2023 STAR SCHOLARS SUMMER SHOWCASE

DREXEL UNIVERSITY
Undergraduate Research & Enrichment Programs
Pennoni Honors College

DREXEL UNIVERSITY

Undergraduate Research & Enrichment Programs

Pennoni Honors College

The STAR Scholars Program is administered by
Undergraduate Research & Enrichment Programs,
a unit of the Pennoni Honors College.

Table of Contents

Table of Contents

Table of Contents

A Message From the Dean and the Director

One of our proudest moments in the Pennoni Honors College is the STAR Scholars Summer Showcase. Each year, this event draws rave reviews from visitors, surprised that such quality work can be produced by rising sophomores. It is also a tribute to our STAR Scholars that increasing numbers of faculty express interest in serving as their mentors. As our students move on from the STAR Scholars Program, those who will be pursuing research careers will find that STAR has given them a head start. Those whose interests lie elsewhere have nonetheless gained important skills that will serve them well, no matter what they do. The intellectual rigor and the camaraderie of STAR are an invaluable part of the college experience, likely to endure in students' memory for a long time to come.

We're so proud to have a dedicated team in Pennoni Honors College, headed by the Director of Undergraduate Research & Enrichment Programs, Jaya Mohan, shepherding students through this challenging program. We're also pleased to be able to host the Showcase in Bentley Hall, the Honors House, for the first time, hopefully beginning a long tradition of displaying our students' projects in our home building.

We encourage students in this program to spread the word about their STAR experience to other students at the University who may have an interest in research. We also hope that our 2023 STAR Scholars will take advantage of other opportunities in the Pennoni Honors College as they continue in their Drexel careers. Bentley Hall is always open, and our staff is eager to listen and give advice.

Dr. Paula Marantz Cohen
Dean, Pennoni Honors College

A Message From the Dean and the Director

Welcome to the 2023 STAR Scholars Summer Showcase. The STAR Scholars Program engages highly motivated first-year students in faculty-mentored research, scholarship, or creative work during the summer between their first and second years as Drexel undergraduate students. The 121 students in our 2023 STAR Scholars cohort participated in projects guided by mentors in 12 of Drexel's 14 colleges and schools. These students, our 21st cohort, lived in Bentley Hall, the home of the Pennoni Honors College, and participated in in-person social and co-curricular programming to help solidify their connections to one another and further develop their research-related skills.

New this year: Four of our STAR Scholars who participated in the Program for Civic Foundations, administered by the Pennoni Honors Program and funded by the Teagle Foundation, were partially or fully funded to participate in STAR and continue their exploration of the nexus between research and public purpose through a discussion series this summer led by Dr. Kevin Egan, Director of Academic Programs in the Pennoni Honors College.

While our STAR Scholars have spent their summers in Bentley Hall since Summer 2021, we are thrilled to bring our flagship event, the STAR Scholars Summer Showcase, home to Bentley for the first time this year. We're thrilled to celebrate the vast accomplishments of our STAR Scholars here in the home of the Pennoni Honors College. Congratulations to the 2023 STAR Scholars!

Jaya Mohan, MA
Director, Undergraduate Research & Enrichment Programs

Outstanding Mentor of the Year

The critical piece of the STAR Scholars Program that makes it such a valuable experience for the students is, without a doubt, their Mentors. The STAR Mentors give much to their students' summer experiences and do so with no compensation.

In Summer 2011, we created a process to recognize the STAR Mentors and to particularly celebrate the Outstanding Mentor(s) of the Year. STAR Scholars are given the opportunity to nominate their faculty mentors or graduate student mentors for the "Outstanding Mentor of the Year" award, which provides the awardee with a $1,000 award to futher his or her research with undergraduate students. Since 2011, this award has been given to 18 faculty.

Each nominated mentor receives a letter signed by the Provost that outlines the common characteristics held by all nominated Mentors, and each letter includes excerpts from the students' nomination letters to provide an individualized account of just how these Mentors have contributed to those specific students' experiences.

Based on these nominations, outstanding Mentors:

- Are passionate experts in their field who freely share their expertise with students
- Care deeply about their students and treat them with respect
- Generously foster students' intellectual and professional development
- Actively engage students in learning and celebrate their success
- Go above and beyond in supporting their students

All of our mentors go beyond the call in their work with STAR Scholars, and we are genuinely grateful for the time and effort they commit to furthering the education of undergraduate students.

2022 STAR Scholars – Outstanding Mentors of the Year

Caroline L. Schauer, PhD

Caroline L. Schauer, PhD is the inaugural Margaret C. Burns Chair in Engineering, Associate Dean for Research and Faculty Affairs in the College of Engineering, and Professor in Materials Science and Engineering. Dr. Schauer heads the Natural Materials and Polymer Processing group at Drexel, where her research encompasses a wide range of topics including processing natural polymers, structural color thin films, electrospun nanoyarns, wound healing dressings and tissue engineering.

Dr. Schauer mentored three STAR Scholars in summer 2022: Alessandra Cabrera, Eli Werbach, and Conway Zheng.

Alessandra Cabrera, Conway Zheng, and Eli Werbach said, ***"Reflecting upon our STAR experiences, we all are truly indebted to our mentor's endless kindness and passion for bringing community to her laboratory space."*** *Conway added,* ***"She went above and beyond to connect with her students."***

The students appreciated Dr. Schauer's ability to foster their intellectual and professional development, noting that she ***"encouraged imaginative exploration."***

Conway Zheng said, ***"One of the first things that Dr. Schauer said in a Zoom meeting was the emphasis that she puts on creating a family in the lab group. Dr. Schauer is research-oriented, and driven, which gives our lab the ability to put out so many papers, but at the same time, she wants to create a hospitable environment for her researchers."***

2022 STAR Scholars – Outstanding Mentors of the Year

Dr. Brian Stuart

Dr. Brian Stuart is an Associate Teaching Professor of Computer Science who teaches in areas such as computer science, data communications, distributed/operating systems, accelerated computer programming, and computer graphics. His research and development experience has spanned a wide variety of disciplines including machine learning, networking, robotics, image processing, simulation, interpreters, data storage, and operating systems.

Dr. Stuart mentored three STAR Scholars in summer 2022: Nicholas Ingravallo, Annaliese Blowers, and Audra Stein.

Nicholas Ingravallo said, ***"Dr. Stuart has facilitated my growth in research and my general academic life. It always felt that he would listen carefully and exactly to what I had to say, and then help me with my dilemma." Audra Stein added, "As a mentor, Dr. Stuart has given us full control over our projects, making it known that I would be working with him, not for him. I often feel he has more faith in me than I do in myself."***

Annaliese Blowers said, ***"Dr. Stuart has made a profound impact on me. I would not be in this program without him encouraging me to apply and offering the opportunity to work with him. I was so flattered when he said this, and it felt so good to have someone see potential in me. He has provided advice in so many ways that has been an incredible benefit to my life and I am so grateful to him for that."***

2023 STAR Scholars Abstracts

Amelia Niedermier

Antoinette Westphal College of
Media Arts & Design
Architecture

Faculty Mentor: **Dr. Ulrike Altenmüller-Lewis**
Architecture, Design & Urbanism

Co-Mentor: Dr.-Ing. Architektin, Debra H. Ruben

Inclusive Playful Learning Spaces: A Guide to Intergenerational and Diverse Learning Environments

The Disability Rights Movement established the United States' first civil rights guidelines for people of various abilities in public spaces and education. However, since then, limited progress has occurred in creating socially equitable environments for all to experience. Inclusive design considers the age, identity, race, abilities, location, and economic demographic of the people in a space. By investigating how to make these spaces inclusive, designers can create more diverse and accessible learning tools for children and communities. Therefore, what if inclusive design could be incorporated into playful learning practices to alleviate this problem? Playful learning is a design concept meant to create educational opportunities for children that allow self-exploration and expand social, emotional, physical, cognitive, and academic skills. Reviewing existing literature on inclusive design and playful learning spaces, I have developed guidelines and learning tools to educate designers and community members on what these environments consider. These learning tools will inspire awareness of designing for inclusivity while encouraging learning through play.

Teagle Fellow

Katie Horton

Antoinette Westphal College of
Media Arts & Design
Graphic Design

Faculty Mentor: **Professor David Beker**
Architecture, Design & Urbanism

The Quest For The Perfect Chair

Do you ever find yourself squirming a readjusting in your chair because you just can't get comfortable? That's because mass-produced chairs are made to be 'one-size-fits-all.' Considering we spend most of our time sitting down, everyone should have comfortable chairs tailored to their individual bodies and seating preferences. That thought launched my idea for this project. I aimed to create a design process that would produce a chair that accommodates the specific preferences of an individual. As a trial, I designed and built a chair that would meet my own preferences. The first step in building a custom chair is making a list of 'must-haves.' For example, my "must-haves" were as follows:

- Ability to sit cross-legged
- Ability to sit with bent knees
- Prevents neck strain
- Homey and inviting

With these requirements in mind, I started sketching many ideas that I wanted to explore. Once I landed on a drawing that I liked, I constructed a small-scale model out of cardboard. After consulting my mentor and making minor changes, I built a full-sized cardboard model before building the final chair out of plywood. My hope is that this project may act as preliminary research for a small business that makes everyone's dream chair.

Mackenzie Hughes

Antoinette Westphal College of
Media Arts & Design
Architecture

Faculty Mentor: **Dr. Andrew Zitcer**
Arts Administration & Museum Leadership

Prison Architecture: Reimagining Rehabilitation and Combating Mass Incarceration Through Design

Many people overlook prison architecture when addressing the issue of mass incarceration. Though with research and time it is possible to change the design of these institutions and start to ameliorate this broken system. Alongside changing the structures inhabited by millions, there are other solutions that some deem as too radical for this time. Abolition of prisons is a movement that has gained traction and provided my research with new perspectives on alternatives and how those could be reflected into an architectural redesign. Abolitionists focus on regrowth and learning; with both of these factors in mind, my design portrays that mindset to its full potential. I drew inspiration from the studies of the built environment (including international examples) and what can create a healing space for inmates. Space with maximum lighting (preferably self-controlled), views of nature, a sense of privacy, "soft" materials and use of different shapes and colors can improve a person's wellbeing. In designing my own sample medium-security prison, I utilize abstract forms and orientation to promote a space of rehabilitation and attempt to remove the stigma of brutalist solitude in prison architecture.

Malyka Alvi

Antoinette Westphal College of
Media Arts & Design
Fashion Design

Faculty Mentor: **Dr. Ali Howell Abolo**
Fashion Design

A meta-analysis of sustainable pedagogy

Sustainability is a buzzword in fashion education. A gap in knowledge exists around the understanding of sustainability and what students bring with them to the fashion industry. I conducted a literature review, exploring research from 2016 to 2023 focused on sustainable education in fashion merchandising and design programs in higher education. To source articles, I identified 8 articles through keyword searches. I read and analyzed articles based on the modality of course delivery, teaching method, and class project. I then cross referenced the citations for each article, yielding 15 articles. I analyzed these articles under the same themes, and continued this process of sourcing and analyzing articles from the citations lists until I reached saturation (n=28). Findings suggest that sustainability is a universal term in fashion merchandising and design education, but the measurement of student application is untested. Further, institutions employ a multitude of teaching methods to infuse sustainability into fashion education, but the long-term impact is not accounted for. Sustainability is important to the health of our world, and the fashion industry, as a primary polluter, needs to refocus education on tangible applications.

Poppy Martínez

Pennoni Honors College
Custom-Designed Major

Faculty Mentor: **Dr. Ali Howell Abolo**
Fashion Design

Examining the Social Risks and Rewards of Participation in Aso Ebi, the Traditional Nigerian Uniform

Aso ebi is a uniform dress tradition originating from the Yoruba people of Nigeria. Wherein significant occasions, guests and celebrants are seen wearing the same fabrics, colors, and sometimes styles, as a symbol of their unity and affiliation with the celebrant. The tradition has an important impact on Nigerians' social and financial life. Although aso ebi represents social identity, solidarity, and cultural heritage, the literature shows that participating in aso ebi may be associated with feelings of social pressure and financial stress. Festinger's (1954) social comparison theory was employed as the theoretical framework to understand the risks and benefits derived from participation in uniforms. Researchers conducted in-depth semi-structured interviews with 7 Nigerian and Nigerian-American women (n=7). A thematic analysis was executed following stages of open, axial, and selective coding, working to improve intercoder reliability by checking codes between researchers. Initial findings are organized under five themes: reciprocity, community, fundraising, saturation, and RRR (reduce, reuse, recycle). Significant overlap between themes suggests that benefits and pressure to participate impact individuals on multiple levels.

Saffron Buscemi

Pennoni Honors College
Custom-Designed Major

Faculty Mentor: **Professor Kathleen Martin**
Fashion Design

The Future of Fashion: Nature and Technology for Sustainability

Each year, the global fashion industry is responsible for 92 million tons of solid waste, 79 trillion liters of water, 20% of global wastewater, and 10% of carbon dioxide emissions. This extractive, linear economy causes extensive levels of pollution and exploitation. Sustainable sourcing, design, and manufacturing processes must be implemented to prevent the fashion industry from destroying the integrity of the environment and its inhabitants. I attempted to address and solve this issue, looking towards technology and nature as key solutions. I created a digital spread covering topics such as plant-based fibers, biofabrication, bacteria-based dyes, digital fashion, and smart textiles. I also drew from sustainable practices, such as traditional craftsmanship, regenerative farming, and upcycling. I highlight environmentally conscious efforts and technologies that can help shift our values and promote a circular fashion model. Through my research, experimentations, and projects, I argue that to make a product inherently successful it must be sustainable, something that can be achieved by fully considering materials, how they interact, and their impact.

Lillian Byrd

Antoinette Westphal College of
Media Arts & Design
Graphic Design

Faculty Mentor: **Professor Mark Willie**
Graphic Design

Researched and Developed Content to Showcase the Unparalleled Individuality and Creativity of the Drexel Polish Posters Collection

From the early 1950s to the 1980s, the Polish School of Posters emerged as a distinctive approach to poster design during a period when Poland was subjected to strict Soviet control. This era was marked by the Polish enduring considerable repression and hardship, and a surge of creativity erupted, intertwining elements of painting, photography, experimentation, and metaphorical expression. These posters served as covert commentaries on society concealed in metaphors and satire, reflecting the artists' response to the prevailing conditions. Drexel University houses the second-largest collection of Polish Posters in the United States. However, the collection remains relatively unknown to the Drexel community. To bridge this gap, I researched and developed content for an online platform to showcase the posters and the artists in the collection. From the 2,500 posters, I curated a selection of twelve posters and created the logo, marketing strategy, and brand guidelines to represent the collection. This fosters visual consistency in communication and a clear understanding of the brand. The online presence increases visibility to the collection, displaying artwork distinguished by its unparalleled uniqueness and creativity.

