INNOVATION & DESIGN
Funding Source: Helen E. Royer Undergraduate Research Fund

Are Bystanders More Persuasive than Victims? The Impact of Social Media Backlash Towards Brand Transgressions

Our research focuses on the intersection of brands, social media, and influencers, and their impact on consumers’ motivation to engage with social issues. We collected archival data from press media using keywords/phrases like “social issues,” “backlash,” and “influencers,” using the ProQuest database. Our initial research goal was to understand backlash involving influencers, consumers’ reactions to it, and brands’ roles in these discussions. We then moved to primary data collection, conducting 33 semi-structured interviews, analyzing the data using Dedoose. We explored 2 main research questions, the first being “How do consumers react to brand transgressions, and how do influencers and celebrities play a role in brand-consumer relationships?” Our findings suggest that consumers often react negatively to brands engaging in performative activism, resulting in backlash. Advertisements aligning with consumers’ identities tend to generate support for social causes, with varying interpretations of diversity. The second component of our research assessed “How can influencers and celebrities motivate consumers to care about social issues and what are the most effective uses of social media for inspiring action?” We found that celebrities and influencers can shape how consumers perceive brand efforts and social diversity issues. Authenticity and emotional appeal are key in motivating consumers. Moreover, a consumer’s background can influence an advertisement’s effectiveness. This research investigates the impact of social media backlash on marketing, and investigates whether the source of backlash can further influence consumers’ attitudes towards brands and their marketing. This research also investigates how influencers and celebrities shape consumers’ views on social issues.

Kaitlin Henry ’25; Melody Sain; Chris Martine

Faculty Mentor(s): Professor Chris Martine, BIOLOGY
Funding Source: Department of Biology; David Burpee Plant Genetics Fund; Manning Intern Botanical Science

Amino Acid Analysis of Extrafloral Nectar in Three Species of Australian Solanum (Solanaceae)

Structurally complex extrafloral nectaries (EFNs) are currently known to occur on the back of the corollas in only three species of Australian dioecious Solanum. These species, Solanum tudununggae, Solanum dioicum, and Solanum cunninghamii secrete extrafloral nectar, in which, little is known about the characteristics of the nectar – although botanists have noted abundant ant activity around these nectaries. Research has shown relationships between trophic resources from plants and ant species. These diverse relationships, spanning far back into Earth’s history, have allowed for the evolution of antagonistic and mutualistic relationships between plants and ants that have given rise to abundant biodiversity in terrestrial ecosystems. Previous literature has shown correlations between the composition of extrafloral nectar, specifically nutritional amino acids, and ant preference. This ex-situ project uses high-performance liquid chromatography (HPLC) to analyze the composition of extrafloral nectar, specifically the presence of amino acids. Through HPLC analysis of nectar, I hope to detect amino acids that have been shown in previous studies to be nutritionally essential and preferred by ants. We hypothesize that the presence of essential amino acids could suggest a mutualistic relationship between these three species and their local ants, with the plant providing essential nutrients to the ant population and the ants offering protection against herbivores.

Lily Hollander ’27

Faculty Mentor(s): Professor Paolo Morales, ART & ART HISTORY

Where Memory Rests

This series of photographs features my family in California, reflecting on themes of memory, preservation, and loss. Having grown up on the East Coast, my time in California became just a chapter in my lifeÑone I aimed to document through these images. The photographs explore the passing nature of time, serving as a record of connection, love, and the desire to preserve moments that might otherwise slip away.This project began as a personal endeavor to hold onto not just a place but the relationships and shared histories that defined my family. Each image reflects an effort to create a visual archive, capturing moments of connection and the events that shape our

livesÑbirthday celebrations, quiet afternoons, and the rituals of everyday life. These photographs also revisit a place where I once lived, a landscape imprinted with memories filtered through time and distance. Revisiting this work, I find that these images, initially made to preserve the present, have transformed into a way to process the complexities of change and lossÑa touching reminder of the power of memory and the places we hold within ourselves.This work speaks to the universal experience of cherishing loved ones and the ways we attempt to preserve their presence in our lives. It invites viewers to reflect on their connections to family and place, offering a framework for remembering and celebrating what matters most by transforming personal stories into a shared experience, and the enduring emotions and relationships that define us over time.

Kayla Holley ’26; Rebecca Switzer

Faculty Mentor(s): Professor Rebecca Switzer, CHEMISTRY
Funding Source: Walthour Fellowship

Impact of Disease-Associated Mutation Y524D on Stability and Activity of DNA Methyltransferase 1

DNA carries the genetic information required for the development and function of an organism. Specific regions of DNA, called genes, provide the instructions for cells to synthesize proteins. While all cells in a multicellular organism contain the same genetic information, not all cells need to express the same proteins for proper function. Thus, cells require regulatory mechanisms to ensure the correct genes are expressed at the right times. One form of this regulation occurs via DNA methylation, the process by which methyl groups are added to specific regions within DNA. DNA methylation is accomplished by a class of enzymes called DNA methyltransferases (DNMTs). DNMT1, the focus of this project, is the most abundant methyltransferase in humans. Mutations within the replication foci-targeting sequence (RFTS) domain of DNMT1 have been associated with formation of adult-onset neurodegenerative disorders. This research aims to better understand the structural and functional consequences of Y524D, a mutation casual for Hereditary Sensory and Autonomic Neuropathy Type 1E (HSAN 1E). To address this research question, I have recombinantly expressed and purified Y524D DNMT1 for biochemical analysis. Electrophoretic mobility shift assays indicate that Y524D DNMT1 exhibits increased DNA binding affinity. Methylation assays show that Y524D DNMT1 exhibits higher activity than wild-type DNMT1. Finally, protein aggregation assays show that Y524D DNMT1 is more prone to aggregate in solution than the wild-type enzyme. Taken together, the evidence supports the idea that the disease-associated mutation Y524D results in a hyperactive, yet less stable enzyme.

Charlotte Hughes ’27

Faculty Mentor(s): Professor Neil Boyd, MANAGEMENT & ORGANIZATIONS

Emergence & Maintenance of Psychological Experiences of Community at Work

Recent scholarship has demonstrated that psychological experiences of community at work (i.e., a psychological sense of community and a sense of community responsibility) can enhance employee psychological and behavioral outcomes. Recent evidence also shows that psychological experiences of community are facilitated by a multitude of actions that can be enacted by executives, human resource professionals, and managers throughout an organization. These findings have helped scholars understand some of the factors that contribute to building experiences of community in organizations. However, very little empirical evidence exists on the dynamic nature of antecedent conditions that exist when experiences of community first form, and what factors lead to maintenance or changes in experiences of community over time. The present study attempted to study this research gap by investigating experiences of students who enrolled in a course where they were charged with forming and running a company for a semester. A mixed-methods study was employed that included surveys at six key moments throughout the semester, and interviews with a randomly selected small cohort of participants to understand factors and incidents that were present as experiences of community manifested, and during states of dynamic change. The findings help frame factors that scholars can empirically test in future studies, and that managers could use in building community at work. KEYWORDS community experience model, sense of community, sense of community responsibility, organizational culture.

Bernard Iringire Nkusi ’27

Faculty Mentor(s): Professor Bekele Gurmessa, PHYSICS & ASTRONOMY
Funding Source: Walthour Fellowship; Department of Physics & Astronomy

Investigating Microscale Mechanics of Actomyosin Networks

Biological cells show a diverse array of complex and nonlinear responses to mechanical stress, including stress stiffening, softening, elastic recovery, and plastic deformation. These responses vary according to the nature of the applied force. Actin, a key cytoskeletal protein, plays a vital role in maintaining cellular stability, enabling motion and replication, and facilitating muscle contraction. It forms entangled and crosslinked filaments that provide the cytoskeleton with its characteristic viscoelastic properties. Actin-binding proteins, such as myosin, regulate many mechanically driven processes. Myosin generates contractile forces through ATP hydrolysis. These forces, on the scale of piconewtons, are essential for cell division, migration, and muscle contraction. Despite increasing evidence of myosin-II’s central role in microscale mechanics, the mechanical behavior of networks crosslinked by myosin-II remains poorly understood. In this study, we developed a series of in vitro reconstituted actomyosin networks with varying myosin-to-actin ratios. We assessed how these ratios influence the morphological changes and mechanical properties of the networks using laser scanning confocal microscopy imaging and optical tweezers techniques.

Olivia Jaye ’26: Douglas B. Collins

Faculty Mentor(s): Professor Douglas Collins, CHEMISTRY
Funding Source: The Katherine Mabis McKenna Environmental Internship Program

Investigating Volatile Disinfection Byproducts of Hypochlorous Acid and Wood Smoke using Real Time Mass Spectrometry

The effects of global climate change include more frequent and intense wildfires. Smoke can enter buildings, deposit on indoor surfaces and remain present for long periods of time. When smoke deposits on these surfaces, multiphase HOCl reactions can occur through the use of disinfectants on contaminated surfaces. Bucknell researchers have previously identified chlorinated disinfection byproducts that remain on surfaces using liquid chromatography/mass spectrometry, however semi-volatile byproducts have not yet been investigated. In this study, we use dielectric barrier discharge ionization mass spectrometry for the real-time, temperature-dependent analysis of semi-volatile disinfection byproducts. We focus on the reaction of catechol, a component of wood smoke, with chlorine bleach vapor (HOCl). Preliminary data shows that a surface reaction between catechol and HOCl gas is occurring. Molecular formulas were assigned based on the exact masses and isotope ratios gathered from the mass spectra. Tandem mass spectrometry and database searches were then used to infer possible molecular structures. Many products had 6 or fewer carbons, likely coming from ring-opening reactions of catechol. Byproducts were monitored in real time with increasing temperature, allowing for estimation of volatility, which is important for understanding inhalation exposure through indoor air in a contaminated environment.

Colton Jiorle ’25

Faculty Mentor(s): Professor Amal Kabalan, ELECTRICAL & COMPUTER ENGINEERING
Funding Source: Presidential Fellowship; PPL Undergraduate Research Fund

Economical System to Gauge Photovoltaic Health for Homeowners

As the need to reduce carbon emissions intensifies, more homeowners than ever are choosing to go solar. However, many homeowner’s lack the expertise to understand the daily operation and identify potential problems. As installation rates continue to rise, providing a reliable and economical system to gauge the effectiveness of photovoltaic modules garners increased interest.

Nicole Joseph ’25; Kayla E. Lichtner (Graduate Student); Benjamin D. Haussmann; Garret P. Peterson; Tiffany R. Hegdahl; Travis R. Robbins; Mark F. Haussmann

Faculty Mentor(s): Professor Mark Haussmann, BIOLOGY
Funding Source: Department of Biology

Investigation of Population Resistance to Cold-Induced Oxidative Damage in a Lizard

In ectotherms, metabolic rate positively scales with environmental temperature. We previously demonstrated that when exposed to cold temperatures (18¡C), southern prairie lizards (Sceloporus consobrinus) showed an expected decrease in metabolic rate. However, these lizards exhibited a statistically significant increase in oxidative damage to DNA, a harmful metabolic byproduct measured as 8-hydroxy-2’-deoxyguanosine (8-OHdG). Interestingly, cold-induced DNA damage differed by population; lizards from the northern-most population, that experience colder annual temperatures, exhibited no increase in 8-OHdG levels. Oxidative damage following cold exposure in southern populations may be due to the cold exposure itself, or to rapid warming up after the exposure. The purpose of this study is to investigate what specifically underlies the cold-induced increase in 8-OHdG. Adult lizards from the northern and southern populations were exposed to a day-long cold temperature challenge (18¡C) in the lab. We measured body temperatures for each lizard immediately following the treatment. Blood samples were taken to measure 8-OHdG in either a cold glove, to determine if the day-long cold exposure affected 8-OHdG levels, or after a brief period in a warm incubator, to isolate the effects of rewarming on 8-OHdG, which proves to be a significant stressor. Finally, we measured 8-OHdG levels two days after the temperature challenge to examine the DNA repair capabilities of each population. As the climate becomes increasingly unpredictable, understanding how ectotherms physiologically respond to temperature changes is essential for predicting their survival.

Jordan Kenton ’26; Jonathan Torres

Faculty Mentor(s): Professor Jonathan Torres, MECHANICAL ENGINEERING
Funding Source: Bucknell Program for Undergraduate Research

Machine Testing of Hybrid Wire Arc Additive Manufacturing

During the summer of 2024, I researched Hybrid Wire Arc Additive Manufacturing (HWAAM) with Professor Jonathan Torres in the Mechanical Engineering Department at Bucknell University. The project I worked on partnered with the Naval Surface Warfare Center (NSWC). The goal of the project was to determine the ideal printing parameters for HWAAM that would optimize the strength and stability of the sample while still utilizing an easy-to-use interface. The machine must be able to be used by anyone since anyone could be using it to do in-field repairs, not necessarily an engineer or someone who has worked on the machine before. While at Bucknell, I ran tension, fatigue, and small punch tests (SPT), and I utilized the scanning electron microscope. Some of the materials that I tested were aluminum, titanium, and several different types of steel. By using the SPT, we were able to determine the ultimate strength, yield strength, and elongation and create graphs. I also conducted much of the data analysis to estimate the values we needed from the data. I utilized equations from a previous paper by Professor Torres to normalize the SPT curves if they had been done on samples that were not within tolerance. I also used Matlab to calculate the yield strength of each of the samples. As of now, it is difficult to draw definitive conclusions about printing parameters. The data will continue to be analyzed by the NSWC.

Noah Kerzner ’27; Ben Vollmayr-Lee

Faculty Mentor(s): Professor Ben Vollmayr-Lee, PHYSICS & ASTRONOMY

Funding Source: Bucknell Program for Undergraduate Research; Presidential Fellowship; Department of Physics & Astronomy

Numerical Test of Far-From-Equilibrium Fluctuation-Dissipation Identities

The success of equilibrium thermodynamics can be attributed to the fundamental assumption of ergodicity, which provides the probability of finding the system in any particular state. This assumption does not hold for far from equilibrium (FFE) systems such as cells and nanotechnology. Here, determining thermodynamic observables becomes increasingly challenging. Recent breakthroughs, most notably the Jarzynski and Crooks relation, connected equilibrium properties to far from equilibrium quantities, offering deep insight into these understudied systems. Adjacent to these well-known identities, a host of promising identities remain unproven. One such example is the generalized fluctuation-dissipation relation, which extends the equilibrium fluctuation-dissipation relation to FFE regimes, offering detailed knowledge of energy flow in FFE systems.We test unproven FFE identities using driven reaction-diffusion systems. Such systems are ideal test beds for studying FFE phenomena since they are inherently spatially and temporally inhomogeneous, allowing small driving forces to generate rich behavior. The simulation is based on Anderson’s Modified next reaction method, a Gillespie-type algorithm designed to handle time-dependent rates. We have verified the Jarzysnki and Crooks relation, as well as a host of related identities, thus demonstrating the simulation consistency with known physics. With this we present preliminary results on our tests of the generalized fluctuation-dissipation relation.