Margaret Mary Cove

Antoinette Westphal College of
Media Arts & Design
Entertainment & Arts Managemnt

Faculty Mentor: **Professor James McKinney**
Music Industry

Women In the Industry: Producing Women, & Women Who Produce

Under the guidance of Professor James McKinney, I explored the question of 'What can be done to help level the playing field in the entertainment and arts industry for people of all genders and identities?' The research commenced with hands-on experience in a recording studio, primarily assisting Stacy Schulman of As/Is Jazz in sound engineering capacities.Another central component involved direct collaboration with emerging artist Lila Dupont, signed to Eusonia Records. In preparation for the release of Dupont's second solo album, this project encompassed the development of social media marketing strategies, press release composition for various publications, and sales initiatives. Notably, the project included active participation meetings with global record label executives, culminating in successful releases. Additionally, a website for McKinney's Infinite Icon Enterprises was conceptualized and constructed, accentuating the career of its founder. This research's findings underscore my direct engagement with the business processes, which has provided first-hand insights into the industry, revealing how equitable access to these aspects of the industry can contribute to fostering a more inclusive environment for all individuals.

Max Lebrun

Antoinette Westphal College of
Media Arts & Design
Music Industry

Faculty Mentor: **Professor Cyrille Taillandier**
Music Industry

An exploration of various audio engineering techniques

The recorded music industry is constantly evolving with the introduction of new technologies, artists, and genres. Audio engineering (Mixing & Mastering) plays a key role in shaping the listening experience for music consumers as the final step of the music production process. The mixing process of balancing dynamics, spectral range, and fx, was originally performed with analog hardware, such as consoles and outboard units, using electronic circuitry. Today, mixing is primarily done with digital tools, some made to emulate analog gear, by replacing circuits with ones and zeros. There is an ongoing industry debate regarding which mixing method achieves the best results, given that analog mixing is significantly more expensive and less convenient to use. To investigate this topic, I am working in the studio, mixing songs from various genres using digital, analog, and analog-emulating mixing equipment and techniques. I am then sending these mixes unlabeled as a blind test to both music consumers and other audio engineers, along with a questionnaire to elicit their unbiased feedback on the quality of the mix. This data helps weigh the pros and cons of analog vs. digital mixing gear and techniques in the modern recorded music industry.

Emaa Detwiler

Antoinette Westphal College of
Media Arts & Design
Product Design

Faculty Mentor: **Professor Raja Schaar**
Product Design

Somaesthetics in Fashion: The Creative Mind and Body

Somaesthetics, a branch of somatic design, concerns the relationship between the body and a design, studies the sensory appeal, and aims to aid the overall well-being of the user. It pays attention to the style, textures, patterns, and experimental designs of a garment.

When it comes to the dilemmas in the fashion industry and the beauty and gender norms associated, somaesthetics is a beneficial solution to integrating a community and empowering individuals. From expressive style to a diversity of bodies, genders, and ages, somatic fashion seeks to fabricate designs that aid the comfortability of the wearer that are equally as visually appealing.

Body and self-awareness allow for the brain to shift habitual ways of thinking, carving new neural pathways and creating new perceptions of the world. This is also known as neuroplasticity: the study of the malleability of one's brain and beliefs. Garments can boost confidence and foster positive experiences that consequently influence the brain's neural pathways to harbor a better self-image.

I applied my research into a variety of garments fabricated from scratch. I intend for my pieces to tell a visual story of open mindsets and body positivity captured through stylistic photography.

Aidan Asmus

Bennett S. LeBow College of Business
Accounting, Finance

Faculty Mentor: **Professor Jonathan Liss**
Accounting

The Impact of a Wealth Tax in America

In recent years a number of American politicians and state governments have proposed the idea of implementing a wealth tax on the most affluent individuals. Such a tax is unique as it is imposed on an individual's net worth, the value of assets minus debt. These proposals differ from the majority of U.S. taxes as they would raise revenue through unrealized gains of American wealth, something unfamiliar to most American taxpayers. While a novelty in the U.S., wealth taxes have been implemented in twelve different countries since 1965 with varying degrees of success. This research looks at the consequences of wealth taxes seen in those twelve nations and uses these experiences as a guide to gain a better understanding of the likely impacts such a tax would have in the U.S. While U.S. tax proposals differ from European wealth taxes through higher brackets and exemption status, it is likely that the outcome of a U.S. wealth tax would follow similar trends. This would be true for both intended and unintended consequences, as a wealth tax would likely narrow the growing wealth disparity in the country while raising revenue, but it would come at the expense of declines in GDP and other sources of tax revenue.

Dimitri Dumbadze

Bennett S. LeBow College of Business
Finance, Economics, Business Analytics

Faculty Mentor: **Dr. David Becher**
Finance

Are Banks Really Risky?

The recent failures of major banks in the US have amplified concerns about the risk exposure of publicly traded banks. Given their central role in fostering economic stability and growth, the actions of banks carry extensive implications for everyday lives, financial markets, and economic policies.

While the centrality of risk in financial markets is undisputed, a gap persists in whether the public and market participant — investors, analysts, and regulators — adequately understand and discipline public banks for their risky behavior. This unexplored niche requires a nuanced examination of the interplay between risk and investor awareness.

Through a comprehensive analysis of risk-measuring variables, this study formulates a detailed risk profile of publicly traded banks and correlates it with market behavior. The underlying hypothesis is that a divergence may exist between how the market perceives the risk associated with public banks and the actual risk profile of these institutions.

By bridging the gap between risk perception and reality, the findings contribute to more informed investment strategies and regulatory policies, fostering a more transparent and resilient financial environment in an age of uncertainty.

Erika Spletzer

Bennett S. LeBow College of Business
Economics, Finance

Faculty Mentor: **Dr. André Kurmann**
School of Economics

Geographical Variation in U.S. Federal Stimulus During the COVID-19 Pandemic

In response to the COVID-19 pandemic, the U.S. federal government enacted unprecedented fiscal measures, totaling $4.3 trillion, $814 billion of that being allocated to Economic Impact Payments, commonly known as stimulus checks (IRS). In this project, we study the regional disparities of this stimulus allocation, the relationship between these disparities and differences in pre-pandemic income, and the extent to which variation in fiscal stimulus accounts for regional differences in inflation.

During this process, we compile a database of statistics from a variety of government agencies, mainly the Bureau of Economic Analysis and the Department of the Treasury. Our data is collected between the years 2019 and 2022 and includes information at the state, metropolitan, and county levels. This data highlights disproportionately high price indexes and inflationary rates across certain regions that generally display low average per-capita income and receive large amounts of pandemic stimulus aid. By unraveling localized complexities, we can proactively shape recovery strategies that are tailored to each region's socioeconomic makeup.

Mustafa Eren

Bennett S. LeBow College of Business
Economics & Data Science

Faculty Mentor: **Dr. Teresa Harrison**
School of Economics

Nonprofit Hospital Conversions: Motivations and Healthcare Implications

The healthcare landscape is marked by the notable phenomenon of nonprofit hospitals converting to for-profit entities. Our research aims to uncover the motivations behind such conversions and assess their ripple effects on the healthcare community.

We established an Excel database to delve into this complex issue. Several themes emerged as pivotal in propelling nonprofit hospitals toward for-profit transitions: Economic pressures, changing regulatory landscapes, and the search for operational efficiency. Additionally, certain types of hospitals, particularly those facing financial strains or those in highly competitive markets, seem more inclined to undergo this transition.

A central discovery of our study is the consistent trajectory of assets post-conversion: assets of a nonprofit, upon its acquisition by a for-profit entity, mainly channel into a foundation.Our research underscores the critical role of public oversight in these conversions. In essence, this investigation bridges the gap between organizational decisions, public policy, and healthcare outcomes, offering a panoramic view of the challenges and considerations nonprofits grapple with in the contemporary healthcare milieu.

Ian Surprenant

Bennett S. LeBow College of Business
Esport Business, Marketing

Faculty Mentor: **Dr. Jeffrey Levine**
Sport Business

Examining Esports Governance, Law, and DEI to Create New Industry Standards and Generate Potential New Revenue Sources

More than 215 million Americans play video games, including 90% of children over the age of two. Gaming has seen great success worldwide, as many turn to video games as a leisure activity. The American video game industry has been historically dominant, with tens of billions of dollars of revenue being pulled in from year to year. However, this success has not transferred over to the esports (competitive video games) industry, which is still developing sustainable business practices and institutional guardrails as a newer industry. With sizeable revenue from a lucrative domestic gaming industry, current esports business practices should be closely examined to determine how esports may find not only self-sustainability but prosperity. In esports, the lack of organizations like the NCAA or an international governing body to regulate competition results in suboptimal business practices. To determine the processes necessary to best standardize the industry, scholastic esports methods were examined through surveys and interviews with various stakeholders. Utilizing this data and external findings, this research project presents a viable business model for the collegiate esports ecosystem.

Mehroj Alimov

College of Computing & Informatics
Computer Science

Faculty Mentor: **Debra Colbert-Maduforo**
Baiada Institute

Co-Mentor: John Wilson

How are Entrepreneurship Centers teaching, using, promoting, and applying AI when supporting and equipping emerging startup entrepreneurs.

The Artificial Intelligence (AI) tools such as ChatGPT have recently shown the significant potential in educational institutions and organizations. By using mixed-methods study, this research aims to identify the degree which EC's are embracing AI-generative technology in their programming, curriculum, and practices when working with student entrepreneurs as they pursue new ventures and related startup activities. Our study covers data about attitudes, applications, and practices in EC's recognizing a wide range of varying opinions and perspectives throughout the Academy when it comes to generative-AI technologies such as ChatGPT, Copy.ai, Content-at-Scale, Midjourney, Dall-E, Google Bard, Microsoft Bard, Jasper,ai, etc. This research leverages quantitative survey data collected from EC directors and Entrepreneurship educators who were involved with incubators, accelerators, startup labs, etc., and interviews conducted with EC directors to gain insight into the current and planned implementation of and support for AI-generative technologies as a means to better prepare student founders to differentiate their offerings in increasingly competitive environments.

Sydney Rowley

Pennoni Honors College
Custom-Designed Major

Faculty Mentor: **Dr. Elizabeth Watson**
Biodiversity, Earth & Environmental Science

Co-Mentor: Andrew Payne

Vegetation Indexing of a Marsh and its Bordering Coastal Forest

Sea level rise is impacting coastal forests in the US Northeast, leading to saltwater intrusion into transitional forests, or those that border marsh. This creates what's known as ghost forests where saltwater intrusion leads to a lack of recruitment of young trees, standing dead trees, and overall forest mortality. To better understand and predict these trends we used the Normalized Difference Vegetation Index (NDVI) to analyze satellite imagery of the marsh, forest, and the ecotone between them, the transitional forest. In this study we used 2017-2023 satellite images from Planet Imagery to analyze the change in NDVI values at our site at Pine Neck Preserve in NY, and yearly phenology. We found characteristic signatures of NDVI for marsh, forest, and transitional forest. Yearly changes in smoothed NDVI were used to calculate metrics related to phenology and productivity such as growing season length, overall productivity, and spring green-up. It's vital to clearly communicate scientific findings to the public so that affected communities can use the results to make informed decisions regarding land management and habitat resilience. Therefore, this study also investigated best practices in communication of scientific findings.

Bijaya Manandhar

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **Dr. Felice Elefant**
Biology

Co-Mentor: Aprem Zaya

Small Molecule Tip60 HAT Activator as a Potential AD Therapeutic

Alzheimer's Disease (AD) is a neurodegenerative disorder impairing cognitive functions and, in late stages, locomotor functions. Recent studies identified epigenetic dysregulation as a hallmark of AD. Epigenetics is the study of histone acetyltransferases (HATs) and histone deacetylase (HDACs) regulating chromatin packaging, thus controlling gene expression. Dysregulation refers to the disrupted homeostasis between epigenetic proteins. The Elefant lab's studies show Tip60 HAT and HDAC2 target neuroplasticity genes. Specifically, TIP60 HAT levels in a *Drosophila* AD model are significantly lower compared to wild-type flies. When Tip60 levels are low, neuroplasticity gene expression decreases resulting in cognitive and locomotor impairment in a *Drosophila* AD model. Overexpression of Tip60 has shown to restore expression levels of neuroplasticity genes. The Elefant Lab is developing small-molecule activators specific to Tip60 HAT to restore expression levels of neuroplasticity genes to rescue cognitive and locomotor functions. Three compounds demonstrated activation of Tip60 in an HAT assay, this poster presents the investigation of one compound using larval locomotor assay to identify a candidate drug at an optimal concentration.

Susan Cahill

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **Dr. Tali Gidalevitz**
Biology

Co-Mentor: Anhelina Volchok, Julia Perhacs

Investigating the Beneficial Effects of HSP-12.6 Chaperone on Protein Misfolding in *C. elegans*

Proteins must achieve specific conformations to perform their functions, and problems can arise when they become misfolded or form aggregates. Chaperone proteins streamline the protein folding process. In *C. elegans*, small heat shock protein (sHSP), HSP-12.6, is a chaperone induced in the muscle cells during stress. The roles of HSP-12.6 are not defined, so we used *C. elegans* to study it *in vivo*. Our lab observed that HSP-12.6 has an affinity for myofilaments. Thus, we hypothesized that deleting HSP-12.6 worsens defects due to mutant misfolded muscle proteins and overexpressing it would ameliorate defects of such mutations.

Mutations in the structural protein paramyosin (UNC-15) causes misfolding and results in muscle dysfunction, including slow movement and embryonic lethality. To determine if HSP-12.6(-) worsens the muscle defects observed in *unc-15* mutants, I designed a genetic cross between an *unc-15* mutation strain and an HSP-12.6(-) strain. The cross will be verified with PCR. To determine whether HSP-12.6 can rescue muscle defects, I am using a strain overexpressing HSP-12.6. We hope to begin uncovering how HSP-12.6 may contribute to protein folding homeostasis in support of muscle function.