Elliott Kilgallen ’26

Mentor(s): Julia F. Charles, MD, PhD, Brigham and Women’s Hospital, Department of Orthopaedics

Funding Source: Thomas Spitzer Undergraduate Research Fund

The Role of Specialized Pro-Resolving Mediators in Post-Traumatic Osteoarthritis

The Charles Lab at Brigham and Women’s Hospital, Department of Orthopaedic Surgery investigates the disease mechanisms associated with post-traumatic osteoarthritis (PTOA) resulting from anterior cruciate ligament (ACL) injuries. The most common cause of PTOA is injury to the ACL with over 50% of ACL-injured patients developing PTOA within 15 years of injury, despite surgical intervention. A central objective of our project was to elucidate the cause-and-effect relationship between ACL injuries and the subsequent onset of osteoarthritis using a mouse model. A significant hypothesis under investigation is that inflammation from the injury never fully resolves, leading to persistent pain and joint dysfunction. In our research, we explored the role of specialized pro-resolving mediators (SPMs), which are molecules involved in actively resolving inflammation. We aimed to determine whether these SPMs could potentially mitigate unresolved inflammation and, consequently, prevent or delay the onset of osteoarthritis.

Tobey Kim ’27; Min-Sub Lee ’26; Sophia Walker ’25; Angelina Santos ’27

Faculty Mentor(s): Professor Olivia Boerman, BIOMEDICAL ENGINEERING

Funding Source: Tague Family Fund for Undergraduate Research in Biomedical, Biological and Biochemical Sciences; Presidential Fellowship

LFLI US Alters Pro-Angiogenic Protein Secretion in 3D Endothelial Cell Culture

Over 181 million people worldwide suffer from chronic wounds, which remain exposed for over three months, inducing significant financial, physical, and emotional burdens on patients. Previous studies suggest that low-frequency low-intensity ultrasound (LFLI US) accelerates chronic wound healing , but the mechanisms behind it remain unclear. A better understanding of these mechanisms will maximize the potential of therapeutic ultrasound for chronic wound therapies. Our lab hypothesizes that LFLI US facilitates angiogenesis, allowing chronic wounds to transition from inflammation to proliferation. This project examines whether LFLI US enhances secretion of vascular endothelial growth factor (VEGF) and basic fibroblast growth factor (bFGF), key proteins released angiogenesis, by endothelial cells (blood vessel cells). Endothelial cells were cultured in a 3D collagen scaffold to mimic in vivo conditions. Cells were exposed to LFLI US at varying intensities (50, 100, and 150 mW/cm_) for 15 minutes, and protein secretion was analyzed using ELISA at 24, 48, and 72 hours post-treatment. Results showed 100 mW/cm_ LFLI US significantly increased VEGF secretion at 24 hours, supporting its role in angiogenesis. However, bFGF secretion was reduced at 24 hours and increased significantly at 72 hours in the 50 mW/cm_ group. This suggests VEGF and bFGF respond differently, potentially due to integrin-mediated mechanotransduction. These findings suggest that VEGF plays a more immediate role in the observed wound healing effects. Further research is needed to clarify the mechanistic pathways in reference to bFGF regulation to optimize LFLI US parameters for clinical applications.

Gavin Kint ’26

Faculty Mentor(s): Professor Hasan Arslan, CHEMISTRY

Funding Source: Walthour Fellowship

Modulation of Guest Structure to Improve Host-Guest Binding Interactions

Host-guest chemistry is a topic in the field of supramolecular chemistry, with applications from biological systems such as enzyme-substrate complexes to everyday items. The common household air freshener, Febreze, is an example of host-guest chemistry in action. For example, the “odor trapping ability” of Febreze, is a result of how well the host molecule (found in the air freshener) can bind to the guest molecule (the molecules responsible for the bad odor) to trap them, preventing a bad odor.Binding strength affects host-guest complexation and it is dependent on several factors including solvent interactions (both attractive and repulsive forces), pi-pi interactions, and ion-pi interactions among many others. ExBox4+, a recently reported host compound, has been shown to bind polycyclic aromatic compounds (PACs), which are known environmental pollutants. Despite some earlier studies that investigated how binding in ExBox4+ is affected by the size of the guest, a

systematic study of intermolecular forces between the host and the guest is lacking.This research aims to expand the field of supramolecular chemistry by examining how host-guest binding strengths can be increased through the addition of side chains to guest molecules. Many studies have been done on how side chain addition can improve host-guest binding, but the driving factors behind this increase in binding strength are mainly hydrophobic interactions, and very few studies have been done in organic solvents. Previous studies have shown that the addition of ethylene glycol side chains to guest molecules can increase the binding strength between the guest and BCPQT.

Ryan Koes '26; Alan Marchiori; Katsuyuki Wakabayashi

Faculty Mentor(s): Professor Alan Marchiori, COMPUTER SCIENCE; Professor Kat Wakabayashi, CHEMICAL ENGINEERING

Unbiased Characterization and Classification of Coffee

Traditional coffee quality assessment relies on certified sensory specialists, who are not easily accessible and can be subjective. These evaluations can lead to inconsistencies in coffee assessment, making it difficult to achieve reliable and standardized evaluations. The goal of this study is to leverage machine learning to objectively classify brewed coffee by brand, class, and roast level using physicochemical characterization. We studied a total of 144 brewed coffee samples from seven different coffee brands ranging across commodity, specialty, and premium classifications, at varying roast levels. For each sample, we measured: pH, color, turbidity, potassium, and total dissolved solids and manually labeled the brand, class, and roast level. We evaluated support vector machine (SVM), decision tree, and logistic regression models to predict coffee brand, class, and roast level. The SVM performed best with 100% accuracy using 10-fold cross-validation.Our ongoing research explores the use of cyclic voltammetry to analyze electrochemical properties of coffee. This work aims to develop a low-cost electrochemical analysis method to determine distinct characteristics of coffee, providing an objective alternative to traditional sensory evaluation. A screen-printed electrode can detect oxidation peaks of key coffee compounds. Our initial studies are focusing on estimating caffeine concentration. Features of the cyclic voltammetry curve are extracted and used to estimate the caffeine concentration, using High-Performance Liquid Chromatography to measure the ground-truth concentration. Further analysis will extend this approach to include chlorogenic acids, a major class of coffee components, to determine their electrochemical signatures.

Tess Korten '27

Faculty Mentor(s): Professor Jenna Christian, GEOGRAPHY

Funding Source: Douglas K. Candland Undergraduate Research Fund

The Politics of Defining Antisemitism: An Investigation of Jewish Meanings of Antisemitism Amid Anti-Jewish Hate Crimes and Conflict in Palestine

As a response to the October 7th Hamas massacre of Israeli communities, Israel launched a massive campaign in Gaza, resulting in an overwhelming number of Palestinian casualties. Discourse over this conflict has become global, affecting opinion on a broad spectrum. While this violence unfolds abroad, within the United States, multiple organizations are tracking a rise in antisemitism toward Jewish communities since the start of the Israel-Palestine war. This rising hate against Jews poses a national threat to Jewish communities across the United States, evoking fear in many citizens. Alongside an increase in antisemitism has been a heightened debate about the meaning of antisemitism within the United States. Jewish communities are grappling with this debate as tensions arise over how differing definitions of antisemitism address anti-Jewish hate, criticism of Israel, and Zionism itself. Amid rising international criticism of Israel's actions against Palestinians and an increase in antisemitic hate crimes against Jews, Jewish communities have come to frame antisemitism in differing manners. At a time when the state of Israel and its position in war is at the forefront of national and international attention, focusing on these questions of what constitutes antisemitism contributes to pressing conversations about the value in particular media and activism. This research used qualitative methodologies to investigate the differing ideas of antisemitism within Jewish communities against the backdrop of rising antisemitism and the Israel-Palestinian conflict. Key findings include political polarization, criticism of Israel, and the use of Jews for advancing political agendas.

Dora Kreitzer '25

Faculty Mentor(s): Professor Elizabeth Durden, SOCIOLOGY & ANTHROPOLOGY

Funding Source: Douglas K. Candland Undergraduate Research Fund; The Tom Greaves Fund for Research & Curricular Development

How the Town Views the Gown: A Case Study of a Campus-Community Relationship in Lewisburg

This research uses Bucknell and Lewisburg as a case study to understand the relationship between universities and their surrounding communities. While prior research has focused on urban, large, and/or research-oriented universities, the rural, small, and liberal arts nature of Bucknell provides an opportunity to explore how campus-community relationships vary by environment. 48 qualitative semi-structured interviews and twelve months of observation of Lewisburg Borough Council meetings are used to explore three main areas of the town-gown relationship: economics, space, and social capital. These themes emerged from interviews and observations as the most important determinants of residents' perceptions of the University. Regarding economics, local respondents recognized employment, attracting students and parents with spending

power, business assistance, and community revitalization as mechanisms through which Bucknell contributes to the local economy. In the scope of space, Lewisburg respondents varied in their comfort using Bucknell's campus. Further, government officials, merchants, and other residents differed both in their reactions to student behavior in off-campus housing as well as if/how they felt it should be handled. Socially, all Lewisburg respondents felt they had at least one strong individual connection to the University, but many respondents wanted a wider network of relationships at Bucknell. The results of this research raise suggestions for next steps to improve the relationship between Bucknell and Lewisburg such as reinstating a Town-Gown Committee, requiring a workshop for students before they are allowed to move off-campus, and adding signage to make the campus more accessible.

Maddie LaCoss '27

Faculty Mentor(s): Professor Stephanie Larson, CLASSICS & ANCIENT MEDITERRANEAN STUDIES
Funding Source: Douglas K. Candland Undergraduate Research Fund

A Historical and Biological Overview of Leprosy and Typhoid in an Ancient Theban Cemetery

As a PUR Fellow, I was given the opportunity to work closely with Dr. Stephanie Larson to create a written synthesis of the biological and historical backgrounds of leprosy and typhoid in the ancient eastern Mediterranean. My research was separated into two phases: data collection and a written interpretation. I commenced with an in-depth review of literature sources published in both major biological and archaeological publications such as the WHO, CDC, American Journal of Anthropology, and International Journal of Osteoarchaeology. I also annotated and summarized sources provided by Professor Larson to use within my work as well as in her own. Utilizing data from both biological and historical areas of scholarship, I produced reports detailing a pathological overview of leprosy and typhoid, incorporating information dating from ancient records to the modern day. I also generated an essay focusing solely on archaeological cases of leprosy reported across the globe as well as a report of genome mutations occurring in the leprosy causative agent, Mycobacterium leprae. After completion of my written analyses, I compiled all relevant sources into separate bibliographies, one for each disease, for Professor Larson's use in her own research. My final work will be incorporated into the first volume of the final publication of the Bucknell Thebes Excavation Project, a manuscript currently in progress. My research explored the fascinating connections between science and history and effectively removed the boundary often created between the two fields, providing academics with a well-rounded understanding of the biology and history of both diseases.

Skyler Le '27

Faculty Mentor(s): Professor Sally Koutsoliotas, PHYSICS & ASTRONOMY; David Farmer, MATHEMATICS & STATISTICS
Funding Source: Hoover Fund for Undergraduate Math Research; Presidential Fellowship

L-functions Out of Nothing: Patterns Explained

L-functions are a bridge between many different areas of mathematics and physics. We found L-functions that no one has ever seen before. Our data set reveals intriguing patterns, which we are now able to partially explain.

Edward Lee '25

Faculty Mentor(s): Professor Aaron Mitchel, NEUROSCIENCE
Funding Source: Tague Family Fund for Undergraduate Research in Biomedical, Biological and Biochemical Sciences

Distracted but Still Listening: How Cognitive Load Impacts Audiovisual Enhancement

There is an ongoing debate about whether multisensory integration (MSI) is pre-attentive and automatic or a later process subject to top-down attentional control. A recent study investigated this by manipulating the availability of attentional resources in a dual-task paradigm, finding that when the demands of the secondary task increased, susceptibility to non-speech audiovisual illusions also increased (Michail & Keil, 2018). This was taken as evidence for the role of post-attentive, top-down control during integration. In the present study, we extend this logic to explore the role of attentional processes in audiovisual speech integration. Participants completed an audio and audiovisual speech-in-noise task interleaved with an n-back task (0, 1, or 2) to apply cognitive load. We found that as cognitive load increased, speech recognition accuracy decreased in audio and audiovisual stimuli; however, there was no interaction between cognitive load and speech modality. Contrasting prior findings, our results suggest that audiovisual integration of speech occurs in an automatic, pre-attentive manner. These findings led to an in-progress experiment assessing how modulating both cognitive and perceptual load influences audiovisual integration of speech. Findings that continue to contrast prior work would support the theory that audiovisual speech integration is unique relative to non-speech audiovisual integration.

Isabella Levin '28

Faculty Mentor(s): Professor Gulay Guzel, MARKETS, INNOVATION & DESIGN
Funding Source: Presidential Fellowship

Political Consumption on the Edge of the 2024 Election

This study explores social media behavior, specifically political consumption and polarization. Political Polarization is a system that results in the division of a country's entire population into two diametrically opposed political camps (Duignan, n.d.). In the project, we focused on the 2024 election, highlighting the binary opinions of content creators based on the United States two candidate electoral system. The content on the social media app TikTok will be analyzed as it intersects with this election. TikTok currently represents one of the most successful Chinese social media applications in the world, attracting young users to engage in viewing, creating, and commenting on "LipSync-Videos" on the app (Montag et al., 2021, 1). Therefore, the question is posed: What does political polarization look like in the climate of a popular social media platform, where users are encouraged to share their opinions throughout the course of a two candidate electoral election? Over the span of 12-weeks (6-weeks before election results, 6-weeks after election results), the top two videos under each hashtag were collected every Monday and Thursday located using the hashtag feature, in which three hashtags were chosen (#Trump2024, #Harris2024, #2024election). Following collection, videos were transcribed and coded to view emerging themes, and analyzed qualitatively by comparing, contrasting, and drawing parallels between the literature and the data. This project is at the stage of data analysis and literature review. In the presentation, the preliminary findings will be presented and the implications surrounding political polarization in social media will be discussed.

Jackson Lewis '27; AKM Sadman Mahmud; Jean Luc Ishimwe; Xiang Li; Junhyuk Kim; Michael J. Bolish; Amin Danesh; Brian Utter; Cacey S. Bester; Amy L. Graves; Katharina Vollmayr-Lee

Faculty Mentor(s): Professor Katharina Vollmayr-Lee, PHYSICS & ASTRONOMY
Funding Source: National Science Foundation Grant (NSF)

The Effects of Pins on Force Chains in a Granular System: A Simulation

Granular media are large collections of disordered macroscopic particles interacting via dissipative forces. We use molecular dynamics simulations to study a two-dimensional, 50:50 binary mixture of purely repulsive harmonic disks of radii 1:1.4. By freezing the top and bottom walls of particles we shear the system at a constant rate and apply dissipative interactions depending on relative velocity. We study how force chains are influenced by the addition of fixed minuscule disks of radius 0.004 placed on a square lattice. We study the forces Fij between particles i and j. We will present distributions P(Fij) both for the complete system as well as for layers. We also study the system both near the jamming transition at p = .00025 as well as slightly above the transition at p = 0.001. We compare the distributions right before the shear and in steady state during the shear.

Kayla Lichtner (Graduate Student); Nicole A. Joseph '25; Sarah E. Chapman '25; Tori J. Chace '26; Jack K. Dziubek '25; Mark F. Haussmann; Antoine Stier; Patricia L. Jones; Robert A. Mauck

Faculty Mentor(s): Professor Mark Haussmann, BIOLOGY
Funding Source: Department of Biology; National Science Foundation Grant (NSF)

Corticosterone and Mitochondrial Efficiency are Associated with Changes in DNA Oxidative Damage During an Acute Stress Response in Leach's Storm-Petrels (Hydrobates leucorhous)

The ability of organisms to effectively respond to challenges is critical for survival. We investigated how an acute stressor affected corticosterone, mitochondrial function, and DNA oxidative damage in a wild population of Leach's storm-petrels (Hydrobates leucorhous). We conducted a standardized 20-minute handling procedure on storm-petrel chicks and collected baseline and post-handling blood samples. We measured plasma corticosterone and red blood cell DNA oxidative damage levels through the detection of a mutated DNA base 8-Hydroxy-2' – deoxyguanosine (8-OHdG). In addition, we quantified six measures of mitochondrial aerobic metabolism from red blood cells. Overall, the handling stressor increased plasma corticosterone levels and decreased mitochondrial efficiency to produce ATP. Although the increase in corticosterone was inversely related to the change in DNA oxidative damage, the decrease in mitochondrial efficiency was positively correlated with the change in DNA oxidative damage. Thus, over an acute stress response, individuals who had the largest increase in corticosterone also had the least amount of oxidative damage. In addition, individuals who prioritized ATP production during the acute stress also showed higher levels of oxidative damage. This work highlights the complex pathways by which corticosterone and mitochondrial efficiency affect oxidative damage during acute stress, providing new insights into the trade-offs underlying physiological responses in wild animals.

Jaycie Mair '27; Elizabeth Mamros

Faculty Mentor(s): Professor Elizabeth Mamros, MECHANICAL ENGINEERING
Funding Source: James L.D. and Rebecca Roser Research Fund

Using Single Point Incremental Forming to Improve Geometrical Accuracy in Stainless Steel.

Professor Mamros and I conducted research together in the mechanical engineering department. Our work was focused on single point incremental forming (SPIF) using stainless steel. We collaborated to make a setup so that single point incremental forming research could be performed at Bucknell. Single point incremental forming is a relatively new manufacturing technique that works by locally deforming the material, layer by layer, to fabricate the desired geometry, e.g., to make customizable parts. This project is ongoing, and our next step is to manipulate variables in the toolpath during SPIF to research how different variables affect the geometrical accuracy of SPIF. We will be comparing the specimen made from SPIF to computerized models, to figure out the ideal conditions for eliminating springback in SPIF.

Dante Mancino ’27

Faculty Mentor(s): Professor Lucas Waddell, MATHEMATICS & STATISTICS
Funding Source: Hoover Fund for Undergraduate Math Research

Linearizable Instances of the Quadratic Minimum Spanning Tree Problem on 3-Connected Graphs

The quadratic minimum spanning tree problem (QMSTP) is graph-based combinatorial optimization problem that, in general, is notoriously difficult to solve. We study special easily-solvable instances of the QMSTP that are known as linearizable, meaning that the quadratic objective can be equivalently rewritten as linear in a manner that preserves the objective function value of each feasible solution. Previous work has shown that a sufficient condition for linearizability is that the (symmetric) matrix of cost coefficients is a weak sum matrix. This work also showed that this sufficient condition becomes necessary for linearizability when the underlying graph is a complete graph. In our work, we broaden this result by proving that this sufficient linearizability condition is necessary if and only if the QMSTP instance is defined on a 3-connected graph.

Sophia Martinez ’25; Lucas Hower; Janine Glather; Elizabeth Capaldi

Faculty Mentor(s): Professor Elizabeth Capaldi, BIOLOGY
Funding Source: Digital Pedagogy & Scholarship Summer Research Program

Digital Linn Conservancy Project

The project, in collaboration with the Merrill W. Linn Conservancy, focuses on developing digital tools to support conservation work and easement management. The research was initiated by identifying key map layers and creating foundational maps of the Conservancy’s easement holdings. Over the summer, this work was expanded by developing GIS-based tools to enhance site assessments and conservation prioritization.

The work resulted in a suite of interactive tools, including a digital assessment survey to streamline data acquisition from annual easement site visits, a parcel prioritization app to guide conservation planning, and a comprehensive StoryMap showcasing nineteen easements managed by the Conservancy. This platform integrates property profiles, historical background, ecological significance, and photo documentation for the convenience of locating information. Throughout the summer, the team engaged with external partners, including the Union County Planning and GIS Departments and Linn Conservancy staff and volunteers, to refine the approach and ensure alignment with conservation goals.

This symposium poster presentation will showcase the tools developed and discuss their impact on conservation planning, emphasizing the integration of GIS data, interactive maps, and dashboards to improve land stewardship. The project highlights how digital innovation can enhance conservation efforts, ensuring effective management and prioritization of protected lands.

Madeline Massa ’27

Faculty Mentor(s): Professor Paolo Morales, ART & ART HISTORY

Internal Illumination

My project, Internal Illumination, was created with the goal of exploring and expanding the relationship between light, color, and emotion through cinematic lighting techniques. I primarily photographed at night, where I could both control the light that I wanted to come through my photos and incorporate the importance of lack of light. Areas of darkness emphasize parts of the picture in ways light cannot. Through historical and modern influences, colors are already associated with feelings – such as blue expressing sadness and yellow representing joy. This project allowed me to both expand on these known associations, while also contradicting these to show how a photograph is impacted. By careful control and manipulation of these variables, I create cinematic photographs that feel immersive to the viewer.

Andie McCullough ’26; Kim Hergenhan ’25

Faculty Mentor(s): Professor Olivia Boerman, BIOMEDICAL ENGINEERING
Funding Source: Tague Family Fund for Undergraduate Research in Biomedical, Biological and Biochemical Sciences

Low-Frequency (20 kHz), Low-Intensity (100 mW/cm^2) Ultrasound Upregulates ROCK RNA Expression in Endothelial Cells

Low-intensity, low-frequency ultrasound has demonstrated its promise as a potential alternative treatment for healing-resistant chronic wounds by promoting angiogenesis. Angiogenesis, the creation of blood vessels, is a critical step in the healing process, as blood vessels form up to 60% of tissue mass found in healing wounds and promote tissue regeneration. GTP binding protein Rho and its downstream effector Rho-kinase (ROCK) are two key genes involved in angiogenesis. ROCKs have been found to mediate important cell functions including cell migration and proliferation. The purpose of this study was to determine the effect of ultrasound on the RNA expression of Rho and Rho-kinase (ROCK) by using reverse transcription polymerase chain reaction (RT-PCR).

600,000 human umbilical vein endothelial cells (HUVECs) were seeded in collagen matrices and exposed to 50 mW/cm_, 100 mW/cm_, and 150 mW/cm_ intensity ultrasound for 15 minutes. Cells were collected and lysed 12, 18, and 24 hours after exposure and RNA was extracted to be analyzed via RT-PCR using ROCK1 and Rho as genes of interest.

Results of the study demonstrate that ROCK gene expression increases following low-intensity, low-frequency ultrasound 18 hours after ultrasound application. ROCK’s involvement in angiogenesis supports that ultrasound may induce healing through the use of the Rho/ROCK pathway.

Tyler McMasters ’27; Maria Pisciotta ’25; Morgan Benowitz-Fredericks

Faculty Mentor(s): Professor Morgan Benowitz-Fredericks, BIOLOGY

Funding Source: Douglas K. Candland Fund

The Influence of Prenatal Versus Postnatal Conditions on the Physiology and Survival of 5 Day Old Kittiwake Chicks

The Black Legged Kittiwake (Rissa tridactyla) is a species of Arctic seabird that breeds on coastal cliffs and usually raises two chick broods. Similar to other bird species, kittiwake egg size is correlated with hatchling mass. In older chicks, mass can also be correlated with physiology, including metabolite and hormone levels. However, it is not yet known whether this relationship is due to early postnatal experiences that shape both mass and metabolic and hormonal functions, or whether these aspects of physiology may be predetermined by maternal investment in the egg. If the prenatal experience is the cause of the mass-physiology relationship, then egg mass will be a better predictor of ketone and corticosterone levels than chick mass at 5 days old. We also manipulated the postnatal environment by providing food supplementation to some nests, allowing us to further test the role of post-natal experience in shaping physiology. Experiments conducted on Middleton Island, AK in 2024 studied kittiwake chicks from nests that were provided with food supplementation 3x/day, and control nests that were not supplemented. We measured egg size and mass, as well as chick mass, and corticosterone and ketone levels on day 5 post-hatch. By comparing the ability of egg size versus chick mass to explain ketone and corticosterone levels and survival in both control and experimentally fed nests, our study will provide insight into whether variation in physiology and survival in young chicks is more strongly influenced by prenatal investment or postnatal experiences.

Leeann Michael (Graduate Student)

Faculty Mentor(s): Professor Kevin Gilmore, CIVIL & ENVIRONMENTAL ENGINEERING

Funding Source: Graduate Summer Research Fellowship

Experimental and Computational Analysis of PFAS Adsorption and Transport Through a Soil-Bentonite Cutoff Wall Amended with Activated Carbon

Poly — and perfluoroalkyl substances (PFAS) pose a significant threat to human and ecological health due to their toxicity and persistence. In-situ containment using engineered vertical barriers, like cutoff walls, offers a potential solution when conventional remediation methods fail. This study investigates the efficacy of soil-bentonite (SB) cutoff walls amended with granular activated carbon (GAC) for long-term PFAS containment.The study investigated four PFAS compounds: perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS), perfluorohexanesulfonic acid (PFHxS), and perfluorobutanesulfonic acid (PFBS). Batch equilibrium adsorption tests (BEATs) were conducted using model SB backfill, both unamended and amended with 1% GAC, and solutions containing the PFAS compounds. The study examined the impact of three testing considerations: suspended solids removal, centrifugation methods, and test duration. Neither conventional nor ultracentrifugation alone effectively removed suspended bentonite from the BEAT supernatant. A sequential centrifugation and filtration process using 0.45-µm syringe filters was implemented. Of the filter materials tested, polyethersulfone (PES) minimized PFAS adsorption. Seven days proved sufficient for achieving equilibrium adsorption. Results for all compounds illustrate minimal adsorption to the unamended backfill, while the GAC-amended backfill exhibited appreciable, non-linear adsorption, well-described by the Freundlich model. Model simulations suggest that 1% GAC in an SB matrix can delay PFAS breakthrough significantly (e.g., over 1400 times for PFBS) compared to unamended SB.

Jacob Mohr ’27; Elizabeth Mamros

Faculty Mentor(s): Professor Elizabeth Mamros, MECHANICAL ENGINEERING

Funding Source: Helen E. Royer Undergraduate Research Fund

Controlling Phase Transformations through Single Point Incremental Forming

The purpose of this project is to manipulate the phase transformation during single point incremental forming. Phase transformation is a microstructural change occurring in metals that is induced by deformation in a specific temperature range, and the result is changes in its strength and brittleness compared to the original. Incremental forming is a sheet metal forming technique that involves making tiny indentations in a sheet of metal, with the goal of eventually achieving a desired geometry. The goal is to be able to control these phase transformations by changing process parameters used in incremental forming and analyzing in which locations of the sheet metal they have occurred. The purpose of having control over these transformations is to change the properties of the metal after transformations occur for the intended application of the part. Using stainless steel, the goal is to transform certain areas of the metal from the austenite phase to a more brittle but also stronger phase known as martensite. Future work will focus on changing the toolpath (code read by the machine) to see how it influences the phase transformation at select locations.

Katie Moncavage ’28

Faculty Mentor(s): Professor Paolo Morales, ART & ART HISTORY

Through Their Eyes

Focusing on a low-income area in which I am deeply familiar withÐShamokin, PAÐ I aim to document the everyday lives of those who live in impoverished communities. Having lived near Shamokin my entire life, I have witnessed the socio-economic challenges that have persisted in this town, and through my lens, I seek to capture the visible decay and history that defines it.This project draws inspiration from the photographic work of Wolfgang MŸller, specifically in his works from Karat, where he explores the harsh realities of impoverished environments in Russia. MŸller incorporates images such as landscapes, buildings, and people to convey a powerful narrative about the struggles of addiction and poverty. His striking images informed the direction of my own photographs. By focusing on intimate, yet raw portrayals of the town in my own photographs, I aim to illuminate the complexities of small-town decline—where generations of economic struggle have left a lasting impression.

Natalie Nareski ’26

Faculty Mentor(s): Professor Tim Strein, CHEMISTRY
Funding Source: Department of Chemistry

Chiral Compounds Interaction with Bile Salt Micelles

A fast and inexpensive method for the separation of chiral compounds is a necessity to test the enantio-purity of new drug substances. Despite numerous published reports using bile micelles for chiral separations, little is known about the thermodynamics of the binding interaction between bile salt micelles and chiral compounds. Bile salt micelles, which are constructed of natural molecules, are useful chiral separators in micellar electrokinetic chromatography (MEKC), a low-volume analytical technique carried out in a narrow capillary tube. Here, a non-disruptive method to determine the mobility of bile salt micelles in the MEKC system is used to enable the determination of the native mobility of the bile salt micelle without altering its structure. The method uses migration behavior of a homologous series of increasingly hydrophobic phenones and a binding curve (Hill equation) to determine the native micelle mobility. With both analyte and micelle migration rates known, the thermodynamic binding constant is then calculated. The method is demonstrated with R – and S – isomer binding of a model chiral drug, BNDHP, to the bile salt micelle pseudo-stationary phase systems: cholate and taurodeoxycholate.

Jean Marie Ngabonziza ’26

Faculty Mentor(s): Professor Tyler Yamin, MUSIC
Funding Source: Bobko-Dennis Fund for Undergraduate Student Research; Balakian Fund for the Arts

“Culture Evolves with Time”: Learning about Rwandan Culture through Traditional Music

Rwandan culture, rooted in oral traditions of storytelling, poetry and music, faces threats from colonization, the loss of knowledgeable people to the 1994 Genocide against the Tutsi, and the adoption of western cultures. In the summer of 2024, I spent ten weeks conducting research on the measures that need to be taken to preserve the Rwandan culture from this fate. I conducted interviews with five traditional music artists and attended various cultural festivals in order to understand how they helped to preserve and pass down traditions to next young generations. Through my interviews, I learned something opposite to my prior understanding of culture. Instead, I found that there is not one single way to retain traditional culture. In this presentation, I will share these artists’ views on what we can do to protect the culture. Some artists advocate for preserving old traditions, while others embrace new combinations of traditional music and modern values. Although these ways are different in their implementation, the ultimate goal is the same: preserving the heritage of our ancestors in this modern society. What I initially thought will be a journey to discover how to bring back the old ways ended up having a detour to how we can protect the heritage from our ancestors from getting diluted and lost.