Christopher Masiello

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **Dr. Ryan Petrie**
Biology

Agarose-Collagen Hybrid Matrices: Tissue Engineering to Manipulate Fibroblast Migration

Fibroblasts are motile cells that maintain the extracellular matrices of connective tissues. Depending on the physical properties of their environment, fibroblasts can employ one of two migratory mechanisms: lamellipodial or lobopodial migration. While much is known about lamellipodial movement, less is understood about lobopodial migration; it is only employed in linearly elastic, three-dimensional matrices. The goal of this project is to engineer a uniform synthetic matrix that reliably triggers lobopodial migration to facilitate investigation of its underlying mechanisms. A hybrid synthetic matrix was created by combining agarose with type I bovine collagen and fibroblasts; this increases the viscoelasticity of the matrix—a property associated with lobopodial movement. Matrices and cells were fluorescently labelled and imaged using a widefield microscope to observe cell morphology. Preliminary results indicate that fibroblasts use exclusively lamellipodial migration in pure collagen gels. Critically, cells in synthetic matrices containing 1 mg/mL collagen and 1-2% agarose exhibit lobopodial migration in ~10% of the cell population. Future efforts will optimize the synthetic gel recipe to maximize the number of lobopodial cells.

Jai'lyn Lagrone-Lassiter

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **Dr. M. Phifer-Rixey**
Biology

Co-Mentors: A.E. Kasprowicz, S. Giancarli

Developing a Framework to Understand the Global Evolutionary Ecology of Plants and Butterflies

With the expansion of cities across the world, the effects of urbanization on native habitats have substantially increased. Some studies have shown variation of functional traits in species between urban and rural populations, suggesting adaptation to urban habitats. However, evidence to date is limited to a few taxa in a few regions of the world. A global survey of differences in functional traits has the potential to identify shared and unique responses to urbanization and inform future research on ecological and evolutionary processes. We developed a framework to assess functional trait variation between urban and rural habitats. The proposed framework will require participants to collect data on locally common butterflies and flowering herbaceous plants. To test our framework, we identified common species in the Philadelphia area: the *Pieris rapae* butterfly, and wildflower, *Erigeron strigosus*. Measuring various functional traits, we obtained high quality data in both urban and rural populations with low investments in time and supplies. Under this protocol, we optimized field collection and preservation methods, refining them to be replicable and accessible to global participants without access to advanced equipment.

Velay Fellow

Dejenae Smith

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **Dr. M. Phifer-Rixey**
Biology

Co-Mentors: A.E. Kasprowicz, S. Giancarli

Exploring the effects of urbanization on functional trait variation within the Cabbage White butterfly (*Pieris rapae*) and Daisy Fleabane (*Erigeron strigosus*) throughout Philadelphia

As land becomes increasingly urbanized, flora and fauna that provide important ecosystem services are directly affected, including pollinators and flowering plants. Urban habitats are generally marked by higher temperatures, increased habitat fragmentation, and exposure to toxins and pollutants. Variation in functional traits may reflect responses to such urban stressors. We present pilot data on the impact of urbanization on two local species common to urban and rural habitats– the *Pieris rapae* butterfly and *Erigeron strigosus*, an herbaceous flowering plant. We collected specimens from six urban and five rural sites in and surrounding Philadelphia, gathering data on traits such as body length, wingspan, and plant height. One-way ANOVA analyses indicate the significance of habitat in weight and upper wingspan, along with pistil and flower diameter. These results suggest trait variation between the areas, motivating continued work. Ultimately, we plan to collaborate to expand the project globally, focusing on areas typically underrepresented in scientific research. With further development, we can build a database to facilitate studies of urbanization's impact on plant and pollinator communities and support conservation efforts.

Maxwell Goddard

School of Biomedical Engineering,
Science & Health Systems
Biomedical Engineering

Faculty Mentor: **Dr. Hai-Feng Ji**
Chemistry

Inorganic Hydrogel: Synthesis and Potential Uses

Hydrogels, gels which expand to >20 times their original size in water, have numerous uses in biomedical and tissue engineering. However, there are many issues with current hydrogels such as low mechanical stress tolerance and an inability to sustain certain cells for extended periods. Despite the numerous studies being done to combine existing hydrogels in order to achieve new gels with the most desirable properties of each as well as create entirely new ones, there are very few studied inorganic hydrogels.

Inorganic hydrogels synthesized from metal oxide nanowires are very likely to have valuable capabilities such as greater stress tolerance (which is useful for assessing the health of cartilage cells in order to treat various injuries and degenerative diseases), and filtering out highly toxic heavy metal ions. As a result, such hydrogels could solve a variety of problems in biomedical engineering.

In this project, we synthesized metal oxide nanowires from metal borides by heating them in a solution consisting of 25% TMAH and 75% water by weight for 5-7 days to create metal oxide nanowires. These wires were then colloidally suspended in water, and then a small amount of acid was added. At this point, hydrogel formation can occur.

Jeffrey Finn

College of Engineering
Mechanical Engineering

Faculty Mentor: **Dr. Karl Sohlberg**
Chemistry

Computationally Finding Forces in the Length Change of a Rotaxane

Shrinking machinery down to the molecular level can improve cost, efficiency, and accuracy. However, a significant roadblock to designing machinery at this scale is the difficulty of predicting the impact of proposed design changes. To gather this information, engineers could either perform costly physical experiments or run the complex simulations required to accurately describe machinery at this scale. The goal of this project is to test how well a molecular simulation can be used to find the forces involved with a contraction in a bistable [c2] daisy chain rotaxane molecular system.

Upon the chemical attachment/detachment of two protons, this molecular system changes its length, a basic function that could be essential to many molecular machines. The forces to be found are both the instantaneous force that initiates this movement and the average force that carries the rotaxane components to their final position.

These forces will be found by computing the potential energy for 400 different structural arrangements that the rotaxane transitions through as it extends/contracts. These potential energies will be graphed against internal position to create a potential energy curve that will be analyzed to find the forces.

Adesinmisola Adegboyega

College of Nursing & Health Professions
Nursing

Faculty Mentor: **Dr. Fred Siegel**
English & Philosophy

How The Modern Portyal of LGBTQ Characters in Media Play A Role In How LGBTQ Individuals and Heterosexual Individuals View The LGBTQ Community.

Media is powerful. Much of the information we receive is through media, whether it be from tv, books, comics, or social platforms. According to the Human Rights Campaign, the amount of people who identify as part of the LGBTQ community has doubled. Media has influenced the public's knowledge of what it means to be a part of the LGBTQ Community. The main objective of my research was to understand how much impact media, specifically tv shows, books, and comics, have when it comes to how we perceive different demographics, in this case, the LGBTQ Community. I first created a bibliography filled with articles, interviews, experiments, statistical data, and video analysis on the portrayal of the LGBTQ community. Then I observed. I spent weeks consuming media, with the LGBTQ community as main characters, side characters, and background characters. Finally, I interviewed those who were part of the LGBTQ Community on their perspective on the benefits and drawbacks of the representation they receive. I have concluded that the modern portrayals of the LGBTQ community in media can provide positive effects when it comes to representation, impacting stereotypes, giving guidance, and assisting in the normalization of the LGBTQ community.

Jyoti Gupta

Bennett S. LeBow College of Business
Business Analytics, Finance

Faculty Mentor: **Dr. Brent Luvaas**
Global Studies & Modern Languages

Examining how foreign stakeholders effect the development of eco-cities in Southeast Asia

In recent years, Southeast Asian nations have embarked on eco-city projects, notable ones being Nusantara, Forest City, Penang South Islands, Tengah, Jurong Innovation District, and Amata City. These cities aim for sustainability, economic growth, and technological advancement. This study investigates how foreign stakeholders in these cities impact their development. Through textual analysis and coding of local and international news reports on eco-cities as well as visual analysis of CGI renderings of them, I argue that the building of eco-cities in Southeast Asia is as much about the interests of foreign stakeholders and investors as it is about sustainability. Involvement of foreign stakeholders emphasizes show: Nusantara and Penang South Islands, has design team consisting of foreigners, held international design contests. Forest City, driven by Chinese investors, serves as a luxurious escape for Chinese citizens. In contrast, Singapore solely developed and invested in Tengah and Jurong Innovation District and they became residential communities and business hubs, respectively. Similarly, Amata City, a Thai developer, has been able to foster industrial centers across Southeast Asia.

Emma Johnson

College of Arts & Sciences
History

Faculty Mentor: **Dr. Kathryn Steen**
History

Art in the Argonne: The Forgotten Story of American Military Engineers

Warfare is a significant topic when trying to understand our history, and while American involvement in World War One was short, it still fascinates. Harrowing tales of men fighting in front line trenches captivate people all around the world. However, the stories of the men deployed in support roles rarely get to see the light of day. Edward Shenton enlisted and was sent to France as a military engineer from the city of Philadelphia, serving with the 28th Division, Pennsylvania National Guard. As an engineer, he built bridges, roads, trenches, camouflage, and other essential structures that allowed an Allied victory to prevail, all under treacherous conditions. During his time in the war, Shenton kept a sketchbook full of his experiences that has survived until today. Using this sketchbook, along with other first-hand accounts, artifacts from the war, and modern scholarly research on the broader topic, I aim to return to Philadelphia the story of a forgotten local hero from America's largest stand of the war, the Meuse-Argonne Offensive. In conjunction with the Atwater Kent Collection and the 103rd Engineer Battalion Armory, I have designed and will soon construct an exhibition to present the offensive though his eyes.

Lourdes Akirtha

College of Arts & Sciences
Physics, Psychology

Faculty Mentor: **Dr. Michelle J. Dolinski**
Physics

Co-Mentor: Dr. Adrian Lozano Sánchez, Ian D. Kotler

Invisible threads in the cosmic tapestry: A study on neutrinos with the Deep Underground Neutrino Experiment

Neutrinos are invisible elementary particles that travel nearly at the speed of light, filling our surroundings at all times. These particles possess intriguing quantum properties and hold the distinction of being the most abundant particles with mass in the universe, playing a foundational role in cosmic processes. The Deep Underground Neutrino Experiment (DUNE) holds the key to understanding the fundamental properties of neutrinos. Operating within the Long-Baseline Neutrino Facility, DUNE employs a high-intensity neutrino beam created by a proton accelerator. After protons collide with a target, the resulting charged particles are directed into a decay pipe to decay into muons and muon neutrinos. The muon beam, which is much easier to measure than the neutrino beam, passes through three muon alcoves. This poster presentation focuses on quantifying and investigating the flux and energy of the muon beam through simulations and data analysis, making contributions to the DUNE mission. Through this analysis, we aim to deepen our understanding of neutrinos and advance our comprehension of the universe.

Charles Ward

College of Arts & Sciences
Physics

Faculty Mentor: **Dr. Gordon T. Richards**
Physics

What are quasars and the difficulties studying them

Quasars, one of the greatest sources of light and energy in the universe, strangely enough are formed from a black hole, the object known to absorb everything, including light. As a black hole absorbs massive amounts of nearby gasses, the gasses rub against each other and end up releasing a massive amount of energy due to friction. While the black hole may absorb any released energy within the event horizon, outside this radius energy is very capable of escaping, causing a brilliant glow and a massive output of radiation. Due to the difficulties of finding Quasars, since they shine with similar luminosity to a galaxy, and the unfortunate fact that some data sets simply don't have data on some wavelengths, studying quasars is difficult. Since the data is collected from telescopes on the ground, and the fainter an object is, the more likely it is for a wavelength to be missing, data being missing is not an uncommon event. After identifying and removing the sets of missing data, the different wavelengths of radiation were plotted graphically as contour plots – for the sake of intercomparison. We seek an understanding of the minimum luminosity and distance for which our data sets are complete and unbiased.

Naomi Hagan

College of Arts & Sciences
Physics

Faculty Mentor: **Dr. Niharika Sravan**
Physics

Creating Machine Learning Training Sets to Observe Kilonovae with HST and JWST

This study explores the systematic detection of kilonovae using NASA's Hubble Space Telescope (HST) and James Webb Space Telescope (JWST). The main goal of this research is to establish a comprehensive training dataset for both telescopes, which can be used to train machine learning models to discern these rare occurrences. Kilonovae, arising from the collision of immensely dense celestial entities like neutron stars or black holes, present observational challenges as they are short-lived and faint, with only one successful detection to date (AT2017gfo). This study iterates over different sources, observational, and detector properties to create an exhaustive training set. Employing both NASA-provided software and custom-coded algorithms, this project aims to devise a method for the identification and observation of kilonovae using HST and JWST. Successful usage of this research would provide crucial insights, enabling the collection of data for further study in gravitational physics and astrophysics.

Maya de Klerk

College of Arts & Sciences
Philosophy, Politics & Economics

Faculty Mentor: **Dr. Meg K. Guliford**
Politics

Exploring the Political Inclusion of Female Ex-Combatants in New Rebel Parties post Successful Transitions: A Literature Review

How, if at all, are female ex-combatants considered in the party following a successful rebel-to-party transition? This question serves as the center of our research investigation. As my primary level of work, I conducted literature reviews on both rebel-to-party transitions and the intra- and post-conflict lives of female combatants. Abundant literature exists on the social lives of female combatants and the isolation faced from their communities, but I found little examining the political inclusion of female rebels into the new party. Studies explore the effects of empowering female ex-combatants at a local level, but there are few national-level studies, which begs multiple questions as we continue this work. Were women involved in the peace negotiations that facilitated rebels transitioning to a political party? If included in the new rebel party, how long did they remain in positions of authority or did their presence only serve as false evidence of the party's support for "feminine" values? Ultimately, we argue that rebel groups prioritize party creation over composition, leaving the disposition of female ex-combatants on the backburner. We will test this on cases of successful transitions in both El Salvador and Ethiopia.

Hannah Slivkanich

College of Arts & Sciences
Criminology & Justice Studies

Faculty Mentor: **Dr. Meg K. Guliford**
Politics

Conceptualizing Ideology: Rebel Ideology and Its Relation to Violence

The literature on the causes and consequences of rebel violence largely centers on capability-based arguments. In a soon to be submitted article entitled "Shaping Violence: Rebel Ideology and Patterns of Violence," my STAR mentor, Dr. Meg K. Guliford presents an argument about rebel violence in which ideology is given primacy. Addressing the questions of What is Ideology? and What are its core features? served as my primary level of effort as a STAR Scholar. I reviewed a host of archival documents and secondary sources and found that many existing definitions of ideology focus mainly on identifiable values or beliefs. However, they fall short when it comes to identifying the critical elements of ideology (the constituency, the challenge, and the objective) that explain the strategies undertaken and the tactics employed by rebel groups. My research determined that Jonathan Leader Maynard's definition of ideology, "a set of systems or beliefs that provide conflict actors with sincerely internalized political worldviews as a structural feature of those actors' social environments, manifested in political norms, institutions, and policy paradigms," presents the best conceptualization of ideology when examining rebel violence.

Anthony Martin

College of Arts & Sciences
Philosophy, Politics & Economics

Faculty Mentor: **Dr. Gwen Ottinger**
Politics

The Growing Need to Organize Transitions from Oil Refining

Oil refineries drive societal dependence on carbon-intensive fuels and emit toxic chemicals when processing crude, leading to dangerous climate changes and harming communities near refineries. We need to transition away from refineries, but the question remains if an effort is being made to do so. This study asks whether refineries are transitioning away from fossil fuels and what drives these shifts.

Our analysis shows no organized move to eliminate crude oil capacity in the U.S., even though total refining capacity has decreased slightly since 2018. 41% of refineries actually increased capacity, while 43% had no change. Seven new refineries were built or proposed, further increasing capacity. A minority of refineries did decrease their crude oil capacity, some by closing or converting to biofuels entirely, resulting in a 3% net decrease in oil refining capacity. However, the majority of these capacity decreases were due to economic factors or failures of aging equipment, and only in a few cases were they representative of a systematic response to the environment or environmental justice concerns. Biofuel refining capacity is increasing, but has yet to replace crude oil capacity.

Anna Zhu

College of Arts & Sciences
Psychology

Faculty Mentor: **Dr. Evangelia G. Chrysikou**
Psychological & Brain Sciences

Co-Mentor: Dong-Ho Kim

Cognitive and Neural Correlates of Learning Preferences

Learning plays an important role in human life, allowing people to acquire information and skills through observation and practice. Different approaches toward learning can affect the proficiency and efficacy of the obtained knowledge and capacities, leading to individual variation in situations that involve problem-solving, innovation, and decision-making. Previous studies suggested that there are two fundamental tendencies when people learn new concepts: Although abstraction learners seek the underlying rules manifested in exemplars, exemplar learners prioritize the trained cue-criterion associations within the given examples. Here, we aimed to illuminate the neural underpinnings of these learning mechanisms. We administered a category learning task that involved learning from sets of pictorial stimuli while recording participants' neural activity with functional magnetic resonance imaging (fMRI). Using specialized brain imaging software, we analyzed differences between successful and unsuccessful learning trials across participants, in conjunction with their behavioral classification as exemplar or abstraction learners.

Jaira Marcos

College of Arts & Sciences
Psychology

Faculty Mentors: **Dr. Evan Forman and Dr. Adrienne Juarascio**
Psychological & Brain Sciences

Co-Mentors: Hannah McCausland (STAR 2017), Lauren Taylor

Examining the Role of Weight Self-Stigma and Social Comparison in Excessive Eating Patterns

Societal expectations complicate eating behavior, such that engaging in social comparison (SC) and weight-self stigma (WSS), may foster excessive eating (EE) to cope. For example, previous research suggests that those with overweight/obesity (OW/OB) are susceptible to hunger when faced with unfavorable social comparison and, compared to those with normal weight, those with OW/OB consume more calories when exposed to weight stigmatizing content. EE is commonly reported among individuals with OW/OB and is an important behavior to address in behavioral weight loss (BWL) programs as EE can maintain OW/OB. We aimed to determine whether WSS and SC are related to EE in BWL. Participants (n = 318) were adults with OW/OB in Project Fitlink (R01DK129300), a BWL trial. Independent sample t-tests compared those with and without pre-tx EE to determine whether those with EE had higher WSS and upward social comparison (USC), and lower downward social comparison (DSC) at baseline. A one-sided significance test indicated that those with EE had higher WSS ($t(316) = -3.48$, $p = <.001$), USC ($t(316) = -1.76$, $p = .040$), and DSC ($t(316) = -2.46$, $p = .007$). WSS, USC, and DSC may serve as risk factors for EE and could be important treatment targets in BWL.

Julian Brown

College of Arts & Sciences
Psychology

Faculty Mentor: **Dr. Danette A. Morrison**
Psychological & Brain Sciences

Private vs Public Schools: What Leads to Student Success?

The public education system in the United States is entrapped by a plethora of issues, most of which are systemic in nature. Reports of chronic under-funding, limited supplies and resources, and shortages of teachers are common for many schools across the nation. For some families, to escape the under performing, underfunded schools, make the choice to send their children outside of their district to private schools for a chance at a better education. However, this option is not afforded to all and remains merely a temporary solution to a more permanent problem. The discourse surrounding how to amend public education mainly surrounds increasing funds, voucher programs, and in some cases banning private schools outright. With this research project, I aim to uncover what exactly increased spending enables in private schools by interviewing students who have attended private schools in their academic career and comparing them against students who have not. In coding these responses to find what these schools were able to do differently, there emerged themes regarding school culture, faculty and administration interaction, and classroom instruction as major benefits within private school system.

Adonia Easie

College of Arts & Sciences
Psychology

Faculty Mentor: **Dr. Amanda NeMoyer**
Psychological & Brain Sciences

Co-Mentor: Nivedita Anjaria

"You Have to Have the Community at the Table": Facilitators & Barriers to Implementing a Novel Record-Clearing Initiative in Philadelphia

As part of an effort to lift 100,000 Philadelphia residents out of poverty, The Promise launched its Jobs & Opportunities Challenge in May 2022. The Challenge focuses on removing employment obstacles associated with a criminal record by funding legal clinics embedded within community events across the city to increase access to record-clearing opportunities. Given that millions of U.S. residents have a criminal record, organizations in other areas might wish to implement similar record-clearing initiatives; however, they would likely require an additional understanding of the implementation process. To generate insights into program development and adoption, I conducted six interviews with representatives from organizations participating in The Promise's record-clearing initiative. Thematic analysis of interview transcripts indicated that participants most often identified prior experience, funding, a strong team, and communication between participating organizations as implementation facilitators. They also identified barriers to implementation, including organizational capacity, external or systemic issues, miscommunication between participating organizations, and the challenges associated with creating something new.

Ajani Levere

College of Computing & Informatics
Computer Science

Faculty Mentor: **Dr. David Breen**
Computer Science

Co-Mentor: Dr. Jane Greenberg

Computational Fish Specimen Classification: Advancing Machine Learning Model Accuracy

Digital specimen metadata is valuable for scientific research and discovery, yet sparse specimen metadata availability restricts its potential. In addition to computational efforts made to remedy this issue, Machine Learning (ML) classification was performed on a computed metadata component, the outline extracted from fish specimen images. An ML model (MLM) approach provided a computational genus classification for a given fish outline. This research improves the MLM's ability to accurately classify fish from their 2D outlines and demonstrates the expressiveness of this computed metadata item. In our analysis, we inspected the outlines of the error cases, followed by a statistical review of their numerical data. We discovered our dataset limited higher MLM accuracy potential. Refactoring the dataset with a reduced feature length thus enhanced our dataset for MLM interpretability. Experimental results indicate a 96% accuracy, a 5% improvement over previous results. These results confirm the outline as a unique and highly distinguishable metadata component. Computing metadata components of this nature aids the development of a more robust metadata catalog for ML researchers.

Teagle Fellow

BumYeol Park

College of Engineering
Computer Engineering

Faculty Mentor: **Dr. Shahin Jabbari**
Computer Science

Co-Mentor: Mihir Rao (STAR 2021)

Measuring the Fairness of Post hoc Explanations

Machine learning systems are becoming increasingly more important to decision making. From predicting a person's credit score to determining whether someone should be given a loan, machine learning is applied along with human supervision. In these situations, simple machine learning models do not fulfill the job, so more complex machine learning models are used. But with complex models comes less interpretability, bringing forth the idea of trust and transparency in decision making. Explainable AI is addressing this issue through post hoc explanations, which simplify the complex machine learning models so they are understandable. But recent research revealed gaps in the quality of post hoc explanations between subgroups separated by race or sex, creating the privileged and unprivileged. In our research, we measured the quality of the explanations through four metrics: complexity, inconsistency, instability, and prediction gap fidelity to three datasets, separating each dataset by a sensitive attribute, race or sex. We also examined how differences in classifiers, perturbations, and constraints affect the metrics. We determined how the values of the metrics change between the privileged and unprivileged with varying factors.

Jainam Kashyap

College of Computing & Informatics
Computer Science

Faculty Mentor: **Dr. Brian Mitchell**
Computer Science

Towards Automated Cloud Threat Detection

As the cloud continues becoming the default deployment paradigm for most computing workloads, organizations must be diligent in protecting against attacks by bad actors. Despite state-of-the-art security technologies, the ultimate responsibility for deploying secure systems falls on the cloud customer, not the provider. Moreover, cloud-native systems are more complex than traditional systems, given that they have many moving distributed parts that require complex configurations to ensure they run as expected.

Our previous research focused on detecting malware-infected cloud systems using Machine Learning. Prominent breaches, like the one Capital One experienced that resulted in more than $1B in fines, were due to cloud misconfiguration errors. Hence, we concluded that additional work was needed to detect these more challenging attack vectors. We focused on creating a simulated cloud-native bank management platform with a load-testing framework to investigate how to detect attacks focusing on exploits that enable access to sensitive data. We are investigating the threshold where our current approach can detect these attack vectors and are using these results to plan our next wave of research to improve our capabilities.

Xander Crankshaw

College of Engineering
Computer Engineering

Faculty Mentor: **Dr. Yusuf Osmanlioglu**
Computer Science

Using Connectomic Brain Data to Classify Autism Spectrum Disorder (ASD) with Machine Learning

Connectomics involves analyzing the connections within the brain. A connectome is a grid of data where each data point represents the connection from one region of the brain to another. The main method of diagnosis for ASD is through examination by an expert physician. Despite ASD being a neurodevelopmental disorder, its diagnosis with neuroimaging has been limited. Our objective is to develop a machine learning algorithm to classify autism, using connectomic brain data. We investigated functional connectomes from the ABIDE Dataset, by using the data coming from NYU site which included 115 individuals in age range [7,32]. We calculated eight graph theory measures for each patient's connectome, including centrality and clustering measures. We explored five machine learning methods including Random Forrest (RF) and support vector machines. We also used phenotypic data to test against current methods. We observed RF to achieve the highest classification accuracy of 65.73% using connectivity data whereas phenotypic data yielded a classification accuracy of 94.36%. In conclusion, although 65% accuracy using connectomic measures indicates that connectivity plays a role in predicting ASD, it is not as informative as phenotypic scores.

Talha Genel

College of Computing & Informatics
Computer Science

Faculty Mentor: **Dr. Yusuf Osmanlioglu**
Computer Science

PREDICTION OF AGE USING CONNECTOME DATA

Introduction: Connectomics investigates connectivity between brain regions. Recently, it was shown that functional and structural connectomes can provide useful information regarding an individual's chronological age.

Methods: We investigated 261 individuals (121 females) in ages [21, 86] with no significant group difference of age distribution across sexes. 40 graph theory measures were calculated for both functional and structural connectome data over 100 and 200 ROI parcellations of the brain using Schaefer atlas. Outliers are removed from the data, leaving 201 individuals in the dataset. Then, correlation between age and graph theory measures were calculated where measures with low correlation ($r<0.15$) were removed, leaving 13 measures. Linear Regression is performed for all the combinations of 13 Graph Theory Measures (8191 different combinations).

Results: In prediction of age, we observed that FC clustering coefficient, reasoning, and processing speed scores are significant predictors which can explain 52% of the variation in age for 100 ROI atlas, and 56% for 200 ROI atlas.

Conclusion: FC clustering coefficient, reasoning and processing speed scores are significant indicators in age prediction.

Hitashi Kalra

College of Computing & Informatics
Computer Science

Faculty Mentor: **Dr. Yusuf Osmanlioglu**
Computer Science

Sex Classification Using Connectomics

Connectomics explores brain connections, which influence behavior and cognition through structural and functional relationships. We explore sex classification using connectomes. We investigated 200 individuals (96 females) from the Human Connectome Project dataset. Using structural and functional connectomes, we first did feature selection and then did sex classification using these features for Support Vector machines by utilizing 5-fold cross-validation. We observed 0.72 classification accuracy in the dataset. This study highlights the potential of connectome-based sex classification and adds to our understanding of gender-related brain differences, laying the groundwork for future research in this rapidly growing field. Finally, our findings pave the path for improved sex categorization approaches and more research into the complex interplay between connectomes and sex-related brain differences.

Afrah Maisa Shaik

College of Engineering
Computer Engineering

Faculty Mentor: **Dr. Yusuf Osmanlioglu**
Computer Science

Exploring the Relationship Between Brain Connectome, Human Cognition and Personality

Background: Connectomics maps the brain's network, unveiling the complexity of cognition and behavior. While research has delved into cognitive functions, the prediction of cognitive abilities and personality using brain connectivity data remains mostly uncharted. This study enters this intriguing field, exploring the links between the brain connectome, cognitive, and social measures of individuals.

Data and Methods: Using structural and functional connectome data of 261 individuals from the 1000BRAINS study, we examined the relationship between brain connectivity, age, sex, and cognitive and social measures through linear regression models. In quantifying brain connectivity, we considered several graph theory measures including betweenness centrality and clustering coefficient.

Findings: Age was a significant predictor of cognition but not of personality type measures. Brain connectivity didn't demonstrate any significant relationship with either domain, signaling a need for further exploration. The implications of these findings are thought-provoking, hinting at fresh approaches to personalized education, therapy, and ways to enrich our understanding of overall well-being.