An Ngo ’26; MinhPhuong Cao ’26; Rajesh Kumar

Faculty Mentor(s): Professor Rajesh Kumar, COMPUTER SCIENCE
Funding Source: Kalman Fund for Undergraduate Research in the Sciences

Deep Generative Attacks and Countermeasures for Data-Driven Offline Signature Verification

This study investigates the vulnerabilities of data-driven offline signature verification (DASV) systems to generative attacks and proposes robust countermeasures. Specifically, we explore the efficacy of Variational Autoencoders (VAEs) and Conditional Generative Adversarial Networks (CGANs) in creating deceptive signatures that challenge DASV systems. Using the Structural Similarity Index (SSIM) to evaluate the quality of forged signatures, we assess their impact on DASV systems built with Xception, ResNet152V2, and DenseNet201 architectures. Initial results showed False Accept Rates (FARs) ranging from 0% to 5.47% across all models and datasets. However, exposure to synthetic signatures significantly increased FARs, with rates ranging from 19.12% to 61.64%. The proposed countermeasure, i.e., retraining the models with real and synthetic datasets, was very effective, reducing FARs between 0% and 0.99%. These findings emphasize the necessity of investigating vulnerabilities in security systems like DASV and reinforce the role of generative methods in enhancing the security of data-driven systems.

Duc-Thanh Nguyen ’27

Faculty Mentor(s): Professor Yan Choi Lam, CHEMISTRY
Funding Source: Walthour Fellowship

Computational Investigation of the Catalytic Pathway for Dinitrogen Reduction to Ammonia by a (PNP)MoI Catalyst

The Haber-Bosch process, responsible for the industrial synthesis of ammonia, operates under extreme conditions and contributes significantly to global energy consumption and carbon emissions. Developing alternative catalytic pathways for nitrogen reduction under mild conditions is crucial for sustainable ammonia production. Recent studies have identified (PNP)MoI-based catalysts as highly active for nitrogen fixation, but their precise catalytic mechanism remains unclear. This study employs density functional theory (DFT) calculations to investigate the reaction mechanism of N_ reduction to NH_ at (PNP)MoI catalysts. We analyze key steps, including NĐN bond cleavage, proton-coupled electron transfer (PCET), and intermediate stabilization, to determine the thermodynamic and kinetic feasibility of proposed catalytic cycles. Computational models allow us to evaluate the role of bimetallic species and the influence of ligand environments on reaction efficiency. Preliminary results suggest that direct NĐN bond cleavage within a dinitrogen-bridged dimolybdenum core enables an energetically favorable pathway, reducing the number of required PCET steps compared to traditional Chatt-type mechanisms. These insights can inform the design of more energy-efficient catalysts by identifying conditions that balance catalytic activity with reduced overpotential requirements.

Shihab Nihan '25, Kathryn Wrynn '26; AJ Thompson '28; Brynn Withey '26; Meiers Dixon; Sarah Lower
Faculty Mentor(s): Professor Jordan Lingo, BIOLOGY
Funding Source: Department of Biology

In Silico Analysis of Firefly ORs

Many organisms use olfaction to communicate with one another through chemical signaling and one of those forms includes pheromones. When it comes to fireflies specifically, they are more commonly known to use light as their method of communication but they also use olfactory signaling too, especially the unlit species Photinus corruscus which is one of our focus species. The pheromones they emit are one of the ligands that are bound by Olfactory Receptors(ORs), which triggers downstream neuronal signaling cascades. A sex pheromone in Photinus corruscus was identified fairly recently, but the identity of the OR that binds to it remains unknown. Our research aims to identify the OR, or multiple ORs, in Photinus corruscus that binds the best to hydroxycamphor, the identified sex pheromone emitted by fireflies. In an attempt to answer this question, we used in silico approaches. This workflow includes predicting protein structures from sequences and simulating molecular docking between the ORs and pheromones. We then analyzed the data from a statistical perspective using Python and R and a structural perspective using PyMOL. Our results identify and characterize potential ORs that may be used to bind the sex pheromone. Going forward, we plan to validate our findings in vitro.

Antoni Nowacki '27; Iaroslava Polusmak '28
Faculty Mentor(s): Professor Paolo Morales, ART & ART HISTORY

oNo

"Ono" is the closest thing most slavic languages have to a gender neutral pronoun. Not as versatile as the English "they", it has a knack for describing things that lack autonomy – objects, plants, infants and animals – thus it feels rude, dehumanizing even, to let it accompany anyone above a few months old. And yet, it's the only one we have.A recent phenomenon among younger slavic people has been experimenting with incorporating this pronoun as our own version of "they", changing it into something that allows for ambiguity, yet remains dignified. It's a way of doing what we can, with what we have – and that approach is what inspired this project."oNo" seeks to show the many ways queer people in oppressive space can reach some form of self expression. Crossdressing, make-up, pondering the limitations of our bodies – all part of a drive to take what little you have and mold it into something that truly represents "You". Imbued with scattered elements of cultural wear, as well as pieces of "the body", this exhibition acts as an exploration of the not-so-black-and-white world of queerness, seen through the seasoned lens of an international. This photography project is a collaboration with my friend Iaroslava Polusmak. As a gay/lesbian duo, hailing from Poland and Russia respectively, we know first hand how limiting "back home" can be. The exhibition encompasses the many ways that we as queer people get to shift our lives, be it through language, dress or body.

Trevor Nugent '25; Dabrina Dutcher; Tim Raymond
Faculty Mentor(s): Professors Dabrina Dutcher & Tim Raymond, CHEMICAL ENGINEERING
Funding Source: Kalman Fund for Undergraduate Research in the Sciences

Hygroscopicity of Aerosol Mixtures: AS/2-MGA and AS/PEG-1000 with Addition of Surfactants

This research investigates the hygroscopic properties of two aerosol mixtures: one composed of ammonium sulfate (AS) and polyethylene glycol (PEG-1000), and the other composed of AS and 2-methylglutaric acid (2-MGA). These mixtures will both be separated and supersaturated with three surfactants with varying chemical properties: sodium dodecyl sulfate (SDS), cetyltrimethylammonium bromide (CTAB), and Triton X-100. The study focuses on measuring the kappa (_) values of these aerosol mixtures, which indicates the hygroscopic growth factor and the water uptake capacity of an aerosol particle as it is activated at a controlled relative humidity. This is done using a cloud condensation nuclei counter (CCNC) in series with a scanning mobility particle sizer (SMPS) system. The different properties of the surfactants and solvents used will be investigated and analyzed to discover how the chemical interactions impact the hygroscopic properties of the aerosol mixtures. Upon analysis, the sizes and charges of the surfactants, as well as the solvent itself had an impact on the aerosol particle activation size. Understanding these interactions is crucial for advancing knowledge in atmospheric chemistry, particularly regarding aerosol-cloud interactions and climate modeling.

Sean Oakey '26
Faculty Mentor(s): Professor Austin Wadle, CIVIL & ENVIRONMENTAL ENGINEERING
Funding Source: The Katherine Mabis McKenna Environmental Internship Program

Isolation and Characterization of Extracellular Vesicles from Manganese Oxidizing Filamentous Fungus Acremonium Strictum

Acid mine drainage (AMD) from abandoned coal mines introduces problematic loadings of acidity and metal pollutants, including manganese (Mn). Passive remediation systems rely on filamentous fungi like Acremonium strictum, among other fungi and bacteria, to oxidize soluble Mn (II) into insoluble Mn (III/IV). Although extracellular proteins are known to oxidize Mn, the role of extracellular vesicles (EVs) in this process remains unexplored. EVs, nanoparticle structures containing diverse biomolecules, are hypothesized to contribute to manganese cycling through extracellular electron transfer and mineral precipitation. Here we report the first successful isolation and characterization of EVs from A. strictum. Additionally, we show that A. strictum cultures exposed to Mn produce a greater quantity of EVs, which were smaller in size compared to cultures grown in control conditions. Particle concentrations and size distributions were quantified through nanoparticle tracking analysis (NTA). NTA revealed EV size distributions of 128.1 +/ – 5.7 nm for samples exposed to manganese and 158.9 +/ – 1.0 nm for samples free of metal exposure. Mn-exposed samples had a flux of 5.20 EV particles/cm2*sec and those grown in control conditions had a flux of 3.09 EV particles/cm2*sec. These results suggest that Mn exposure influences

the production and physical properties of the EVs produced by filamentous fungi. Specifically, cultures with metal pollutants had a higher flux of EVs, by a factor of 1.7, and a smaller average particle size, by 31 nm. These results suggest that EVs could play a functional role in Mn cycling and contribute to efficient passive remediation of AMD.

Oluwasefunmi Oluwafemi '25

Faculty Mentor(s): Professor Ken Field, CELL BIOLOGY/ BIOCHEMISTRY; Professor DeeAnn Reeder, BIOLOGY
Funding Source: Department of Biology; National Institutes of Health

Testosterone and Immunity in African Bats: Investigating Hormonal Influence on Immune Function

Testosterone is commonly associated with immunosuppressive effects in vertebrates, yet its role in bat immune function remains unclear. This study asks: Does increased testosterone correlate with suppressed immune function in Old World Fruit Bats? Understanding this relationship is essential, given bats' significant ecological roles and potential as reservoirs for zoonotic diseases.To address this question, enzyme-linked immunosorbent assays (ELISAs) are used to quantify testosterone levels in bat serum samples. By measuring testosterone concentrations with ELISA, the study aims to correlate testosterone levels and immune function using transcriptomic data. This approach will help determine whether bats with elevated testosterone levels exhibit signs of immunosuppression, as predicted by immunomodulatory theories.If a negative correlation is observed, it would support the hypothesis that testosterone modulates immune responses in these species. Alternatively, a lack of correlation or a more complex relationship may suggest species-specific adaptations. The relevance of this research lies in its potential to enhance our understanding of hormonal regulation of immunity in bats, offering insights into disease susceptibility and transmission dynamics. These findings could inform conservation strategies and public health policies, especially in regions where bats play a crucial ecological and epidemiological role.

Chimezie Frank Onwudinjo (Graduate Student); Noah Thorpe '27; Jude A. Okolie

Faculty Mentor(s): Professor Jude Okolie, CHEMICAL ENGINEERING
Funding Source: College of Engineering

Synthesis and Characterization of Lithium Orthosilicate

Lithium-ion batteries (LIB) have found their way in every aspect of our daily activities and operations due to their energy storage capacity and lower global warming potential. Despite the obvious advantage, the issue remains electronic waste management at end-of-life. Most of the spent LIBs are dumped in landfills constituting potential negative environmental impacts such as heavy metal contamination of groundwater table, soil contamination and damage to human organs arising from bioaccumulation. While efforts have been made towards waste management, the conversion of spent LIB to useful materials remains under-explored. The present study explores a novel way for the synthesis and characterization of lithium orthosilicate (Li4SiO4) using spent LIB as precursor. The study provides an opportunity to convert electronic wastes into a sorbent material for mitigating climate change. The produced Li4SiO4 samples were characterized by BET, XRD, ICP-MS, FTIR, SEM analyses to help understand the structure and composition. Furthermore, the material was treated for CO2 capture in a TGA. Our findings demonstrated that the prepare material is Li4SiO4 and an environmentally friendly and low-cost preparation method. Furthermore, the material showed promising results for CO2 capture while exciting a BET surface area ranging from 2.5 – 5 m2/g. These results are significantly important in furtherance of research on carbon capture, utilization and storage.

Christian Owens '26

Faculty Mentor(s): Professor Kenny Mineart, CHEMICAL ENGINEERING
Funding Source: Chemical Engineering Department – Undergraduate Research

Visualizing Polymer Concentration Gradient in Organogels Using Dye

The goal of this research is to develop polymeric gels with varying stiffness within a single sample, which could have practical applications in areas such as customized orthotics. To achieve this, a method was created to visually represent differences in gel stiffness by incorporating a dye that correlates with polymer concentration. Since these dye concentration variations are not visible to the naked eye, UV-Vis spectrophotometry was employed to quantify the dye levels. Using Blue 1 dye, a significant absorbance peak was observed at 634 nm in the UV-Vis spectrum. A calibration curve was established to relate absorbance to dye concentration, confirming adherence to Beer's Law up to a 1 wt% dye solution. This curve facilitated accurate measurement of unknown dye concentrations in gradient samples. The results demonstrated a strong correlation between the visual appearance of dye gradients and the UV-Vis spectrophotometry data, indicating that the gradient creation method is consistent and reproducible. Additionally, microindentation testing was conducted to measure the elastic modulus across the gel samples. The data showed consistent modulus values that corresponded with the dye concentration gradients, further validating the effectiveness of the preparation method. This work presents a straightforward and reliable technique for visualizing stiffness gradients in polymer gels, supporting future development of materials with tailored mechanical properties for diverse applications.

Laura Ozoria ’27

Faculty Mentor(s): Professor Paolo Morales, ART & ART HISTORY

Traces of Quisqueya

“Traces of Quisqueya” came out of my final project for ARTD 112 (Photography I), where we were tasked with creating a project of twenty photographs that reflected our growth as photographers throughout the semester. My project explores the representation of Dominican culture in the United States, focusing on the experience of cultural hybridity. Many people struggle to keep a connection to their culture when they live outside their home community, either due to immigration or because their predominant culture is not present in their daily surroundings. Through photography, I explore the feeling of living between two cultural spaces, and how identity is shaped by past and present experiences and adapting to new spaces.

The project is inspired by my own experience since moving to the United States. My goal was to document and share my perspective while drawing parallels between my life and the broader Dominican diaspora. These photographs include portraits of family, friends, and strangers, as well as images of spaces that hold cultural significance. Some themes that appear from the project are nostalgia, belonging, and identity, capturing moments of comfort, admiration, and change. This project is a combination of intimate portraits with urban and natural landscapes, highlighting the presence of Dominican culture in everyday spaces. Each photograph is carefully composed and edited to emphasize intricate details that contribute to the overall narrative. The positioning of the images is intentional, structuring the project into sections that reflect various aspects of cultural identity and transition.