Velay Fellow

Ishan Patel

College of Computing & Informatics
Computer Science

Faculty Mentor: **Dr. Dario Salvucci**
Computer Science

Using Deep Learning for Human-Like Icon Classification: Towards a Web-Based Teachable Agent

Intelligent agents are computer programs characterized by their ability to perform tasks autonomously. One such type of agent is the web-based teachable agent, which is aimed at automating frequent tasks conducted on the web, such as buying tickets or booking appointments. Our central focus is developing a teachable agent that can learn and execute web-based tasks like humans across diverse web domains. However, to achieve this human-like behavior, these agents should be capable of visually inspecting webpages to identify and interact with common elements seen online. We approached this issue by creating a machine learning model capable of classifying 18 common icons and buttons. The model was trained on a custom dataset formed using manual and API-based image data collection. Using deep learning techniques, we analyzed these images and developed a model that could classify 18 diverse categories of icons with 80%+ accuracy. We plan to integrate this model with a browser extension that will provide the model with real-time screenshots of the active webpage. Through a reasoning system, we can utilize the model's predictions to formulate a series of actions the teachable agent should take to fulfill the designated user objective.

Eray Aktokluk

College of Computing & Informatics
Computer Science

Faculty Mentor: **Dr. Brian L. Stuart**
Computer Science

Combination Algorithm for Multiple Decision-Making Models

Sensor fusion or combining results from different classifier algorithms into more accurate ones is a common concept in the field of computer science. However, combining the results of decision-making models for reinforcement learning agents is a concept that hasn't been explored widely. Because the brain consists of multiple parts, this type of fusion for decision-making can be key to achieving human-level intelligence and learning. That's why this research focuses on developing a new probabilistic algorithm for combining multiple decision-making models using short-term memory for reinforcement and unsupervised learning.

I investigated combining instances of Cybernetic Automata, an alternative approach towards A.I. developed and implemented by Professor Brian L. Stuart. Two Cybernetic Automata models were trained individually on the Skinner box experiment. Responses of these models were used as input to the new combiner algorithm. The algorithm probabilistically selects the output symbol and learning was achieved by adjusting the probabilities. Results showed that the new algorithm shows clear learning behavior for combining multiple decision-making models successfully.

Tsion Bekele

College of Computing & Informatics
Software Engineering

Faculty Mentor: **Dr. Brian L. Stuart**
Computer Science

Resurrecting the ENIAC: Journey into the first programable computer

The ENIAC (Electronic Numerical Integrator and Computer) was one of the earliest general-purpose electronic digital computers and first programmable computer. It was designed and constructed at the University of Pennsylvania's Moore School of Electrical Engineering during World War II. Programming it required the use of plugboards, patch cables, and a control panel with thousands of switches and indicator lights. Despite its limitations, the ENIAC was a milestone in the history of computing as it paved the way for the development of more compact and efficient computers in the following years. The ENIAC, however, has not existed as a whole machine since it was decommissioned in 1955. As a result, we set out to build a three-dimensional virtual reality version, allowing people to experience it in a way that hasn't been possible in almost 70 years. For this project, I used the Irrlicht Engine, a 3D gaming engine, to create an interactive presentation of the ENIAC and afterward connect it to Dr. Brain Stuart's virtual simulator. Now, the experience will be more immersive than just walking around in the static machine as the simulation will be actively running programs and users would be able to see it operate in real-time.

Chris Jarocha

College of Computing & Informatics
Computer Science

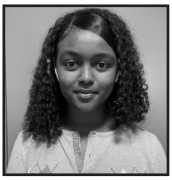
Faculty Mentor: **Dr. Brian L. Stuart**
Computer Science

Exploring Avoidance Conditioning Using A Machine Learning Model

Avoiding threatening stimuli or situations is a core characteristic of adaptive fear in biological organisms. Animals run away from scary noises while humans flee burning buildings. While avoidance conditioning is a well-documented naturally occurring phenomenon, there is little scientific consensus regarding the mechanisms behind this learning property. Furthermore, the evidence behind the utility of unsignaled vs signaled avoidance (warning signals presented before a punishment) is contradictory. My research aims to establish the extent to which an A.I. model can exhibit avoidance conditioning. I utilized the cybernetic automata model, created by Brian L. Stuart to mimic the learning mechanisms of a real brain, for my experiments. A learning environment based on the original shuttle box experiment was created to collect data. The results showed that the model learns to terminate an aversive stimulus via escape behaviors as proposed by Howard Mower's two-factor theory of learning. Moreover, the model showed no significant difference in learning between a signaled and unsignaled experimental setup. Lastly, the data indicate that intense punishments can result in maladaptive avoidance behaviors.

Beamlak Mebrate

College of Computing & Informatics
Software Engineering



Faculty Mentor: **Dr. Brian L. Stuart**
Computer Science

Demonstrating the Turing Completeness of the ENIAC

In World War II, calculating the numbers needed for artillery machines called for the makings of the first programmable computer, the ENIAC(Electronic Numerical Integrator and Computer). Independently, a few years earlier, Alan Turing devised a model of computation and wrote his highly influential paper introducing a Universal Turing Machine: a machine that can solve any computational problem given the appropriate instructions, enough memory, and time. One fascinating aspect of the ENIAC was that it was a physical realization that had the same universality as the Turing Machine. For this research, I demonstrated the Turing completeness of the ENIAC by developing the essential components of a program that will emulate any Turing Machine operated on the virtual simulation of the ENIAC designed by Dr. Brian Stuart. By storing the state of a given problem on the ENIAC's accumulators and using its function tables to store the transition function which specifies the new state, symbol, and direction of the next steps of the problem, a problem can be computed. This research explores the fundamental parts of computers by breaking it down into steps such as the read, move, clear, and write, and shows the essence of computation.

Augustus Sroka

College of Computing & Informatics
Computer Science

Faculty Mentor: **Dr. Brian L. Stuart**
Computer Science

Transcending Dimensions: Unveiling the Potential of Intelligent Learning Systems

The pursuit of artificial intelligence aims to develop systems capable of advanced learning, resembling natural intelligence. My research centers on Dr. Brian L. Stuart's Cybernetic Automata, a computational model that emulates low-level learning abilities, which progressively build into complex behaviors. This model delves into the intersection of psychology and computer science by replicating the renowned Skinner Box experiment within a one-dimensional world defined by two points.

The cybernetic automata model exhibits traits encompassing instrumental learning, reinforced learning, and operant conditioning. My primary objective was to establish the model's faithfulness within a more lifelike Skinner box, granting it complete freedom in a two-dimensional world and further accentuating its plausibility to imitate natural intelligence.

By exploring the capabilities of the model and simulating nature-mimicking learning processes, this research provides invaluable insights into the potential of intelligent systems for replicating both rudimentary and sophisticated learning. The unraveling of adaptive and learning mechanisms in intelligent systems holds profound implications across diverse disciplines, industries, and societal contexts.

Sukriti Dhungel

Bennett S. LeBow College of Business
Economics & Data Science

Faculty Mentor: **Dr. Ellen J. Bass**
Information Science

Co-Mentor: Joseph Glavan

Validating Simulated Data from Multi-Unmanned Aircraft Supervision

Simulation aids in developing operational concepts for complex multi-vehicle supervision tasks. Validating the simulation output for analysis needs is a crucial step. Researchers simulated multi-UAV supervision, defining human operator shift stages based on the first set of aircraft taking off (ramp up), initial aircraft flying and landing and new ones taking off, flying, and landing (steady state), and all aircraft landing at the shift's end (ramp down). The experimental design varied the maximum number of aircraft an operator can supervise (max aircraft) and how many aircraft can take off at a time. I created R scripts to visualize simulation data over different samplings at different rates (1, 5, and 10 seconds). While the ramp up phase should have ended when the peak number of aircraft for the phase were active, the defined ramp-up (RU) phase included multiple peaks. While the ramp down phase should have ended when all active aircraft landed, this phase continued beyond this point. In several trials the peak number of active UAVs never reached the defined max aircraft. Visualizations revealed unexpected outcomes, showcasing the significance of exploratory visual analysis in highlighting trends beyond numerical data.

Velay Fellow

Bhavya Isotia

College of Computing & Informatics
Computer Science

Faculty Mentor: **Dr. Ellen J. Bass**
Information Science

A virtual visualization of Medjool date thinning robot operations from the human operator's perspective

In Israel, Medjool Dates cultivation holds significant economic importance, but it also presents challenges in pruning due to the tree's considerable height, dangerous cutting tools, and the hot temperatures where the trees grow. Researchers are developing a robotic system incorporating vision technology and a robotic arm to facilitate pruning. One active area of development is how to best support a human operator supervising the robot. Critical to the human-robot interaction is where to place cameras to aid the operator in understanding where the arm is and whether it is pruning in the correct location. To support the development of the human-robot interface for the robot, a virtual simulation of the human operator's perspective from the ground would be helpful. For my research I made a visual simulation that would enable the visualization of trees and robotic arms using the software Blender. I modeled the elements of the trees and the movement of the robotic arm. Using Blender's built-in capability, the visualization can be used to support experimentation of camera placement. This contribution aims to facilitate the realization of a functional and efficient robotic pruning system for enhancing Medjool Date cultivation practices.

Loren Lei

College of Computing & Informatics
Computer Science

Faculty Mentor: **Dr. Ellen J. Bass**
Information Science

Co-Mentor: Dr. Bat-Zion Hose

Supporting Traceability of Cognitive Artifact Design Developed through Participatory Design Processes

An important part of improving team-based activities is to document existing processes. Analysts acquire feedback from subject matter experts and iteratively refine existing processes. To support process improvement and standardization, analysts conduct barrier and facilitator analyses, find ways to improve processes, review findings with subject matter experts, and then create cognitive aids. Tracking interim findings and associated rationale helps analysts ensure the final process and aids meet the organization's needs. My research focuses on developing methods to organize and track cognitive aid development. After identifying what critical information is required as well as relevant interrelationships between analyst activities, I developed potential design concepts in Microsoft Visio and Excel, including flowcharts, diagrams, and Gantt charts to capture data and relationships. I compared their functionality. I am working with analysts to collect relevant data for the tracking tool. I am iteratively developing tracking mockups with the project data and reviewing them with the analysts for their feedback. The end goal is to be able to compare processes and findings across the development of cognitive aids at multiple sites.

Krishna Thaker

College of Computing & Informatics
Economics & Data Science

Faculty Mentor: **Dr. Jina Huh-Yoo**
Information Science

Exploring the Feasibility of LLM Chatbots for Dementia Caregiving Information Support

Caregivers play a crucial role in guiding individuals with dementia, providing essential physical and emotional support. Unfortunately, this large and often daunting task does not come with an information guide, leaving caregivers un-supported and in the dark with many questions about how to effectively lookout for the health and safety of both their loved-ones and themselves throughout each stage and phase of the disease. In an effort to provide equitable support accessible by all caregivers, using new revolutionary technology, specifically AI software such as ChatGPT, will be a game-changer. This study aims to test the feasibility of LLM chatbots in providing information support to dementia caregivers.After testing ChatGPT responses to human-generated questions on platforms such as reddit, it is revealed that this chatbot provides a myriad of relevant information, much of which is largely similar to personal responses provided by individuals well-versed in dementia caregiving. However, ChatGPT responses tended to omit specific information regarding dementia-aiding products or medications, for example, when prompted directly. In terms of information support, chatbots show tremendous promise in aiding dementia caregivers.

Yohanna Gebremariam

College of Engineering
Computer Engineering

Faculty Mentor: **Dr. Afsaneh Razi**
Information Science

Leveraging Social Media to Study Social Determinants of Health for People Living with Epilepsy

Epilepsy is a chronic neurological illness that adversely affects various aspects of individuals' lives. The majority of those affected reside in low and middle-income countries, making coping with the condition a significant financial burden for those with the illness and for health care facilities. Conducting medical research is crucial to alleviate this burden. Investigating the social determinants of health (SDOH), or the social factors that affect an individual's health, is vital to achieve a holistic approach to this research.

Analyzing an epilepsy subreddit with 35,300 members, we examined over 26,000 posts and comments using qualitative and quantitative methods. LDA topic modelling method was used to generate prominent topics of posts, resulting in 15 categories. We also used the SSBC (Social Support Behavior Code) developed by Cutrona and Suhr to categorize comment support types. So far, qualitative coding has shown that informational and emotional support emerged as primary themes. We plan to train a supervised machine learning algorithm to classify the comments based on support types. Our results from social media posts aid our understanding of how peoples' lifestyles and experiences are related to their health outcomes.

Velay Fellow

Hansen Smith

College of Computing & Informatics
Computing & Security Technology

Faculty Mentor: **Dr. Afsaneh Razi**
Information Science

Conversational Chat Bots Assisting With Online Sexual Safety

Conversational interfaces, or chatbots, have offered promising results that they may assist customers and patients within numerous fields, like healthcare and support services. However, their potential to enhance youth online safety remains underexplored. Today's youth are prolific users of technology, benefiting from opportunities to connect, learn, and explore. The digital landscape also exposes them to cyberbullying, sexual risks, and mental health issues. This research investigates how chatbots can aid young individuals in mitigating sexual online risks. The study addresses critical questions: How can chatbots contribute to online safety from a youth standpoint, and in what scenarios can they intervene effectively? Through a scenario-based survey, involving a comparison of five distinct chatbot response types, with a group of participants aged 18-24, the research delves into their expectations and perceptions. This provides insights for designing chatbots that safeguard youth online. The study's contributions lie in interdisciplinary understanding and practical design implications, aiming to empower youth and foster a safer digital environment.

Minh Trinh

Bennett S. LeBow College of Business
Economics & Data Science

Faculty Mentor: **Dr. Shadi Rezapour**
Information Science

Decoding LLMs: Unveiling ChatGPT's Human-Like Deception

Generative artificial intelligence (AI) has revolutionized human-AI interactions, but ethical and societal concerns arise due to deceptive AI-generated content. Our research delves into the layers of deception in Large Language Models (LLMs) like ChatGPT, exploring their ability to produce texts without factual basis and the self-deception they trigger in users. Recognizing demographic biases in deceptive word choices through literature review, our study aims to answer whether AI mimics human deception. Having synthesized false human reviews for restaurants, hotels, and doctors, we curate a dataset of over 1000 personas using ChatGPT-generated names reflecting U.S. Census demographics. Furthermore, we test and fine-tune various prompts for ChatGPT to attain human-level deception. After generating reviews for each persona via ChatGPT, we utilize machine learning and NLP techniques to analyze and extract various linguistic biases that can be leveraged for AI-generated content detection. Ultimately, our goal is to gain insights into AI's deception and its implications and refine methods for deception detection. Following STAR, I intend to continue research with my faculty mentor as we investigate diverse contexts and more LLMs.