Anushka Parab ’25; Bayasagalan Erdene-Ochir ’24; Lorelei Curtin

Faculty Mentor(s): Professor Lorelei Curtin, GEOLOGY & ENVIRONMENTAL GEOSCIENCES
Funding Source: The Katherine Mabis McKenna Environmental Internship Program

A Holocene Lake Sediment Record from Northwestern Pennsylvania

Earth’s climate system has experienced continuous change in the past, including slow changes over time, short-lived events, and abrupt transitions. Observations of climate system changes in the past allow us to better understand the current climate transition, including how climate changes may cause substantial ecological, hydrological, and resource impacts. Lake sediments from the Northeastern US offer continuous archives of climate change since the last deglaciation. Here, we present a Holocene paleoclimate record from Lake Pleasant (42¡00’15”N 79¡53’51”W), which is a kettle lake located at the southern margin of the former Laurentide Ice Sheet, 20 km southeast of Erie, PA. With this work, we aim to expand on these initial data through analyses of newly collected, longer cores that encompass the entire Holocene. Two sediment cores, 5.5 m and 5.0 m in length, were collected in June of 2024 at 9.5m and 4.0m water depth, respectively. Initial radiocarbon ages indicate that their basal ages are 7950 yr BP and 9730 yr BP. X-Ray fluorescence proxies were used to create graphical models of possible environmental changes throughout the Holocene. Loss on Ignition was measured for sediment samples throughout both cores to measure changes in organic matter concentrations. Ongoing work includes finishing writing a senior thesis analyzing and summarizing the findings of this project.

Amelia Peters ’27; Leandro Bonfim; Robyn Eversole

Faculty Mentor(s): Professors Leandro Bonfim & Robyn Eversole, MANAGEMENT & ORGANIZATIONS
Funding Source: Presidential Fellowship

Entrepreneurship in Vintage Malls

Our research is centered around how antique malls or vintage shops can work as places of encounter in which people can experiment with informal entrepreneurship in rural areas. We are studying these informal spaces to determine why people get into the temporary entrepreneurship field around vintage items. We aim to explore the paradox that these spaces provide the opportunity for experimentation and temporariness, even though they are sustained over time. Community, entrepreneurship, belonging, memory, culture, and identity can make these experiences meaningful to prospective temporary entrepreneurs and connect them through a common passion for antique items. We are interested in understanding how these forms of entrepreneurship differ from traditional entrepreneurs who are sharing the same space but use the antique trade as a form of subsistence.

Jean Picado ’25

Faculty Mentor(s): Professor Jasmine Mena, PSYCHOLOGY
Funding Source: Psychology Undergraduate Research

Literature Review of Psychosocial Factors Linked to Latinx Education and Occupational Development

This review examined prior literature in psychology to better understand the educational experiences of Latinxs. The aim was also to identify the contextual factors that influence educational and occupational outcomes among Latinxs. An examination of the eligible peer-reviewed articles (__ = 32) published between 2011 and 2024 was conducted with an emphasis on identifying recurring themes that play a significant role on U.S. Latinx student educational experiences. Articles were coded and the results across studies synthesized. The results were classified into three categories: individual, social, and environmental. Studies that examined individual factors emphasized the role of Latinx students’ increased likelihood of encountering barriers and the importance of developing self-efficacy compared to their non-Hispanic peers. Other studies that examined the social contexts surrounding Latinx education demonstrated that positive perceptions of school climate can promote academic success. With regard to environmental factors, prior research emphasized the importance of creating contextual settings for Latinx students that support autonomy, competence, and social connection to others in order to enhance academic and social integration. In addition, the current review identified recurring barriers and facilitators that promote or detract from Latinx educational achievement. Notably, many barriers and facilitators were related to structural factors, such as socioeconomic status of family members or access to social support. The review findings indicate interventions designed to increase self-efficacy, career outcome expectations, and resources to overcome barriers may ideally support the educational and occupational development of Latinx students.

Gwen Radecki '25

Faculty Mentor(s): Professors Aaron Mitchel & Haley Kragness, PSYCHOLOGY
Funding Source: Gary A. and Sandy K. Sojka Fund for Research, Teaching and Scholarship in Developmental Disabilities, Neuroscience & Human Health

The Alien Language Game: The Developmental Trajectory of Auditory and Visual Statistical Learning

Statistical learning (SL) extends across multiple stimulus domains and modalities, including vision, audition, and touch. However, it remains to be seen whether SL is supported by a modality-general or modality-specific mechanism(s). Prior work examined this by varying the rate of presentation across modalities, finding evidence of modality-specific constraints on learning (Emberson, Conway & Christiansen, 2011). In a prior experiment, I extended this work by testing the effect of presentation rate in standardized audio and visual SL tasks. The results of this project provided evidence against modality constraints to SL, suggesting instead that the mechanism is modality-general in nature. However, SL's developmental trajectories in school age children are highly debated and minimally researched, begging the question of whether modality constraints on statistical learning exist at any point during development. Utilizing a gamified version of the task used in my prior experiment, I was able to examine the mechanism's performance in the visual and auditory domains at two rates of presentation in children 7 – to 12 – years-old. Performance in the auditory domain was significantly better than that of the visual domain, with performance in visual task at both rates of presentation at or below chance, suggesting the SL mechanism is better equipped to track temporal dependencies of auditory stimuli. However, performance at the slower rate of presentation in both the auditory and visual domaines improved with age. Thus, my results may provide evidence suggesting that modality constraints to statistical learning do not exist in school age children.

Yuthikaa Raj (Graduate Student); Jennie Stevenson; Allie Lopez; Loren Roth; Lexi Handy; Zoe Walsh

Faculty Mentor(s): Professors Jennie Stevenson, Jasmine Mena & John Ptacek, PSYCHOLOGY
Funding Source: Graduate Summer Research Fellowship; Department of Psychology

Moderation of the Effects of Social Connectedness on Well-being by the Big 5 Personality Dimensions

Objective: A robust body of literature suggests that social connectedness (SC) enhances subjective well-being (SWB) while a lack of SC significantly impairs SWB (i.e., lower SC is linked to depression, maladaptive coping, risk of early mortality). The specific variables that impact the positive relationship between SC and SWB remain unclear. We sought to address this gap by assessing personality traits using the 5-factor personality model (Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism – OCEAN) to understand if personality moderates the relationship between SC and SWB. These five traits are well established dimensions of personality and, individually, have demonstrated relationships with SWB. We hypothesize that each dimension will strengthen/ weaken the correlation between SC and SWB to differing degrees. Method: N=218 participants completed demographic information and two surveys measuring SWB via the Life Engagement Test (LET), Satisfaction w/ Life scale (SWL) and Flourishing measure, recent affect via the Positive and Negative Affect Schedule (PANAS-negative & PANAS-positive) and were scored on OCEAN via the Big 5 Inventory. SC was measured via the General Belongingness scale (GBS). Data were scored, and analyzed with SPSS. Results: As predicted, GBS scores were strongly positively correlated with each SWB measure (GBS & LET $r(216)= 0.653$, $p< 0.001$; GBS & SWL $r(216)= 0.670$, $p< 0.001$; GBS & Flourishing $r(216)= 0.750$, $p< 0.001$). Moderation of these relationships by specific personality dimension will be discussed.

Isabel Ramos '26

Faculty Mentor(s): Professors Carley Gwin & Deborah Sills, CIVIL & ENVIRONMENTAL ENGINEERING
Funding Source: The Katherine Mabis McKenna Environmental Internship Program

Identifying Fecal Sources Contaminating Buffalo Creek

Approximately 45% of streams in Union County are impaired for recreation due to bacterial pollution. The main goal of this project is to identify the source(s) of fecal pollution within the Buffalo Creek Watershed utilizing microbial source tracking (MST). During the summer of 2024, we monitored 15 sites along Buffalo Creek and conducted field and lab testing in collaboration with the Buffalo Creek Watershed Alliance (BCWA). Our lab testing included bacterial enumeration that revealed that all 15 sites are still impaired, based on concentrations of E. coli. MST is used to detect specific microbes found in the feces of various organisms through quantitative chain polymerase reaction (qPCR). We also compared PCR to qPCR by adding probes to bovine, human, and swine primers that were previously tested, but lacked specificity and sensitivity. The addition of the probes to our primers caused the three primer sets to be sensitive and specific when tested with DNA extracted from animal manure. We also created standard curves for primer-probe assays. With standard curves, we demonstrated that all our standards fall within the acceptable efficiency range of 90% to 110%. We will continue to run qPCR on water samples to reveal the source(s) of fecal contamination in the watershed and assist the BCWA in preventing and limiting bacterial pollution from entering Buffalo Creek.

Bryce Reimer (Graduate Student); Chiara Vessicchio '26; Ben Wheatley

Faculty Mentor(s): Professor Benjamin Wheatley, MECHANICAL ENGINEERING
Funding Source: Graduate Summer Research Fellowship; Joseph A. Ciffolillo '61 Healthcare Technology Inventors Program

The Design of a Bioinspired Impact Mitigation System Towards the Prevention of Brain Injuries

Traumatic injuries from automotive crashes, sports impacts, and falls contribute to conditions such as chronic traumatic encephalopathy (CTE), which can lead to memory loss, depression, and neurodegeneration. With CTE prevalence reaching nearly 90% in players with a history of brain trauma, there is an urgent need for improved impact mitigation

technologies. Bighorn sheep, despite experiencing frequent high-energy head impacts, show little evidence of CTE, suggesting their horn structures serve as effective energy dissipators. Inspired by this, we aim to develop a bioinspired impact mitigation system modeled after bighorn sheep horns, leveraging their tapered spiral geometry to reduce head injury criteria (HIC) by over 50% in simulations. Using SolidWorks, horn-like geometries were designed with customizable splines for varied curl and excursion. These models were analyzed in Abaqus, incorporating a spring-damper system based on experimental data. A custom MATLAB pipeline facilitated comparison between simulated and experimental results. A parametric analysis varying five key factorsÑhorn excursion, curl, impact velocity, core inclusion, and material propertiesÑwill further refine impact performance. It is anticipated that the tapered spiral design will outperform the half-sphere in energy dissipation and impact force reduction. Model validation will ensure computational accuracy, guiding systematic optimization of geometry and material properties. This technology has broad applications in sports safety, military protection, automotive crash mitigation, and shipping logistics. By optimizing its design, we aim to develop a scalable, high-performance impact mitigation system for diverse real-world scenarios.

Amina Reyes ’25

Faculty Mentor(s): Professor David Rojas, LATIN AMERICAN STUDIES
Funding Source: Bucknell Program for Undergraduate Research

Intersection of Race and Athletics: The Experiences of Black Athletes at Bucknell University

This research investigates the unique challenges that black student athletes face at Bucknell University. It specifically focuses on how Race and sports intersect in a predominantly white institution. During the duration of the research this summer, my goal was to uncover the structural and social issues these athletes encounter. For example, mental health, racial, discrimination, and social exclusion within their teams and the broader campus community. Using qualitative methods, including detailed analysis of interviews conducted with black student athletes, the research identified several key themes that characterize their experiences. The analysis was carried out using Dedoose, a web-based platform which helped me with the coding and organization of data.

Since I was able to effectively code interview data, I came across key themes that were repeated in most of my interviews. Some key findings included social exclusion, and isolation. Despite being part of a team, many black athletes experienced social exclusion, both within their teams, and in the broader campus life. This exclusion often came from the formation of clicks and a lack of inclusivity, which negatively impacted team bonding and individual well-being. Another key finding that I came across was the impact on academic and athletic performance. The pressures of balancing academic and athletic commitments combined with the additional stress of racial discrimination, affected both academic performance and athletic motivation. Some athletes reported changing their career paths due to the perceived incompatibility of their academic and athletic goals.

Caryn Rippey ’26

Faculty Mentor(s): Professors Carley Gwin, Jessica Newlin, & Deborah Sills, CIVIL & ENVIRONMENTAL ENGINEERING
Funding Source: The Katherine Mabis McKenna Environmental Internship Program

Nutrient Mapping in the Buffalo Creek Watershed

The goal of the study was to determine the amount and potential sources of fecal pollution in Union County waterways, as well as to determine a potential correlation between manure spreading and concentration of fecal indicators. The study involved sampling 15 sites on Buffalo Creek and Limestone Run for fecal indicators such as colonies of E. coli, colonies of total coliform, and nitrate. Concentrations of these indicators for each site for each of the five sampling dates were then recorded and uploaded into ArcGIS Pro. Each site was indicated on the interactive map, and sites were surrounded by Union County tax parcels. Parcels that were determined to spread manure as fertilizer based on previous work with Union County Nutrient Management Plans were color coded by the amount of manure added per year, and each site was color coded by the concentration of E. coli and nitrate. Sampling determined that all sites were above the PADEP standards for fecal coliforms, including streams that are frequently used for recreation. Sampling results and maps generated in ArcGIS Pro were shared with representatives from the Buffalo Creek Watershed Alliance. Sharing these results with the public would be valuable as to improve public health and spread awareness about types of contaminants in local waterways and potential sources of these contaminants.

Emily Rivera ’25

Faculty Mentor(s): Professor Gulay Guzel, MARKETS, INNOVATION & DESIGN
Funding Source: Bucknell Program for Undergraduate Research

Belonging Through Bourdieu: Belonging as a Community College Transfer Student

The study aims to understand the feeling of belonging as a community college transfer student that has transitioned to a four year university. Utilizing Bourdieu’s (1997) capital theory as a framework, this qualitative study seeks to answer what capitals students need to feel belonging, how to provide different types of capital to transfer students and fill the gaps students are experiencing. We find that the three capitals posed by Bourdieu (1997) (social, economic, and cultural) influence a student’s sense of belonging and that by providing different types of capital to transfer students and fill the gaps students are experiencing does successfully influence the feeling of belonging. Through articles, literature, and interviews we identify that capital, economic, and social capital all pose important roles in a transfer student’s experience and the presence of these capitals can improve the overall experience of a student’s transfer process. Students tend to come in with a variety of skill sets related to each of these capitals including self efficacy, resilience, and perseverance. However, these students also need help in obtaining the capitals that they are lacking. There are many actions that can be taken to help in improving each of these capitals including advising and

mentorship programs, increasing opportunities for involvement in campus activities, expansion of scholarship programs, and the development of networks of support. In increasing the necessary capitals that enable transfer students to thrive we see that the sense of belonging in academic and social environments increase.

JaSayle Rivera '25

Faculty Mentor(s): Professor Rebecca Switzer, BIOCHEMISTRY/CELL BIOLOGY, CHEMISTRY
Funding Source: Walthour Fellowship

Analyzing the Binding Affinity of Class 1A-Specific Dihydroorotate Dehydrogenase Inhibitors

Dihydroorotate dehydrogenase (DHOD) is a crucial enzyme that catalyzes the only redox step in de novo pyrimidine biosynthesis. Without pyrimidine nucleotides, organisms would be unable to carry out cellular functions such as DNA replication, transcription, and synthesis of complex lipids and sugars, so DHOD could be a promising drug target. DHODs have been divided into two classes. Many pathogenic species, including E. faecalis and T. cruzi, contain Class 1A DHODs while humans contain Class 2 DHODs. Therefore, small molecules targeted at Class 1A DHODs could be useful therapeutics against infections. Previous work has shown that dihydroxybenzoates can bind and inhibit the Class 1A DHOD from L. lactis without inhibiting Class 2 DHODs. My project is focused on analyzing the binding affinity of dihydroxybenzoate inhibitors to Class 1A DHODs from pathogenic species. I have recombinantly expressed and purified DHODs from T. cruzi and E. faecalis. I am determining the binding affinity of 3,4-dihydroxybenzoate and 3,5-dihydroxybenzoate, class specific inhibitors, in titration experiments and for comparison I am also analyzing the binding affinity of the product, orotate. I have been analyzing binding at pH 8 but will also examine binding at additional pH values to observe how pH impacts binding. Initial results indicate that the inhibitors do bind to Class 1A DHODs from pathogens, but the affinity for these molecules is weaker than what was originally observed in L. lactis DHOD. These findings call into question the usefulness of these molecules as leads for potential therapeutics.

Antoinne Robinson '26; Kenneth Mineart

Faculty Mentor(s): Professor Kenny Mineart, CHEMICAL ENGINEERING
Funding Source: Kalman Fund for Undergraduate Research in the Sciences

Gradient Gel Inserts: Innovative Solutions for Knee Pain Relief

The present research focuses on developing a novel shoe insert made of a gel material featuring a controllable stiffness gradient to improve biomechanical foot alignment, reduce knee joint loading, and alleviate knee pain. The material's stiffness was adjusted by varying polymer concentration, and compression and indentation testing provided insights into the optimal range of these concentrations. A specialized template was designed to ensure consistent gradient sample production, facilitating repeatable results. Fatigue tests simulated real-life conditions, demonstrating the material's durability under repeated stress. The findings evidence the feasibility of creating a customizable gel material for shoe inserts, offering a promising solution for managing knee pain.

Dong Hyun Roh '26; Rajesh Kumar

Faculty Mentor(s): Professor Rajesh Kumar, COMPUTER SCIENCE
Funding Source: Kalman Fund for Undergraduate Research in the Sciences

Utilizing Keystroke Dynamics to Address Academic Dishonesty

This research addresses academic dishonesty by leveraging keystroke dynamics in the Korean language. We developed a dedicated website to capture Korean keystroke data to facilitate systematic data collection. A total of 69 participants completed three phases of typing tasks: bona fide (original) writing, ChatGPT-4-assisted (paraphrasing, and copy-typing). Each phase consisted of six questions designed to vary in cognitive load according to Bloom's taxonomy, resulting in a rich dataset. This dataset enables the exploration of typing patterns captured through keystrokes for plagiarism detection across different cognitive levels. We conducted exploratory data analysis and trained plagiarism detection models using classical machine learning classifiers, achieving encouraging results with an 87% or higher accuracy. These findings highlight the potential of keystroke dynamics in enhancing academic integrity through advanced authentication and detection methods.

Jackson Rubiano '27; Laura Ozoria '27; Yida Chen

Faculty Mentor(s): Professor Eric Faden, FILM & MEDIA STUDIES; Professor Nathan Ryan, MATHEMATICS & STATISTICS
Funding Source: Bucknell Program for Undergraduate Research

KALMUS: Film Color Analysis

Analyzing color across entire films proves challenging; single frames cannot capture the full spectrum of color present in the films and videos. The original KALMUS program, developed by Yida Chen et al. (2021), generates "film barcodes" that create a mosaic of a film's overall color profile. This tool allows the analysis of color in films and videos using various statistical methods.

However, we have found a discrepancy between the barcodes generated and what colors are perceived and remembered in films. Our project aims to enhance KALMUS by outputting barcodes that better align with human perception. To achieve this, we have conducted surveys examining the dominant colors recognized in single frames and tracked eye movements while watching a selection of films to compare against the current mathematical averages. Further, we have adjusted KALMUS to target dominant colors, focusing on the hue, luminosity, and saturation of colors in a given frame.

In the future, we look to increase accessibility and ease of use for the program by (1) Creating a web version of the program, (2) Improving existing data visualization methods for clearer and simpler analysis, and (3) Better aligning the program's output with that of human color perception rather than statistical methods. These improvements will make KALMUS a more accessible and effective tool for film color analysis.

Amelia Ruck ’25; Maria Pisciotta ’25; Alexander S. Kitaysky; Morgan Benowitz-Fredericks

Faculty Mentor(s): Professor Morgan Benowitz-Fredericks, ANIMAL BEHAVIOR

Funding Source: Douglas K. Candland Fund

Influences of Prenatal and Developmental Conditions on Telomere Dynamics in Seabird Chicks (Rissa tridactyla)

This study investigates the effects of prenatal and postnatal environmental conditions on telomere dynamics in Black-legged Kittiwake chicks (Rissa tridactyla). Telomeres are considered molecular markers for biological aging. They are highly conserved, noncoding, repetitive DNA sequences that form the “caps” at the end of chromosomes, protecting the coding sequences. In some species, variation in telomere length among same-age individuals is associated with individual “quality” and variations in life expectancy. Although higher telomere attrition rates can occur in early development, the inherited and environmental factors driving this physiological process vary by species. In kittiwakes, chicks develop in the nest for over forty days. During this time, chicks are subjected to environmental conditions that affect their growth and longevity. The ensuing study will test the hypothesis that favorable conditions are associated with longer telomeres. We will use blood samples from known-age kittiwake chicks to assess the potential impacts of food availability, sex, hatching order, and sibling competition on chick telomere dynamics. From our hypothesis, we predict that high food availability, status as a first-hatched chick (A chick), and lower sibling competition contribute to maintaining inherited telomere length. Additionally, we will test the hypothesis that rapid growth is associated with longer telomeres at hatching but more rapid telomere loss during development. If this is true, male chicks who grow faster and may have higher metabolic rates will hatch with longer telomeres but show more telomere loss than female chicks.

Cory Sanderson ’25; Rebecca Bonomo (Graduate Student); Ailsa Boger ’25; Karyna Fowler ’26

Faculty Mentor(s): Professor Erica Delsandro, WOMEN’S & GENDER STUDIES; Professor Bill Flack, PSYCHOLOGY

Funding Source: Bucknell Program for Undergraduate Research; Center for Social Science Research

A Broader Range of Sexual Misconduct and Associated Mental Health Outcomes

College women are at a high risk of experiencing sexual misconduct (SM) or assault (Graham et al., 2022). Research shows a connection between sexual victimization and psychological distress (Graham et al., 2022). The lack of research on a broader range of SM and associated mental health outcomes is a lacuna that must be addressed.

Angelina Santos ’27; Tobias Kim ’27; Min Sub Lee ’26; Maya Sak; Sophia Walker ’25; Dr. Olivia Boerman

Faculty Mentor(s): Professor Olivia Boerman, BIOMEDICAL ENGINEERING

Funding Source: Tague Family Fund for Undergraduate Research in Biomedical, Biological and Biochemical Sciences

Effects of Lead-Based vs. Lead-Free Low-Frequency, Low-Intensity Ultrasound Devices on VEGF Secretion from Endothelial Cells in a 3D Scaffold

The application of low-frequency, low-intensity ultrasound (LFLI US) accelerates healing in cell tissue, with studies showing diabetic ulcers healing approximately three times faster under ultrasound treatment. Beyond wound healing, LFLI US shows promise in pain management, nerve stimulation, and transdermal drug delivery.Traditional therapeutic ultrasound devices rely on lead-based piezoceramics like lead zirconate titanate (PZT), containing over 60% lead, but increasing health and environmental concerns have led to regulatory efforts to phase out lead-based materials. This study evaluated lead-free piezoceramics as alternatives by comparing their effects on vascular endothelial growth factor (VEGF) secretion in human umbilical vein endothelial cells (HUVECs).Two rounds of flexural cymbal transducers were manufactured, using lead-based (PZT Pz26) and lead-free (NBT Pz12) piezoceramic disks. HUVECs in a 3D collagen scaffold were exposed to ultrasound at 50, 100, and 150 mW/cm_ for 15 minutes, with a control group receiving no treatment. VEGF secretion was quantified via an enzyme linked immunosorbent assay (ELISA) after 48 hours, and results were analyzed using ANOVA and Tukey’s post hoc test.Lead-based devices significantly increased VEGF secretion, with 50 and 100 mW/cm_ intensities yielding higher levels than 150 mW/cm_. Lead-free devices produced similar VEGF levels at 100 mW/cm_, suggesting NBT could substitute PZT. Further ELISA testing is necessary for confirmation, but lead-free devices appear to replicate lead-based effects. These findings indicate that 50Ð100 mW/cm_ ultrasound application may enhance wound healing by promoting angiogenesis, supporting the feasibility of lead-free piezoceramics in therapeutic ultrasound.

Hannah Schaeffer ’26; Sofia Guerra-Torres ’26

Faculty Mentor(s): Professor Ryan Snyder, CHEMICAL ENGINEERING

Funding Source: ESA Summer Research Scholarship

Assessing Release Profile of Electrosprayed Polymeric Coatings

Electrospraying is an efficient technique for producing easily reproduced polymeric coatings with smooth surfaces. These polymeric coatings can be fabricated to incorporate a uniform concentration of drug molecules for delivery inside the body. The primary goal of this study is to develop model drug-loaded films that exhibit controlled release into a medium, specifically Rhodamin B (RhB) into Phosphate Buffered Saline (PBS). To simulate in vivo conditions, we employed a thermal shaker and replenished the PBS after each model drug concentration measurement. We determined the total cumulative percentage of drug release for the model drug RhB over time. The controlled release observed was a result of exploiting the change in the glass transition temperature (Tg) of the polymer, Polyvinyl Acetate (PVAc). Tailored drug release is highly sought

after in various medical treatments, including cancer therapy. Moving forward, we intend to investigate controlled released coatings to generate tunable and distinctive release curves.

Lauren Shaffer '26; Chris Feudale '25; Sarah Smith; Moria Chambers

Faculty Mentor(s): Professors Moria Chambers & Sarah Smith, BIOLOGY
Funding Source: Department of Biology

Accessing Growth Inhibition of Providencia Pathogens with Single Amino Acid Changes in Drosophila melanogaster Cecropins

The antibiotic resistance crisis is a worldwide issue that has rising death and infection rates each year. One potential antimicrobial agent to combat this crisis would be the use of antimicrobial peptides (AMPs), and the focus of our work is on Cecropins, a type of AMPs that are produced by insects. Cecropins are _-helical proteins that are approximately 40 amino acids long and lack cysteine bonds. We chose to assess the activity of the naturally secreted cecropins, CecA, CecB, and CecC, from the Drosophila melanogaster and their ability to inhibit growth of the Providencia species, a natural pathogen found in the gut microbiota of Drosophila melanogaster. We found that CecB exhibited the highest antimicrobial activity against the Providencia pathogens and hypothesized that this was due to amino acid changes in the hinge region of the peptide. We demonstrated the importance of amino acid changes in this region by generating single amino acid mutations in the hinge region of the cecropins and measured the impact on growth inhibition by determining the minimum concentration of peptide needed to inhibit bacterial growth in liquid culture. We looked at the kinetics of permeabilization and killing using flow cytometry and CFU assays. Overall, we found that small changes in the amino acid sequence impact the antibacterial activity of the cecropins without having a major impact on the structure of the peptide. Ongoing experiments are focused on mutating other regions of the peptide to better understand peptide flexibility and how it can develop AMP inspired pharmaceuticals.

Alexander (Sander) Smith '27; Jeffery Trop

Faculty Mentor(s): Professor Jeffrey Trop, GEOLOGY & ENVIRONMENTAL GEOSCIENCES
Funding Source: Department of Geology & Environmental Geosciences

Paleogene Forearc Basin Evolution in the Eastern Talkeetna Mountains, South-Central Alaska: Provenance and Depositional Ages Constrained by Detrital Geochronology

Paleogene sedimentary strata in the Matanuska Valley, Talkeetna Mountains, and northern Chugach Mountains of south-central Alaska document evolution of a continental forearc basin. New field and analytical data were collected from previously unstudied outcrops of Chickaloon and Wishbone Formations near Billy Mountain. Field mapping records an angular unconformity, showing tilting and erosion between the deposition of the Chickaloon and Wishbone Formations. Youngest U-Pb detrital zircon age populations (~55.7-53.7 Ma) from one Chickaloon Formation sandstone and one Wishbone Formation sandstone together with previously published ~49.4-35.6 Ma ages reported from overlying lavas constrains deposition between ~53.7 and 49.5 Ma. Conglomerate clast counts from the Chickaloon Formation (N=3, n=305) display dominantly sedimentary clasts (54%) and subordinate 18% volcanic, 16% altered volcanic, and 12% plutonic. Conglomerate clast counts overlying Wishbone Formation (N=2, n=211) demonstrate 36% altered volcanic, 34% volcanic, 7% sedimentary, 13% plutonic, and 1% metamorphic. U-Pb detrital zircon geochronology analysis shows Chickaloon sample (n=110) yields 21% Early Paleogene ages, 47% Late Cretaceous ages, and 15% Late Jurassic-Early Cretaceous ages. Wishbone sample (n=110) yields 18% Early Paleogene ages, 50% Late Cretaceous ages, and 11% Late Jurassic-Early Cretaceous ages. Abundant sedimentary/metasedimentary and volcanic-plutonic clasts within the Chickaloon indicate sediment mixing from Jurassic-Cretaceous accretionary prism sources to the south and Jurassic-Paleogene igneous dissected arc sources to the northwest. Conversely, the younger Wishbone Formation lacks the degree of sedimentary clasts suggesting a change in sourcing during deformation during the development of the angular unconformity.

Bethany Sromoski '26

Faculty Mentor(s): Professor Zukhra Kasimova, HISTORY
Funding Source: Bobko-Dennis Fund for Undergraduate Student Research

Friends From Afar: Ukrainian-American Fellowship in Rural Pennsylvania

"Friends From Afar: Ukrainian-American Fellowship in Rural Pennsylvania" is a research project conducted as part of the Bucknell University Program for Undergraduate Research in conjunction with the Department of History. The project focuses on documenting the sister city relationship between the towns of Boyertown, Pennsylvania, and Bohodukhiv, Ukraine, from the years 1983 through to the early 2000s. The Boyertown-Bohodukhiv pairing was a product of Professor Earl Molander's Ground Zero Pairing Project (GZPP) to facilitate fellowship and understanding between the people of the United States and the Soviet Union. Of the over one thousand American towns and cities involved, few were successful in establishing a connection. The Boyertown-Bohodukhiv pairing, however, emerged as one of the handful of GZPP success stories. Despite its notable beginnings, this sister city relationship, especially its early years, has gone largely unrecorded. Only vague, and oftentimes conflicting, information is readily available via local news outlets about the relationship's origins. Two years into the Russian invasion of Ukraine with seemingly no end in sight, accurately recording and documenting local histories such as these is important now more than ever. Original letters, meeting notes, financial reports, and other related primary sources from the now-defunct Boyertown Bogodukhov Friendship Committee (stored in the archives of the Boyertown Area Historical Society) were utilized in the effort to paint a clearer and more accurate picture of the beginnings of this Ukrainian-American pairing.