Samiha Zarin

College of Computing & Informatics
Computer Science

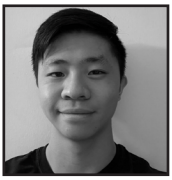
Faculty Mentor: **Dr. Shadi Rezapour**
Information Science

Unmasking ChatGPT: Identifying Deceptive Cues and Stereotypes in ChatGPT-generated deceptive text and Persona-centric analysis

In recent years, Large Language Models (LLMs) such as ChatGPT skyrocketed in popularity, leading them to become a fixture in many people's lives. Important processes and sometimes critical decisions use ChatGPT's output, which is not always truthful. Research related to ChatGPT is increasing, but there has been little research done on identifying deceptive text generated by ChatGPT. Our research aimed to compare cues of deception in human-generated deceptive text with deceptive text generated by ChatGPT personas. For comparison, we took pre-existing datasets of human-generated deceptive doctor, hotel, and restaurant reviews. We then created personas that varied in race and gender, giving them names that implicitly included these characteristics and creating prompts with these names to input into ChatGPT. The output is then analyzed with ML techniques to examine trends and anomalies between both sets of data. Although data analysis is ongoing, preliminary findings suggest that ChatGPT leans into racist and sexist stereotypes when writing reviews from the point of view of a persona. Future research can aim to further explore the discrimination in ChatGPT's output and its varying impacts on day-to-day users.

Devin Leung

College of Computing & Informatics
Computing & Security Technology



Faculty Mentor: **Dr. Hegler Tissot**
Information Science

Fast Ontology-based Retrieval and Search Tool

Within the clinical domain, there are unstructured pieces of text in Electronic Health Records that often have misspelled words, especially drug names. TRIE-based queries and metrics like Edit Distances and Jaro-Winkler Similarity can extract the misspelled drug name in the bodies of text accurately when searching for the correct spelling of the drug name. This research introduces a phonetic TRIE which is a data structure resembling a tree and includes phonetic representation of drug names to make TRIE-based queries more accurate and even faster for the purpose of Natural Language Processing and Named Entity Recognition. Metaphone and Soundex phonetic representations make query speeds faster by shortening words in Electronic Health Records which ultimately shortens large data sets as well. Phonetic representations mainly help to find the original word that was intended from the misspelling by increasing the Edit Distance threshold for the original word.

Vincent So

College of Computing & Informatics
Economics & Data Science

Faculty Mentor: **Dr. Jake Ryland Williams**
Information Science

The Fragility of Market Players: The Impact of Coordinated Bots on S&P 500

Handed with the task of emulating human behavior, coordinated bot efforts, when embedded in public discourse, can have substantial impact on opinions voiced on social media. These socio-technical algorithms can have influence on topic sentiment through impression-leaving tactics, like artificially inflating or deflating specific accounts or social movements. With the ability to have unwarranted consequences on the stability of the U.S. stock market, we look to understand the implications of specific types of users found on the Twitter platform on U.S. financial decisions. Under the expected conditions of market volatility and U.S. expenditure behavior, we analyze the fragility of stock prices found on the stock market index S&P 500, speaking to the susceptibility of human decisions. Utilizing a long short-term memory model, a neural network architecture, we preliminarily predict the closing prices of the S&P, which tracks the performance of the largest 505 companies listed on U.S. stock exchanges. We have set the critical foundation for future work that will be extended through the integration and analysis of text-based features from Twitter using natural language processing methods.

Holly Spletzer

College of Engineering
Environmental Engineering

Faculty Mentor: **Dr. Jason Baxter**
Chemical & Biological Engineering

Co-Mentor: Stefen Moeller

Incorporation of Wind Turbine Blades into the Economy after Their Useful Life

Wind turbines, a prominent form of renewable energy, were implemented into the US power grid approximately 20 years ago. The blades of those turbines have a lifespan of 15-20 years, meaning for the first time, we must decide how to manage them at the end of their useful life. Most turbine blades are primarily made of a fiberglass composite. This material is very weather resistant, as turbines are exposed to the elements constantly. However, the composite is very difficult to recycle as a result. Thus far, we've broken down turbine blade material using heat treatment. Doing so will help us determine the ideal recycling technique by learning more about the materials' properties and behavior in various circumstances. My work primarily focused on running our tube furnace and collecting data on mass loss, material behavior, and chemical composition. I also used FactSage software to make predictions about how composites can be combined with other waste materials to form light weight aggregate for construction applications. Overall, the goal of this project is to support the surge of wind energy as a primary power source while upholding values of waste minimization and promoting a circular economy.

Kiana Ahmari

College of Engineering
Chemical Engineering

Faculty Mentor: **Dr. Richard Cairncross**
Chemical & Biological Engineering

Data Analysis of a High-Altitude Balloon during Solar Eclipses

Stratospheric ozone and tropospheric ozone (O3) have an important impact on human health. For instance, stratospheric O3 shields the Earth from UV radiation while tropospheric O3 can cause asthma in certain individuals. Despite their differences, the formation and degradation reactions of stratospheric O3 and tropospheric O3 are both photochemical. Studies have shown that ozone concentrations in the stratosphere and troposphere slowly decrease at night. However, there is very little data addressing how ozone concentrations respond to short periods of darkness, such as during a total eclipse.

This project, supported by the Nationwide Eclipse Ballooning Project, uses high-altitude ballooning as a tool for measuring stratospheric ozone response to a rapid change in sunlight during the upcoming October 2023 and April 2024 eclipses.

The ozone sensor attached to our high-altitude balloon is En-Sci's Electrochemical Cell (ECC) Ozonesonde. To properly receive the data being sent from the sensor, we designed and built a datalogger that decodes the sensor's UART output and stores them within an SD card. To test the accuracy of the sensor, we also constructed a calibration curve with an ozone generator.

Nursultan Zhanabay

College of Engineering
Chemical Engineering

Faculty Mentor: **Dr. Richard Cairncross**
Chemical & Biological Engineering

High-Altitude Balloon Measurements of Atmospheric Dynamics During Eclipse Events

The Nationwide Eclipse Balloon Project (NEBP) is a large multi-university initiative aiming to capitalize on the unique opportunity presented by solar eclipses to observe atmospheric phenomena. A tea
m of students at Drexel and collaborators Springside Chestnut Hill Academy are constructing and testing multiple payloads to be deployed on High Altitude Balloons (HAB) during October 14, 2023, and April 8, 2024 eclipses. This poster focuses on design, construction, and testing of a customized ozone-sensing payload. The project's central objective is to examine how eclipse events impact ozone levels in the stratosphere, because formation and degradation processes of ozone are photochemical. These reactions might not happen during the eclipse, where there will be low amounts of photons. Additionally, another scenario remains uncertain during eclipse and afterwards: will ozone concentration increase, decrease or stabilize? This study shows that we can assess ozone photochemistry as it ascends the atmospheric column using an EN-SCI Ozonesonde device. We launched the device in a tethered field test on 16 August and successfully established the relationship of ozone concentration and altitude for the range of 0-400 ft above ground level.

Annette Kroes

College of Arts and Sciences
Environmental Studies & Sustainability

Faculty Mentor: **Dr. Maureen Tang**
Chemical & Biological Engineering

Co-Mentor: Karla Negrete

Combatting the Invasive Spotted Lanternfly with Blob Detection

The Spotted Lanternfly (*Lycorma delicatula*) is an invasive insect currently occupying the Mid-Atlantic United States. Lanternflies may lay egg masses on train cars, under trucks, and on storage crates, which allows rapid spread of the pest across state lines. This project seeks to develop an image processing algorithm that can automatically detect egg masses in spaces where humans themselves cannot safely go, using sample photos taken at various angles. OpenCV, a Python library, contains a SimpleBlobDetector that recognizes blobs in images based on criteria including area, color, circularity, convexity, and inertia ratio. The detector has the potential to identify and flag egg masses for removal. In this work, we apply this tool to a code loop that iterates through sample images and study the algorithm's success when different maximum and minimum parameters are entered for each criterion. We also study the successes of the different thresholding methods that are used to prepare each image for processing. Further studies should investigate other image processing tools, such as Skimage, and compare the efficiency of each algorithm.

Chandler Turner

College of Engineering
Architectural Engineering

Faculty Mentor: **Dr. Ivan Bartoli**
Civil, Architectural & Environmental Engineering

Multipurpose Wireless Sensors for Rapid Assessments of Bridge Structures

Modern civil infrastructure assessment technology could streamline the assessment process and provide real-time data insights, enabling informed decision-making, and proactive maintenance strategies. For bridges, an approach is Structural Identification (St-Id) which is a 6-step process to guide the use of sensing systems and simulations needed to perform structural assessment.The present work focuses on step 1 of 6 of St-Id on the Pencoyd I-76 viaduct in Bala Cynwyd (PA), transforming blueprints, field-collected images, and preliminary sketches into a detailed online 3D model via REVIT software. Step 1 is the essential preparatory work for the successful use of St-Id, since it helps in visualizing the complexity of the structure and is crucial to successfully executing all steps of this process which include structural analytical modeling, field testing, data interpretation, structural model update, and simulations of extreme loading scenarios for structural assessment.

St-Id, if properly used, could successfully transform the management of structures such as bridges, especially with the development of increasingly reliable wireless sensing systems for structural testing and the advances in modeling and other areas of engineering.

Noelle Lilan

College of Engineering
Environmental Engineering

Faculty Mentor: **Dr. Zhiwei Chen**
Civil, Architectural & Environmental Engineering

Co-Mentor: Manlin Gong

Intersectional Spatial Inequities in Access to Critical Facilities in Philadelphia

Access to critical facilities such as schools and hospitals is essential for societal well-being and prosperity. Previous studies have revealed spatial inequity in the distribution of access to these facilities across different geographical areas with different sociodemographic composites. However, these studies have typically considered spatial inequity with respect to different sociodemographic groups independently, leaving the complex interplay of these attributes and their collective impact on spatial inequities inadequately explored. This study addresses this knowledge gap by studying access to two types of critical facilities -- schools and hospitals -- in Philadelphia. This is achieved by retrieving sociodemographic data from the U.S. Census Bureau, and information on the road network and facilities in Philadelphia from OpenStreetMaps. Access to these facilities is calculated using the distance to the nearest facility. Finally, spatial mismatch and inequality indexes are used to analyze the spatial distribution of access to these facilities. By adopting an intersectional lens, this research contributes to understanding how various sociodemographic attributes collectively shape the landscape of access to critical facilities.

Velay Fellow

Michael Krieger

College of Engineering
Civil Engineering

Faculty Mentor: **Dr. Patrick Gurian**
Civil, Architectural & Environmental Engineering

Impacts of Flow Velocity on Biological Growth

Millions of dollars are spent yearly to ensure that the water we drink is clean and filtered. However, lesser emphasis is put on what happens to the water once it comes into a house or building. Water leaving a plant is safe for drinking and clean, but once it enters the pipes of a building, the biofilm that has been forming on those pipes can leach off into the water and carry opportunistic pathogens, such as *Legionella*, non-tuberculous mycobacteria, and *Pseudomonas aeruginosa.* These microbes can cause diseases and harm whoever consumes them. When ammonia is present, some microbes grow through a process called nitrification, in which the ammonia in the water is oxidized and turned into nitrite and nitrate. The end of the process, and the most concerning part, is that carbon then gets fixed which allows for and is a building block for biological growth by many organisms, including potentially opportunistic pathogens. The test bed we use simulates twenty-eight different pipe conditions in a systematic and controlled experiment. Seven different tests are run on each pipe, and once analyzed, they will help lead us to a conclusion on the most ideal pipe conditions to limit microbial growth and promote the safety of drinking water.

Lamia Begum

College of Engineering
Mechanical Engineering

Faculty Mentor: **Dr. Simi Hoque**
Civil, Architectural & Environmental Engineering

Occupant Comfort & Stress Study

There is limited research on how indoor environmental quality (IEQ) affects stress quantitatively. As a result, we developed a longitudinal study where participants will undergo combinations of conditions while answering the comfort and stress surveys, which are based on the Center for the Built Environment (CBE) guidelines. The survey questions will measure perceived stress and comfort while their physiological data is collected to compare. While they answer questions, the conditions of the room will be manipulated, and these conditions will be measured through several devices. First are the ARANET sensors, which measure the temperature, humidity, and CO2 levels of the room. The PASCO light sensors measure illuminance, and the sound level meter measures noise at an A-weighted decibel level. These sensors actively collect data, and once the data is collected, we will be looking at how the participants answers to the survey correlate with the environmental conditions they experienced. A preliminary data analysis using statistical methods is to be performed to find this correlation. The findings from this study will help engineers design better-performing spaces that are responsive to occupants' comfort and stress.

Amos Zou

College of Engineering
Civil Engineering

Faculty Mentor: **Dr. Jin Wen**
Civil, Architectural & Environmental Engineering

Impact of indoor environmental quality on stress and comfort

Modern healthcare facilities often lack patient-centered designs, failing to consider occupant comfort and stress. The end goal of this research is to develop an adaptive indoor environment that values patients' needs first, improving general experience and outcomes. However, a gap in research needs to be filled first, which is to develop a correlation between indoor environment quality (IEQ) and quantitative stress levels. Thus, this study focuses on developing a human subject experiment to find the quantitative correlation between six IEQ variables: temperature, humidity, airflow, lighting, smell, and acoustics, and occupants' stress.

Using a fractional factorial design, sixteen combinations of IEQ variables, measured through environmental condition sensors, are designed. Occupants' comfort and stress under these changes in IEQ will be measured in both physiological responses and survey studies. Physical data correlated with stress, such as heart rate, are recorded through nonintrusive wearables. Surveys are designed to solicit self-reported comfort and stress levels. Establishing a connection between the changes in environment to these responses will allow for an individualized, optimal IEQ to reduce stress.

Ruby Ihediwa

College of Engineering
Computer Engineering

Faculty Mentor: **Dr. Kapil R. Dandekar**
Electrical & Computer Engineering

Co-Mentor: Malvin Nkomo

Design of an embedded system controller for a reconfigurable intelligent surface (RIS) testbed using a Programmable System-on-Chip (PSoC

Reconfigurable Intelligent surfaces (RIS) are part of the next-generation Internet of Things (IoT) applications. It is a high-density antenna array that provides dynamic control of propagation channels to enhance communication links between legitimate nodes or impair eavesdropping/interfering links. In general, the RIS can be thought of as an electronically configurable "lens" or "mirror". The controller unit controls the RF (Radio Frequency) switch ON/OFF state. My research focuses on utilizing a programmable system-on-chip (PSoC) embedded controller to enable reconfigurable control for the high-density antenna array.

The PSoC microcontroller integrates both analog and digital subsystem functions on a single chip. The PSoC includes programmable logic to create digital logic circuits and flexibility to incorporate specialized functions that are ideal for a control system that undergoes vast reconfiguration. The PSoC Creator IDE is used to design and reconfigure the digital and analog subsystems hardware and provides a firmware programming interface for the C programming language. To debug and program the system, the MiniProg4 is used allowing for an ease-of-use interface in an otherwise complex internal system.

Velay Fellow

David Volchonok

College of Engineering
Electrical Engineering

Faculty Mentor: **Dr. Gary Friedman**
Electrical & Computer Engineering

Locomotion of Paired Solid Spheres Through Soft Materials

Abstract: Locomotion of a small device through soft media such as living tissue remotely actuated by magnetic field is analyzed, in the context of potential medical applications. The device consists of two differently sized magnetized or magnetizable spheres of millimeter or sub-millimeter diameter, interacting with each other magnetically while mechanically disconnected. A controlled, changing magnetic field transfers energy to the device, while the device itself executes a reversible linear motion gait by increasing and decreasing the distance between the spheres' centers. Likewise, the capabilities of this device to use the transferred energy to rotate through a soft medium are analyzed and tested through a simulation written in F#, the parameters of which are based on a previously developed model of solid sphere's motion through such a medium.

Yarileldy Payano

College of Engineering
Computer Engineering

Faculty Mentor: **Dr. Nagarajan Kandasamy**
Electrical & Computer Engineering

Co-Mentors: Abhishek Kumar Mishra, Ilknur Mustafazade

A Comparative Analysis Between Convolutional Neural Networks and Spiking Neural Networks

Engineers are looking for new optimizations to satisfy societal demand as society continues relying on technology to improve different aspects of their everyday life. Additionally, accuracy and efficiency are focal points when making new powerful technology. As a result, engineers are optimizing different computer processing methods like machine learning. Neural Networks are a form of machine learning that has allowed the rise of Artificial Intelligence (AI and has been introduced to software systems to classify images and analyze data into hardware. Although relatively new, Neuromorphic Computing addresses technological demand by attempting to make the design of the central processing unit (CPU) to be more like the human brain by merging memory and processing units. With Spiking Neural Networks (SNN) put in place, neuromorphic computing can mimic the human brain's ability to adapt and evolve to new information. By exploring convolutional neural networks implemented on standard CPUs and their spiking neural network equivalents implemented on neuromorphic CPUs, one can compare their efficiency and accuracy to ultimately determine what can still be improved in Neuromorphic computing.

Velay Fellow

Poorv Lal

School of Biomedical Engineering,
Science & Health Systems
Biomedical Engineering

Faculty Mentor: **Dr. Gail Rosen**
Electrical & Computer Engineering

NBC Genomic Database

There is biodiversity within microbial communities of microscopic organisms. Researchers need a way to identify which organisms are present within their samples. This lab works to create an iterative algorithm that identifies whether it is a known or unknown organism (novel species). It then takes the unknown organisms to pseudolabel and feeds them back into the classifier, so it can better categorize related DNA fragments. My part in this is to 1) compare the log-likelihood scores, a measure of how fragments relate to each other, given by our Naive-Base Classifier (NBC) to a threshold to identify which organisms are known vs. novel species. The known are then given species labels. Next, 2) cluster the novel species' genetic fragments using the log-likelihood information from part 1). Then 3) feed the pseudolabels back into the classifier so that it can identify the previously unknown information. This cycle of steps 1-3 repeats until a few samples are left unknown.

Favour Iwueze

College of Engineering
Mechanical Engineering

Faculty Mentor: **Dr. Yury Gogotsi**
Materials Science & Engineering

Maximizing the specific capacitance of supercapacitor material by pre-intercalating MXene electrodes with cation

MXene has tunable properties (e.g. structure and surface chemistry) that make it a suitable material for ion storage and transport, and competitive for broader fields like energy storage and ion removal. Among these properties, the interlayer-spacing of MXene can be tuned to study ion transportation and charge storage. There have been methods to adjust the interlayer-spacing of flakes, by applying a variety of intercalant species like ions (Li+ and Na+), solvent molecules like water, and with nanoparticles like graphene nanoparticles. This research involves using large cations (CTA+ from CTAB, hexadecyltrimethylammonium bromide) to intercalate between Ti3C2 flakes to increase the d-spacing, in order to determine the amount of CTAB used that would yield optimal charge storage capacity of electrode. This study covers the etching of 36 nm long Ti3C2Tx flakes via the MILD method. Subsequently, different Ti3C2Tx electrodes were synthesized using vacuum filtration with different concentrations of CTAB. With the cation-pillaring effect, their electrochemistry profile was measured. An optimized peak current of 0.175 mA/g is obtained at a Ti3C2:CTAB mass ratio of 5:100.

Prastuti Upadhyay

College of Engineering
Materials Science & Engineering

Faculty Mentor: **Dr. Yury Gogotsi**
Materials Science & Engineering

Co-Mentor: Dr. Stefano Ippolito

Fast Gelation of MXene Induced by Metal Ions

Hydrogels based on 2D transitional metal carbides and nitrides (also known as MXenes) are biphasic materials made of porous, permeable, and robust solids as well as water, showing a wide range of applications, spanning from electronics, electromagnetic interference shielding, and energy storage, to catalysis, sensing, and biomedicine. This project focuses on an innovative synthetic route to attain MXene hydrogels via a metal ion-induced gelation process. Materials processing was done through diverse deposition techniques (e.g., spray coating, vacuum filtration, blade coating). Moreover, the study also covers the production of aerogels, obtained by the freeze-drying approach starting from the corresponding hydrogels. We explored the effects of different metal ions on MXenes hydrogels and aerogels and investigated their enhanced/innovative properties and performance. In this regard, we capitalized on a long list of multiscale characterization techniques, such as rheological measurement, scanning electron microscopy, and conductivity. The focus was also laid on the potential applications of MXene hydrogels and aerogels in different fields, such as air filtration, bioelectronics, and sensing.

Jaxon Weiss

College of Engineering
Materials Science & Engineering

Faculty Mentor: **Dr. Yury Gogotsi**
Materials Science & Engineering

Co-Mentor: John (Ruocon) Wang

Using Titanium Carbide MXene as a Current Collector in Anode-Free Lithium Metal Batteries

As of 1991, lithium-ion batteries (LIBs) have been the most prominent commercialized batteries on the market. Though effective and practical, the energy density of these batteries is beginning to reach its theoretical limit. As the insatiable need for energy is rapidly increasing, the demand for more efficient batteries requires new avenues of technology to be explored. A promising new technology aims to eliminate the need for a graphite anode, which occupies about half the volume of a LIB, to create anode-free lithium metal batteries (AFLMBs). The issue with AFLMBs is that lithium dendrite growth within the batteries is sporadic, causing them to short-circuit unpredictably, making them unsafe. Literature shows that using MXenes as the current collector for lithium metal anode can mitigate dendrite growth. MXenes, a two-dimensional transition metal carbide nanomaterial discovered at Drexel, possesses properties that have potential to aid in more uniform lithium plating and solid-electrolyte interphase (SEI) formation. My research seeks to understand the structure and processing conditions under which titanium carbide MXene allows for uniform lithium plating so that AFLMBs can one day be a safe alternative to LIBs.

Yael Passy

College of Engineering
Materials Science & Engineering

Faculty Mentor: **Professor Joshua Agar**
Mechanical Engineering & Mechanics

Enabling Ferroelectric Characterization through BE-PFM and Python API

This project implements Band-Excitation Piezoresponse Force Microscopy (BE-PFM) for ferroelectric material analysis. The aim is to make this technique, mainly used at facilities like Oak Ridge National Laboratory, accessible in labs. It involves developing signal processing algorithms to apply BE-waveforms to AFM tips, creating a measurement setup with a National Instruments oscilloscope, and building a flexible switching spectroscopy arrangement with a Python interface.The main goal is to enable switching spectroscopy on various ferroelectric materials. Signal processing makes sure that the BE-waveform is applied precisely to the AFM tips. This shows the dynamics of ferroelectric switching while reducing the effects of resonance. A Python API connects Python and the setup, simplifying control, data acquisition, and analysis.Using an Oxford Instruments Cypher AFM, researchers can study BE-PFM on materials like PbZrO3, BTO, and emerging ferroelectrics. Integration with tools like Pycroscopy enhances data analysis. This project democratizes BE-PFM, enabling researchers to uncover ferroelectric behavior and advance material studies.

Sean Rassa

College of Engineering
Electrical Engineering

Faculty Mentor: **Dr. Joshua Agar**
Mechanical Engineering & Mechanics

Physics-Constrained Neural Network Fast Approximates of Reflection High-Energy Electron Diffraction

Pulsed Laser Deposition (PLD) is a widely used material science technique that deposits material onto a substrate. Reflection High Energy Electron Diffraction (RHEED) is commonly used to monitor the surface crystallinity of the deposited material. These techniques combined allow controlled growth for material fabrication. Typically, these systems rely on video cameras operating at 60-120hz, which fail to capture growth dynamics at practical deposition frequencies. By operating at 500hz, high-speed RHEED can provide real time insight into growth processes obscured by slower acquisition systems. Using this high-speed and information dense imagery has allowed the development of a neural net that can parameterize RHEED results in real time. This neural net is based on a physics-constrained LeNet5 that serves as a fast approximate for fitting RHEED. In the future, this model will be implemented on a Field Programmable Gate Array (FPGA) connected to the high-speed camera, allowing for real time control and adjustment of the testing devices.

Tasfia Wasima Rahman

College of Engineering
Mechanical Engineering

Faculty Mentor: **Dr. Ania-Ariadna Baetica**
Mechanical Engineering & Mechanics

Synthetic Biological Circuits: Analyzing Sensitivity in a Dynamic Environment

The human body is highly efficient at coordinating multiple functions and responses simultaneously, using a complex web of feedback mechanisms. These mechanisms can be conceptualized into simple "biological circuits," meaning, inputs given to the circuit produce a particular output. Due to their resemblance to electronic circuits, these circuits can be engineered synthetically, which would help achieve any desired response to a given change. For example, a biological circuit may be designed to detect cancer cells and in response trigger the automatic release of molecules to kill those cells. However, synthetic circuits cannot be utilized unless they are stable in the ever-changing cell environment. Previous research has found that cells commonly use negative feedback mechanisms because of their insensitivity to most biochemical parameters. In this study, we broadened this sensitivity analysis and found that negative feedback is robust when biochemical rates of production and degradation are sufficiently large. We further applied this analysis to two additional circuits: positive feedback and the toggle switch. Moreover, our analyses provide insight into how cell circuits can be reliably designed and used in changing environments.

Velay Fellow

Ahmet Yalim Kiral

College of Engineering
Mechanical Engineering

Faculty Mentor: **Dr. James Tangorra**
Mechanical Engineering & Mechanics

Co-Mentor: Nicholas Marcouiller

The Development of an Active Bending Pectoral Flipper Inspired by the California Sea Lion

The California Sea Lion (*Zalophus Californianus*) is being studied as a biological model for improving propulsion in unmanned underwater vehicles (UUV). The focus of this work is to develop a bio-robotic system of the sea lion's pectoral flipper that models the active flexion and variable stiffness for the purpose of understanding their impact on propulsive forces. The robotic system utilizes servos motors and compression cables to control the bending at the wrist portion of the flipper which controls the active flexion and variable stiffness. When actuated the stiffness of the flipper was able to achieve an increase of up to 110% and actively flex up to 50 degrees at the wrist. This system will be used for further tests to evaluate the thrust forces in the water and understand the modeling of an active bending fore flipper.

Adekunmi Lala

College of Engineering
Mechanical Engineering

Faculty Mentor: **Dr. Ajmal Yousuff**
Mechanical Engineering & Mechanics

Co-Mentor: Luke Simeone

ASCEND: Leaping Beyond Limits in Space Exploration

Of recent, there has been an increased interest in exploring beyond Earth. One of the technologies used to explore the moon and the planets in our solar system, specifically Mars, is the rover (an exploration device designed to move across the solid surface of another planet). Alongside these rovers are astronauts also sent to explore Mars. However, the size of these rovers (similar to a small SUV) and the astronauts themselves can limit their access to certain areas. Hence, I, alongside my two teammates, built ASCEND (Advanced Spring Craft for Exploring New Destinations). A 1kg, 30cm by 19.5cm by 18cm two-wheeled rover with detachable wheels that allow it to fit in an astronaut's backpack. It also has a leaping mechanism that allows it to jump over obstacles about 8 inches high. This mechanism involves a motor that operates a gear system to compress two springs. Once the springs reach a specific point of compression, they are released and cause the rover to propel upwards. By using the principle of conservation of energy, I was able to select the appropriate springs to achieve the desired height for the rover's jumps. Overall, this project offers a more compact, safe, and cost-effective option for space exploration.

Andrew Wang

College of Engineering
Mechanical Engineering

Faculty Mentor: **Dr. Ajmal Yousuff**
Mechanical Engineering & Mechanics

Co-Mentor: Luke Simeone

Revolutionizing Martian Exploration and Beyond with ASCEND: The Advanced Spring Craft for Exploring New Destinations

Martian exploration has intrigued humans for decades. While large-scale rovers have transformed Mars exploration, their limitations in mobility and size raise concerns for future human missions. To address these challenges, my group and I set out to design a small-scale, agile exploration rover that overcomes the constraints of current rovers.Our rover boldly breaks convention, using a sleek 2-wheel design with a 9 cm radius. We also engineered a spring-gear mechanism that harnesses the potential energy from compressed springs, enabling the rover to jump over obstacles up to 21 cm in height. This design allows the rover to move omnidirectionally, enabling precise navigation in caves and confined spaces.Though we envision future versions to be autonomous, in its current state, ASCEND is controlled wirelessly via Bluetooth. Its rechargeable battery ensures prolonged use, while a space-efficient design permits transport within a backpack. We also aim to add a video camera in the future.My role on this project centered on the battery, power output, and design and construction of the spring mechanism. Through its compact size and dynamic movement, ASCEND lays the groundwork and expands our exploration capabilities on Mars and beyond.