Travis Stanitis ’26; Reggie Gazes; Morgan Benowitz-Fredericks; Douglas Collins

Faculty Mentor(s): Professor Morgan Benowitz-Fredericks, BIOLOGY
Funding Source: Department of Biology

Analyzing Cortisol Levels Using Liquid Chromatography-Tandem Mass Spectrometry in Primate Hair and the Relationship with Salivary Cortisol

Cortisol, a steroid hormone released in response to stress, can be measured in various biological matrices, including blood, saliva, and hair. Cortisol levels directly influence behavior, the most common being stress-associated behaviors in a variety of different animals, including primates. Blood and saliva samples can be used to measure primates’ cortisol levels. However, these samples are only effective for measuring short-term responses to stressors, reflecting stressful experiences within the last few minutes or hours. In contrast, hair cortisol captures long-term stress exposure (up to six months). By comparing cortisol in hair and saliva samples, we can determine an individual’s exposure to both short and long-term stressors. The difference between the cortisol levels in the different sample types would determine which time scale better matches the cognitive function and social behavior of animals. This study seeks to validate the use of liquid chromatography-tandem mass spectrometry (LC-MS/MS) to quantify cortisol levels in primate saliva and hair. LC-MS has been used to determine the amount of cortisol in saliva and hair samples in humans, nonhuman primates, and other mammals in previous studies. At Bucknell University, ELISA kits are currently used to measure salivary cortisol, while hair samples have been sent out to other laboratories. This study investigates the potential advantages of using LC-MS to quantify cortisol in saliva and hair as non-invasive and long-term biomarkers for stress in our campus primates.

Lauren Stettler (Graduate Student); Ryan Ziskin ’26; Douglas B. Collins

Faculty Mentor(s): Professor Douglas Collins, CHEMISTRY
Funding Source: Department of Chemistry; Chemistry Graduate Research Fund; Graduate Summer Research Fellowship

The Influence of Mixtures on the Reactivity of Fatty Acids when Exposed to Chlorine Bleach Vapor

The COVID-19 pandemic led to the increased use of disinfectants like chlorine bleach in indoor environments, which releases hypochlorous acid (HOCl) and chlorine (Cl_2) gases when applied to a surface. HOCl and Cl_2 can undergo multiphase oxidation and chlorination reactions with olefinic compounds like fatty acids (FAs) that are found on indoor surfaces and human skin. With the recent increase in wildfires, many people are exposed to combustion-sourced compounds, like polyaromatic hydrocarbons, which may influence how FAs react with cleaning vapors. To investigate multicomponent reactions between HOCl/Cl_2 and FAs, films of oleic acid (OA) with and without aromatic compounds (eg. benzo[a] pyrene, pre-ozonated benzo[a]pyrene) were prepared on glass circles and exposed to gaseous HOCl/Cl_2. Oxidation and chlorination products were characterized/quantified using mass spectrometry. Chlorohydrins, epoxides, and OA dimers were identified in the product distribution. At low levels of HOCl/Cl_2 exposure, the addition of B[a]P and pre-ozonated B[a]P to OA films enhanced the formation of OA dimers compared to pure OA films. Notably, film composition for all three mixed films converge for large HOCl/Cl_2 exposures. OA decay and primary product formation rates were slightly increased with the addition of polyaromatic hydrocarbons, promoting the OA secondary reactions. Literature indicates that the oxidation of polycyclic aromatics tends to increase inherent oxidative potential via quinone formation, which we hypothesized would influence OA oxidation. However, DTT assays suggest little formation of expected B[a]P-derived reactive oxygen species in any of the films.

Jason Ussery ’28

Faculty Mentor(s): Professor Joe Wilck, ANALYTICS & OPERATIONS MANAGEMENT
Funding Source: Presidential Fellowship

Evolution of College Football Offensive Strategies Since 2000

The offensive strategy of college football has changed from a rushing focused play-calling strategy to a more passing focused play-calling strategy. Data from multiple levels (e.g., FBS, FCS) were analyzed to assess this evolution for college football. The evolution is further analyzed against the National Football League during the same time period. The data were collected from public websites for the various teams, conferences, and leagues. The data were analyzed using Microsoft Excel and various statistical analysis techniques.

Gianni Valentine ’27

Faculty Mentor(s): Professor Benjamin Wheatley, MECHANICAL ENGINEERING
Funding Source: National Science Foundation Grant (NSF)

Micro-indentation of Gasrocnemius and Vastus Intermedius

Introduction: Musculoskeletal tissue is composed of multiple subunit layers with a protective connective tissue sheath known as the epimysium. Consistent compressive force applied to muscular tissue can lead to muscular disease and deep tissue injury or pressure ulcers. A better understanding of the mechanical properties of muscle tissue can allow for further computational modeling and decreased risk factors. Microindentaion is a technique used to measure material properties in a non-destructive manner resulting in force-displacement data. The onset of musculoskeletal disease largely impacts passive tissue tensile strength and force transmission. We seek to measure force-displacement and relaxation rates between sectioned and unsectioned passive and healthy muscle tissue with the use of micro-indentation. Methods: Rabbit tissue was harvested, dissected, and tested within eight hours of euthanization. 40 gastrocnemius lateral heads, 40 gastrocnemius medial heads, and 40 vastus interemedius muscle samples were used. Three to five indents were performed on each muscle sample.Results: The mean max force-displacement between cut and uncut gastrocnemius lateralis is 0.5252N and 0.5335N respectively. For the gastrocnemius medialis the mean max force displacement was 0.5247N and 0.5373N. The vastus intermedius mean max force displacements were 0.5282N and 0.5363N. For

each muscle tested the counterpart without the epimysium proved to have a lower mean max force-displacement than the whole muscle sample, but statistical tests are yet to be appliedAcknowledgments: This material is based upon work supported by the National Science Foundation under Grant No. 2301653

Juliette VanLuven '26

Faculty Mentor(s): Professor Ellen Herman, GEOLOGY & ENVIRONMENTAL GEOSCIENCES
Funding Source: The Katherine Mabis McKenna Environmental Internship Program

Rare Earth Elements as Tracers in Arch Spring, Blair County, PA

The goal of this research project was to study rare earth elements (REEs) in a karst environment and their relationship with storms to understand them better as tracers. A karst environment is a landscape with many defining features created by the dissolution of bedrock. Commonly, this bedrock is limestone which is sensitive to carbonic acid found in rain. When there is an increase in discharge in karsts springs, the REEs can increase in concentration from less than 0.15 ppb to greater than 1.0 ppb while other tracers such as conductivity and calcium ions decrease in concentration. An ISCO automatic 6172 Portable Sampler installed at Arch Spring, Blair County, PA, was used to collect multiple samples of spring water over three days. The samples were then filtered with a syringe filter at .45um and put through a centrifuge to achieve ultra-filtered samples for the inductively coupled plasma mass spectrometer (ICPMS). The ICPMS measures elements in concentrations expected for REEs in the parts per billion range. Samples were also analyzed with an ion chromatograph to measure major cations and anions. Though the method shows promise, no storm during the summer of 2025 sufficiently impacted the waters of the spring during our sampling window to enable us to assess the method at Arch Spring. Further study of this area is needed as karst environments are particularly vulnerable in terms of water supply and contamination issues as the water flows quickly into some of these systems with little filtration.

Eleni Vasiliades '25

Faculty Mentor(s): Professor Stephanie Larson, CLASSICS & ANCIENT MEDITERRANEAN STUDIES

From Antiquity to Exile: The Perseverance of Pontic Greeks

Pontus, a region along the southern coast of the Black Sea, has long been a cultural and geopolitical crossroads, shaped by Greek, Anatolian, Persian, Roman, Byzantine, and Ottoman influences. As a Pontic Greek whose ancestors were refugees from Anatolia, I have sought to bring attention to the deep and enduring history of this region, which is often overlooked in both classical and modern studies. The Pontic Greeks played a significant role in the latter half of the Byzantine Empire, maintaining cultural and economic influence until its fall in 1453. My research integrates the study of ancient artifacts, literature, and oral traditions to trace the evolution of Pontic identity from early settlements in the Neolithic period to the present day.

Despite centuries of foreign rule, the Pontic Greeks adapted to shifting political landscapes while preserving their language, customs, and traditions. Pontic dance, an expression of both resilience and defiance, and the Pontic Greek dialect, which retains archaic Greek elements alongside regional influences, reflect this enduring cultural continuity. Just over a century ago, the Pontic Genocide led to the forced displacement of hundreds of thousands, scattering Pontic communities to Greece, Russia, and Georgia. Yet the music, stories, and traditions of Pontus persist. By uncovering this region's long and complex history, my research challenges its erasure and highlights the resilience of the Pontic people, reaffirming Pontus' significance in both classical antiquity and the modern world.

Chiara Vessicchio '26; Bryce Reimer (Graduate Student); Benjamin Wheatley

Faculty Mentor(s): Professor Benjamin Wheatley, MECHANICAL ENGINEERING
Funding Source: Joseph A. Ciffolillo '61 Healthcare Technology Inventors Program

The Development and Implementation of a Mini Drop Tower for Energy Dissipating Tapered Spirals

During mating season, male bighorn sheep establish dominance by forcefully ramming their horns into one another. Due to the unique material properties and geometry of their horns, they can do so while experiencing minimal head trauma. This study investigates the impact properties of a horn-like tapered spiral in comparison to a half-sphere geometry using an experimental drop test system. By analyzing how these biomimetic structures dissipate energy, this research aims to enhance the understanding of their impact mitigation. To maximize recorded oscillations of the tapered spiral model, SolidWorks was used to design 3D printed molds, which were cast in Smooth-On Silicone Mold Star 30 to create silicone models of the horn and half-sphere geometries. A drop test system equipped with a load cell, accelerometer, and two Sony RXO high-speed cameras captured the oscillations and maximum displacements of the silicone models following impact from a weighted drop at three heights. Results indicated increasing displacement values along the X, Y, and Z axes with higher drop heights. These findings highlight the need for further refinement of the drop tower to improve test repeatability and reduced standard deviations. Additionally, the data can be used to validate computational models for the development of energy dissipating spirals for safety applications such as car bumpers and helmets.

Macy Volp '26; Jonathan Torres

Faculty Mentor(s): Professor Jonathan Torres, MECHANICAL ENGINEERING
Funding Source: James L.D. and Rebecca Roser Research Fund

The Integration of Hot Lithography Processes on Vat Photopolymerization Additive Manufacturing

Vat photopolymerization, specifically stereolithography, is a type of additive manufacturing that creates objects by selectively curing ultraviolet-activated resin. The process involves printing three-dimensional objects in a layer-by-layer process by sequentially raising and lowering the print platform into the resin tank and selectively curing the areas of resin that form the object. In order to improve the mechanical properties of the prints produced, the method of implementing hot lithography processes into the vat polymerization stereolithography process has grown in popularity. The addition of heat to the ultraviolet-activated resin printing process potentially minimizes the

time printing takes and increases the tensile strength of the printed part. The integration of hot lithography processes on stereolithography vat photopolymerization, while experimental, shows the greatest improvement to the tensile strength without sacrificing integral aspects of the process such as increasing print time and aesthetics. Implementing a process that raises the tensile strength of the process and material without requiring an extension of the production time is ideal. Hot lithography offers the chance to maintain rapid production orientations, steps, and processes with benefits that are proven quantitatively improved from the traditional results.

Tiduo Weng '26

Faculty Mentor(s): Professor SingChun Lee, COMPUTER SCIENCE
Funding Source: Gary A. and Sandy K. Sojka Fund for Research, Teaching and Scholarship in Developmental Disabilities, Neuroscience & Human Health

Sign2Sign – A first Attempt

At the core of human engagement is communication. While technological advances enable convenient translation for different language speakers to communicate, millions of Deaf, Mute, and Hard-of-Hearing people still face immense hurdles due to the lack of accessible tools to facilitate direct sign language translation. Our project aims to build a Sign2Sign direct immersive translation tool using WebXR that takes input from any accessible camera and produces output in WebXR-supported platforms. This presentation presents the preliminary results of direct translation between ten gestures of American and Chinese Sign Languages for sign language translations in an immersive environment.

Charles White '25

Faculty Mentor(s): Professor Kenny Mineart, CHEMICAL ENGINEERING
Funding Source: College of Engineering

Exploring Liposome-Chitosan and Liposome-Xanthan Gum Interactions

My work investigates the interactions between liposomes and two polyelectrolytes with opposing charges: chitosan, a polycation, and xanthan gum, a polyanion. The primary objective is to assess liposome stability upon interaction with these polyelectrolytes. To evaluate stability, I utilize dynamic light scattering (DLS), zeta-potential measurements, and a calcein leakage assay via fluorescence spectroscopy. When combining chitosan with a 0.25 mg/mL solution of liposomes, a substantial increase in measured effective diameter was observed from 1 ppm to 10 ppm chitosan. In contrast, xanthan gum does not induce a significant change in effective diameter within the same concentration range. The calcein leakage assay provided additional confirmation for the interaction of liposomes and chitosan and lack thereof for liposomes and xanthan gum. This difference is attributed to the negative zeta-potential surrounding bare liposomes, which facilitates stronger electrostatic interactions with the positively charged chitosan compared to the negatively charged xanthan gum. Additionally, calculation of the number of charged groups per mass of each polyelectrolyte shows that xanthan gum has 2.5 times more charge density than chitosan, further amplifying its charge repulsion with liposomes.

Madeleine Whitsitt '25

Faculty Mentor(s): Professor Brian Smith, CHEMISTRY
Funding Source: Walthour Fellowship

The Impact of Drying Additives on Selective Polymorph Crystallization of Acetaminophen

Pharmaceutical drug delivery strongly depends on the solid-state packing of that drug within the pill or tablet. However, many drugs can form multiple different packing crystal structures, called polymorphs, that are difficult to predict and control. Moreover, the polymorph can determine key properties like solubility that control bioavailability. Thus, polymorph selectivity is a vital part of the pharmaceutical development and formulation process. Several factors impact selective polymorph crystallization, including environmental conditions and the use of additives in the formulation mixture. Acetaminophen, the active ingredient in Tylenol, is an example of a polymorphic compound with three well-characterized forms. Here I explore how the model drug acetaminophen (Tylenol) crystallizes when different sugar-based additives are present during crystallization.

Nick Wiebke '25

Faculty Mentor(s): Professor Lorelei Curtin, GEOLOGY & ENVIRONMENTAL GEOSCIENCES
Funding Source: Walthour Fellowship

Eastern US Climate Reconstructions Through Geochemical Analysis of Silver Lake Sediment Biomarkers

Understanding the biogeochemical systems that shape the ever-changing climate of our Earth is critical when it comes to making predictions about climate change. Though human activity is greatly accelerating these otherwise extremely gradual changes, patterns such as vegetation growth, seasonal weather, and glacial meltwater activity will react in similar ways to that of thousands of years ago. With modern advances in geochemical proxy methods, ways to reconstruct paleoclimate conditions have become increasingly diverse and widespread across the scientific community. With this study I used a sediment core taken from Silver Lake in New York alongside a variety of geochemical analysis tools, such as radiocarbon, silica gel flash column chromatography, XRF and LOI to piece together changes in the sediment record. These observations indicate several physical and chemical changes around the 13000-11000 years before present (BP) mark, namely decreased element concentrations, and increases in organic matter and the length of alkane chains. From these observations, I can gather that even with the cooler conditions of the Younger Dryas (approximately 12900 years BP), biological productivity and higher-order plants' predominance greatly increased during this time, making way for the warmer interglacial period that we find ourselves in today.

Beth Williams '25; Michelle Oswald Beiler; Janine Glathar; Carrie Pirmann

Faculty Mentor(s): Professor Michelle Beiler, CIVIL & ENVIRONMENTAL ENGINEERING

Exploring Trail Deserts using GIS Spatial Analysis: Investigating Trail Access in Relation to Land Use and Demographic Factors

Geographic Information Systems (GIS) software is helpful in exploring pedestrian, cycling, and vehicular mobility in relation to trails. Through this research, ArcGIS Pro is utilized to determine transportation justice and specifically "trail justice". This is done by developing a methodology using current trail map layers and using various ArcGIS tools to determine modal accessibility. Modal accessibility in this study is based on walking distance, biking distance, and vehicular drive time calculated using roadway networks. The geographic areas that do not fall under any mode of accessibility are termed "trail deserts". These accessibility modes and trail deserts are then mapped with land use and demographic factors in order to determine the connections and trends between them. This newly developed methodology was then applied statewide to Pennsylvania in an investigative case study. Similarly, the methodology can be applied to other states to determine trail deserts. This process and application can be used to aid transportation planning organizations in trail planning, and therefore, supports progress in addressing transportation justice issues.

Max Wilson '27

Faculty Mentor(s): Professor Samuel Gutekunst, COMPUTER SCIENCE; Professor Joe Wilck, ANALYTICS & OPERATIONS MANAGEMENT

Funding Source: James L.D. and Rebecca Roser Research Fund

NFL Top 100 Research

The NFL Top 100 is a ranking released each summer, designed to highlight the top NFL players based on the votes of their peers. Each year, NFL players are asked to rank the league's best players, with results providing an insider's perspective on player performance. This project aims to better understand the factors that matter most to NFL players when determining these rankings. Specifically, we explored how player positions, team affiliations, and other external factors might influence the rankings. We also identified whether certain factors, such as media coverage or statistical performance, play a substantial role in shaping the rankings. Our methodology began by collecting data on the NFL Top 100 rankings, along with other major player rankings (like those from ESPN and CBS Sports), as well as individual player statistics. We then analyzed how the NFL Top 100 has evolved over time, looking at trends in player selections and the impact of factors like legacy and QBR. In doing so, we aimed to uncover patterns in the rankings and predict which factors NFL players prioritize when making their selections.

Anna Marie Wingard '25

Faculty Mentor(s): Professor Erica Delsandro, WOMEN'S & GENDER STUDIES; Professor Diane Jakacki, COMPARATIVE & DIGITAL HUMANITIES; Carrie Pirmann, LIBRARY & IT; Professor Roger Rothman, ART & ART HISTORY

Funding Source: Douglas K. Candland Undergraduate Research Fund

Putting the Pieces Together: Understanding the History and Legacy of "Waste Not Want Not"

This project explores the feminist art historical significance of Miriam Schapiro and Melissa Meyer's article "Waste Not Want Not," originally published in the Winter 1977-78 issue of Heresies: A Feminist Publication on Art and Politics. This article discusses the overlooked history of collage and demonstrates how women across different cultures have employed collage techniques for significant periods of time. The two authors invent the term "femmage" to describe the feminine practice of collaging in order to bring recognition to women's artistic labor and influence on art history. The creation and development of the article was analyzed by visiting the Heresies archive in Special Collections at Rutgers University and studying meeting minutes and issue planning pages. The efficacy and strength of the article's argument was assessed through analytical, conceptual, and evaluative close reading and writing a literary analytical essay. The scholarly legacy of the article was analyzed by tracking online presence and citations, in addition with evaluative close reading of scholarly responses. By analyzing both the creation and legacy of "Waste Not Want Not," this project highlights the article's role in the larger recovery movement and its efficacy in the reclamation of women's contributions to art. The article was crucial in promoting feminist discourse around the marginalization of women in art and continues to stimulate conversations surrounding feminist artistic practices.

Anna Marie Wingard '25

Faculty Mentor(s): Professor Erica Delsandro, WOMEN'S & GENDER STUDIES; Professor Chase Gregory, ENGLISH

Breaking the Boundaries of the Binary: Non-Normative Gender Expression and Rebellion in 19th-Century Literature

This thesis explores non-normative expressions of gender in three nineteenth-century novels: Valperga (1823) by Mary Shelley, The Hermaphrodite (c. 1846) by Julia Ward Howe, and The Awakening (1999) by Kate Chopin. Each novel's protagonist displays gender expression that rejects nineteenth-century British and American ideals and is consequently exiled from society and faces death. The project diagrams trajectories of gender expression and identity through the use of an analytical framework that is based on Jacques Lacan's Imaginary/Symbolic/Real to illustrate how non-normative gender expression directly leads to social exclusion and death. The findings of this literary analysis suggest that nineteenth-century understandings of gender were rigidly policed and the novel served as a discursive space for exploring different non-normative expressions. In Valperga, Euthanasia's "masculine" political loyalty prevails over her feminine identity in a heterosexual relationship; in The Hermaphrodite, Laurence struggles to identify as truly masculine or feminine due to their intersex body; in The Awakening, Edna rejects traditional

femininity by resisting marriage and motherhood. Each character defies gender expectations in a different manner, yet none of them are spared death. This project provides a foundation for future analyses of other works of literature through a similar framework and thus demonstrates literature as a method of conveying commentary on the destructiveness of gender expectations.

Kevin Wu ’25

Faculty Mentor(s): Professor William Scott, MECHANICAL ENGINEERING
Funding Source: Culliton Family Fund for Undergraduate Research

Development of an Origami-Inspired Bistable Soft Robotic Gripper

The increasing demand for high-quality, delicate agricultural products like fruits and vegetables requires innovative harvesting solutions due to the limitations of manual labor. Traditional robotic grippers often fail to handle these items gently, causing bruise damage. This poster presents an origami-inspired bistable soft robotic gripper designed to address this challenge by providing a gentle and adaptive grasp of soft fruits – peaches. Utilizing a bistable mechanism, the gripper can remain in two stable states without continuous power input, automatically closing when contacting an object, thus reducing the need for active control. The gripper’s design includes parameters such as valley width, height, and wall thickness to optimize performance. Through a series of tests and simulations using SolidWorks and Abaqus CAE, the gripper demonstrated the ability to handle peaches without causing bruising. The final design, featuring a combination of rigid and soft materials for the fingers and a strategically positioned elastic ring, ensures efficient and damage-free fruit handling. This innovative approach not only enhances the efficiency of automated agricultural operations but also contributes to the production of higher-quality produce. Future work will focus on integrating the gripper components into a single part and further optimizing gripping parameters.

Emma Yorke ’26; Eowyn Andres ’28

Faculty Mentor(s): Professor Gulay Guzel, MARKETS, INNOVATION & DESIGN
Funding Source: Helen E. Royer Undergraduate Research Fund

Dream or Illusion? – Social Mobility in a Divided Era

The “American Dream” embodies evolving ideals of economic and social success in the U.S., rooted in the Declaration of Independence’s promise of “life, liberty, and the pursuit of happiness.” This research examines contemporary perceptions of the American Dream and its attainability today, focusing on how socioeconomic background, race, and gender shape individual interpretations of success and opportunity.Drawing from historical and sociological frameworks, we integrate perspectives from American studies, social mobility research, and economic inequality discourse. A questionnaire conducted among college students from diverse backgrounds explored their perceptions of the American Dream and key attributes linked to achieving it. Qualitative coding identified recurring themes and emotions, while quantitative analysis examined correlations between responses and socioeconomic status. Preliminary findings indicate that historical patterns persist, with white males often seen as the quintessential embodiment of the American Dream. However, views on attainability vary due to rising living costs and workplace diversity efforts. Our analysis revealed differences in expected income levels and lifestyle aspirationsÑsome participants included vacations as part of their dream, while others omitted them, considering them either an unrealistic luxury or too normalized to be a goal.Future research will expand data collection through in-depth interviews and archival analysis to refine these trends. By analyzing modern interpretations of the American Dream, this study contributes to discussions on social mobility and economic opportunity, offering insight into how diverse individuals navigate and redefine this evolving ideal.

Quinn Zabiegalski ’26

Faculty Mentor(s): Professor Andrew Sloboda, MECHANICAL ENGINEERING
Funding Source: Helen E. Royer Undergraduate Research Fund

Optimizing Boundary Transformation Vectors by Choosing The Best 2-D Representation

Boundary transformation vectors (BTVs) are a method tailored for analyzing damage in linear and nonlinear dynamic systems. BTVs are constructed by first comparing two system attractors-one representing the system with normal parameters and the other with altered parameters. A system attractor represents the long-term behavior that a dynamic system settles into after transient behavior has dissipated. Utilizing a 2-D representation of the system attractors, BTVs can be created by drawing vectors between the boundaries of the normal and altered attractors to illustrate system changes. The main objectives of this research were to understand the sensitivity of BTVs to different 2D attractor representations and determine an optimal representation method if given a set of data. Initially, literature regarding system attractors and their representations were reviewed. MATLAB was then used to code the four most promising representations for the system attractors, these being plane projections, PoincarŽ sections, principal component analysis (PCA), and singular value decomposition (SVD). The BTVs were constructed using simulated Lorenz attractor data. After successful implementation of the different representations, two comparison groups were formed. The first group involved altering the rho parameter (_) of the Lorenz system from its normal value (_ = 28) to 27, 26, and 25. The second group used intermediate rho values (27.5, 26.5, and 25.5). Finally, MATLAB functions were used to evaluate the magnitude and direction of the resulting BTVs. Among the methods tested, PoincarŽ sections yielded the most consistent and effective BTV results, while PCA appeared least effective.

Mathew Zilberman ’25

Faculty Mentor(s): Professor Karlo Malaga, BIOMEDICAL ENGINEERING
Funding Source: Costa Healthcare Research & Design Fund

Comparison of Thalamic Atlases and Segmentation Techniques in Defining Motor and Sensory Nuclei for Deep Brain Stimulation Targeting in Essential Tremor

Deep brain stimulation (DBS) of the ventral intermediate (VIM) nucleus of the thalamus is a proven treatment for essential tremor (ET). Neurosurgeons rely on thalamic atlases; however, many atlases are available, with different divisions of motor and sensory subnuclei. Segmenting anatomical targets using diffusion tensor imaging (DTI) offers a patient-specific alternative to traditional atlas-based approaches. This work compares the effectiveness of multiple atlases and segmentation techniques in defining motor and sensory subnuclei.22 ET patients who underwent unilateral VIM DBS were analyzed retrospectively. Six prominent thalamic atlases were obtained from LEAD-DBS. The atlases segmented the patient thalami in two ways: atlas-based segmentation (ABS) used the atlas to determine subnuclei divisions, and DTI-based segmentation (DTIBS) incorporated tissue properties to create clusters of subnuclei.High motor and low sensory activation is expected for tremor reduction stimulation, and ABS produced this trend across all atlases, whereas DTIBS produced this trend in only half of atlases. Greater sensory stimulation is expected for paresthesia VTAs compared to tremor reduction VTAs, and ABS yielded this trend in almost all atlases, where DTIBS yielded this trend in only half of atlases.ABS was more generalizable than DTIBS across atlases. The Jakab atlas was the only atlas to show the expected motor/sensory stimulation trend associated with each clinical outcome when using either ABS or DTIBS, making it the most clinically accurate atlas investigated.

Ryan Ziskin ’26

Faculty Mentor(s): Professor Douglas Collins, CHEMISTRY
Funding Source: Department of Chemistry

Effects of Mixture Composition on Fatty Acid Reactivity in Chlorine Bleach Vapor

The COVID-19 pandemic led to the increased use of chlorine-based disinfectants such as bleach, introducing chlorine (Cl_2) and hypochlorous acid (HOCl) to indoor environments. HOCl gas partitions onto various indoor surfaces not meant for initial exposure, including human skin, participating in multiphase chemistry with compounds on the surfaces themselves. HOCl, a strong oxidizing agent, is capable of chlorinating compounds, including olefinic compounds like fatty acids (FAs) that are found on indoor surfaces and human skin. With recent wildfires, many individuals are exposed to aromatic hydrocarbons like catechol, which our lab has shown can react with HOCl gas to produce an abundance of free radicals and highly unstable oxidative products. The different components on skin surfaces and in the air could lead to different oxidized products and affect their formation rates. To investigate multicomponent reactions between HOCl and FAs, oleic acid (OA) films with and without aromatic compounds (catechol) were prepared on glass circles which were placed in a glass flow tube reactor. Gaseous HOCl and Cl_2 were directed over the glass substrates within a glass chamber, and the products were analyzed using an UHPLC with Agilent 6560 Ion Mobility Q-ToF mass spectrometer. In addition to previously-studied chlorohydrin and ester products for OA as well as polychlorinated and dimerized products for catechol, heterodimer products were observed between the two species. It is hypothesized that the addition of an aromatic wood-smoke compound, like catechol, will increase the rate of oxidation of OA and alter the distribution of products to generate these compounds.

Diamanda Zizis (Graduate Student); Melody P. Sain; Scott Schuette; Christopher T. Martine

Faculty Mentor(s): Professor Chris Martine, BIOLOGY
Funding Source: Department of Biology; David Burpee Plant Genetics Fund

Implications of Range-edge Populations in Conserving the PA Critically Imperiled Aconitum Reclinatum

Range-edge populations often exhibit unique genotypes compared to core populations due to their tolerance of greater variation in environmental conditions. However, range-edge populations can also suffer the effects of inbreeding if they are isolated from other populations. Aconitum reclinatum (Ranunculaceae) is a critically imperiled plant species found in five states of the Appalachian region of the United States: Pennsylvania, West Virginia, Virginia, North Carolina, and Tennessee. This plant is adapted to cool, moist environments but faces threats from increasing wetland disturbance and logging over its range. The species health of A. reclinatum has previously been found to be lowest in its northern and southern range-edge populations, in Pennsylvania and Tennessee respectively. Comprehensive knowledge of A. reclinatum population structure remains limited. To address this, we collaborated with Natural Heritage programs in the five states within its range to sample populations across the species distribution and generate a genotyping-by-sequencing data set of single-nucleotide polymorphisms (SNPs). This dataset will be used to calculate population statistics and infer population health. Particular attention will be focused on range-edge populations, which have historically been under-researched despite their importance for conservation. The findings will contribute to conservation strategies aimed at protecting A. reclinatum, including identifying genotypes that may enhance species resilience to a rapidly changing environment.

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