Andy Zhang

College of Engineering
Mechanical Engineering

Faculty Mentor: **Dr. Ajmal Yousuff**
Mechanical Engineering & Mechanics

Co-Mentor: Luke Simeone

ASCEND: Traversing Martian Terrain

When humans land on Mars, they will need rovers suited to efficiently gathering information about potentially dangerous environments. My team's project, ASCEND (Advanced Spring Craft for Exploring New Destinations) is a 1 kilogram, 19.5 cm wide, 30 cm long, exploratory rover. Its compact construction allows it to be transported without expending significant energy or storage space.

I designed the body of the rover in Solidworks and manufactured it with polylactic acid through 3D printing. It is made to survive drops from medium heights through shock absorption in its 2 airless, 18 cm wheels. At its core, a reduction gearbox loads a compression spring which, upon release, launches the rover about 20 centimeters in the air. This allows the rover to navigate potential obstacles such as rock formations in a cave environment. The rover is controlled wirelessly through Bluetooth with a range of about 9.1 meters.

Further development may include the addition of night vision cameras and ultrasonic sensors for object detection and mapping. The design can also be scaled by programming a swarm of autonomous rovers to sweep large areas of interest for rapid discovery of generally inaccessible locations that hold geological interest.

Caroline Kokolus

College of Nursing & Health Professions
Nursing

Faculty Mentor: **Dr. R. DiMaria-Ghalili**
Doctoral Nursing

Co-Mentor: Karissa Barbarevech, Dr. Peter A. Lewin

Validation of the Timing Mechanism of an Ultrasound Prototype to Treat Chronic Wounds in the Home Setting

Chronic legs wounds occur more frequently in older adults and are associated with increased healthcare costs and decreased quality of life. New wound treatment options delivered in the home setting to accelerate wound healing are needed. Ultrasound therapy is a novel wound treatment therapy that is being tested in the outpatient setting by trained research staff. The long-term goal is to enhance the ultrasound device for use in the home setting by an older adult or their family caregiver. The at-home device would need a timer to ensure the ultrasound dose was administered as prescribed by a healthcare provider. This project was designed to validate the timing mechanism of 16 ultrasound prototypes. Each device was programmed with a different treatment duration and frequency ranging from once every 24 hours for 5 minutes to 3 times a week for 45 minutes. We tested the validation of the timing mechanism in the lab setting by recording the start and end time according to the treatment duration and frequency and compared the recorded start and end time with the data on the memory card inside each device. The findings from this project will help inform the ongoing development of the ultrasound prototype.

Teagle Fellow

Manya Mittal

Dornsife School of Public Health
Public Health

Faculty Mentor: **Dr. Renee M. Turchi**
Community Health & Prevention

Addressing Fire Safety Among Families with CYSHCN via a Home Assessment Study

Background: Children and youth with special health care needs (CYSHCN) are at higher risk than typically developing children during emergencies, such as house fires.
Methods: Families of CYSHCN with medical homes in PA participated in an emergency planning virtual home assessment receiving (1) targeted pre/post interviews; (2) materials to improve preparedness in emergencies, and (3) referrals to medical providers/ community partners for as-needed support related to preparedness, the CYSHCN's medical conditions, or social determinants of health. We analyzed the fire safety domain of this study before and after the intervention by repeated measures analysis of 14 items in the interview.
Results: 170 families completed initial and 148 completed follow-up interviews. Fire safety preparedness levels at baseline were relatively high. After the intervention, the preparedness levels improved, with metrics of having fire extinguishers and clearing walking paths of obstructions showing statistical significance comparing pre/post measures.
Conclusion: In this study of CYSHCN, a preparedness assessment/intervention improved metrics of fire safety. Specific resources for CYSHCN during fire safety/planning are warranted given their risk of harm.

Jafaru Levere

Pennoni Honors College
Custom-Designed Major

Faculty Mentor: **Dr. Stephanie Hernandez**
Epidemiology & Biostatistics

Healing Carceral Wounds: Black Male Adolescents, Parental Incarceration, and Considerations for Mental Health Intervention

Black children are more likely to have incarcerated parents, and thus, the burden of parental incarceration (PI) on the mental health of children is disproportionately felt by Black children. As this disparity is often overlooked in scholarship, we seek to understand the impact of parental absence caused by mass incarceration on mental health (MH) through the lens of Black male adolescents (BMA). This study comprises three reviews of seminal literature contextualizing PI as a determinant for BMAs' MH, guided by abstract screening, synthesis, and limitation identification. In tandem, an interview with a BMA-serving organization was conducted to facilitate a literature gap analysis, comparing BMA-tailored interventions with literature recommendations for best practices. Findings indicate that parental estrangement compounded with few social supports tailored for BMAs exacerbates susceptibility to poor MH outcomes. We propose an expansion of cross-sectored, community-oriented interventions that alleviate the emotional and socioeconomic (e.g. healthcare access) burdens of PI. Proposed interventions could reduce inequity in mental health policies, granting BMAs protective factors for poorer mental health outcomes.

Madeline Plummer

Dornsife School of Public Health
Public Health

Faculty Mentor: **Dr. Agus Surachman**
Epidemiology & Biostatistics

Socioeconomic Status, Perceived Control, and Inflammation Among Cancer Survivors

Background: Recent research suggests that perceived control, or the belief that one has control over one's life outcomes, may mediate the association between socioeconomic status (SES) and inflammation. However, little is known about whether this association persists among cancer survivors. The goals of this study were three-fold: 1) to examine SES differences in perceived control, 2) to test SES differences in inflammation, and 3) to examine differences in inflammation based on perceived control.
Method: Data are from 298 cancer survivors (87.54% white; Mean age = 63.6) who participated in the Midlife in the United States (MIDUS) study wave 2 and Refresher. SES was measured by participant education, and the two markers of inflammation were interleukin-6 (IL-6) and c-reactive protein (CRP). Hypotheses were tested using a series of independent sample t-tests.
Results: Relative to those with bachelor's degrees, participants with lower education showed lower perceived control and elevated inflammation. Furthermore, lower perceived control was associated with elevated inflammation.
Discussion: Our findings provide early evidence that perceived control may mediate the association between SES and inflammation among cancer survivors.

Riyana Bhatt

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **Dr. Michael Bouchard**
Biochemistry & Molecular Biology

Co-Mentor: Nima Sarfaraz

Role of lncRNA FAM99A on apoptotic signaling pathways in liver cancer HepG2 cells

In 2023, the Centers for Disease Control and Prevention declared cancer as the second leading cause of death in the United States. Globally, liver cancer is deemed one of the most commonly diagnosed. Hepatitis B is a severe liver disease caused by a Hepatitis B virus (HBV) infection; a chronic HBV infection increases the likelihood of developing hepatocellular carcinoma (HCC), the most common form of liver cancer. Long noncoding RNAs (lncRNAs) are RNA transcripts classified by their greater than 200 nucleotide length and lack of protein-coding abilities. Although once believed to have no vital cellular function, they are now known to play critical roles in HCC development. We determined that lncRNA FAM99A is highly expressed in healthy hepatocytes but of negligible levels in liver cancer HepG2 cells and HCCs, thus hypothesized to function as a tumor suppressor. We used western blotting to assess expression of proteins that regulate apoptosis, such as Bax, Bcl-2, and cleaved caspase-3, when FAM99A was overexpressed in transformed liver cell lines, to determine if FAM99A affects apoptotic signaling pathways. A better understanding of FAM99A could provide further insight on HCC development and defining novel therapeutic targets.

Velay Fellow

Drexel University College of Medicine

Martin Vallejo

School of Biomedical Engineering,
Science & Health Systems
Biomedical Engineering

Faculty Mentor: **Dr. Irwin Chaiken**
Biochemistry & Molecular Biology

Co-Mentor: Dr. Charles Ang and Dr. Gabriela Canziani

Tracking of Conformational Change of SARS-CoV-2 caused by Lectin

The SARS-CoV-2 virus depends on spikes for infecting ACE2-expressing tissues. Cyanovirin-N (CV-N) lectins permanently neutralize SARS-CoV-2 pseudovirus by targeting spike glycan. This finding could aid COVID-19 treatment and prevention. However, the mechanism behind lectin-triggered spike inactivation remains unknown. Our STAR project employs antibodies (CR3022, VHH-72, 2-4) targeting the Receptor Binding Domain (RBD) to detect lectin-induced changes. We aim to assess if CV-N-induced conformational shifts can be detected by antibodies. Pseudoviruses, infective to HEK293-ACE2, were produced. Antibody binding was assessed using SPR and ELISA. Plates with adsorbed S1 and RBD in side-by-side wells containing CV-N treated and untreated pseudovirus were prepared. Antibodies showed clear dose-response on S1 and RBD wells but none on spikes. Pseudovirus bound antibodies in a dose-dependent manner. We are optimistic that our next ELISA detecting these antibodies on spikes treated with increasing CV-N concentrations will yield valuable insights.

Jerry Qin

School of Biomedical Engineering,
Science & Health Systems
Biomedical Engineering

Faculty Mentor: **Dr. Patrick Loll**
Biochemistry & Molecular Biology

Exploring the interaction of the TonB D-box peptide and the ExbD protein in Gram-negative bacteria

TonB-dependent transport (TBDT) allows Gram-negative bacteria to import nutrients from their environment. TBDT requires an outer-membrane transporter that specifically recognizes the nutrient to be imported, an inner-membrane motor complex denoted ExbBD, and the TonB protein, which is anchored in the inner membrane but spans the periplasm to interact with the outer-membrane transporter. Collaborators of the Loll Lab have discovered a previously unknown interaction between a portion of TonB and the ExbD component of the inner-membrane motor. It is believed that a conserved sequence within TonB, called the D-box, binds to two copies of the C-terminal domain of ExbD. To determine whether the D-box peptide can drive dimerization of the ExbD C-terminal domain, we examined the stoichiometry of this interaction in more detail. Mutagenesis was conducted to introduce cysteine residues into three selected positions in the ExbD protein. These proteins were then purified using Immobilized Metal Affinity Chromatography. These proteins will be pyrene labeled. We predict dimerization will bring the fluorophores into close apposition, causing a change in emission spectra when subjected to fluorometry in presence and absence of the D-box peptide.

Shannon Shih

School of Biomedical Engineering,
Science & Health Systems
Biomedical Engineering

Faculty Mentor: **Dr. Eishi Noguchi**
Biochemistry & Molecular Biology

Co-Mentor: Chiaki Noguchi

Effects of Caloric Restrictions on Maf1 Phosphorylation and Growth Signaling

The nutrient-sensing mTOR kinase regulates metabolism, protein synthesis, cell growth, and aging. Caloric restriction, which results in mTOR inhibition, extends lifespan in various organisms such as yeast, worms, and fruit flies. However, the mechanism through which this occurs is elusive.

We previously demonstrated that glucose restriction, which mimics caloric restriction, results in mTOR inhibition, leading to Maf1 activation via dephosphorylation. Maf1 is a master inhibitor of RNA polymerase III (Pol III) responsible for the transcription of tRNA and 5S rRNAs. When Maf1 is inhibited, transcription is elevated causing DNA damage and genomic instability, leading to lifespan shortening.

To further understand the role of the mTOR-Maf1-Pol III pathway in aging regulation, we are currently investigating the effects of calorie/dietary restrictions on Maf1 activity and growth signaling in the human BJ-hTERT fibroblast cell line. The impact of calorie/dietary restrictions on DNA damage response and senescence pathways – both hallmark signs of aging – is also examined. Furthermore, by using rapamycin (an mTOR inhibitor) we expect to understand the impact of nutrient sensing on the maintenance of genomic integrity and lifespan in human cells.

Madhu Karuppiah

School of Biomedical Engineering,
Science & Health Systems
Biomedical Engineering

Faculty Mentor: **Dr. Mauricio Reginato**
Biochemistry & Molecular Biology

Identification of novel ACSS2 inhibitors in regulating breast cancer brain metastatic growth

Triple negative breast cancer is an aggressive cancer with an overall survival rate of months when it spreads to the brain. There is no effective drug treatment for brain metastasis patients, thus novel therapies are urgently needed. Breast cancer cells that metastasize to the brain are dependent on fatty acids for growth. The acetyl CoA synthetase 2 (ACSS2) enzyme converts acetate to acetyl CoA, which is critical for the fatty acid production in tumors in the brain. The Reginato lab previously showed that genetically targeting ACSS2 can reduce the growth of breast cancer brain metastasis (BCBM) cells and identified novel ACSS2 inhibitors that show promise using *in vivo* models of breast cancer brain metastasis. Here, we show that treating BCBM cells with new second generation ACSS2 inhibitors 2749, 7033 and 4855 was able to block BCBM growth in crystal violet assays. Using western blotting, we show that novel ACSS2 inhibitors like 4855 lead to a reduction in E2F1: a downstream protein of the ACSS2. These results identify ACSS2 inhibitor 4855 as a potent inhibitor of BCBM cell growth and supports further testing of these novel ACSS2 inhibitors as novel therapeutic agents for treatment of breast cancer brain metastatic growth.

Anna Ramesh

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **Dr. Mauricio Reginato**
Biochemistry & Molecular Biology

Co-Mentor: Emily Esquea, Riley Young, Alexandra Talarico

Role of Novel ACSS2 Inhibitors in Regulating Breast Cancer Brain Metastatic Cell Growth

Breast cancer kills approximately 40,000 U.S. women annually, primarily from widespread metastasis to major organs such as the brain. While most tumors are highly dependent on glucose as an energy source, breast cancer brain metastatic (BCBM) tumors rely on fatty acid synthesis, driven by acetate conversion to acetyl-CoA by the enzyme Acetyl CoA Synthetase 2 (ACSS2). Our lab has previously shown that newly discovered ACSS2 inhibitors can cross the blood brain barrier and block the growth of BCBM tumors *ex vivo* and *in vivo*. Here, we screened 50 novel second-generation ACSS2 inhibitors and found that treatment of MDA-MB-231BR cells with inhibitors 2749, 7033 and 4855 for 24 hours blocked BCBM growth via crystal violet staining, with 4855 having similar effects as first-generation analog 8007. We also examined the effect of inhibitors on downstream genes regulated by ACSS2. Using Western blot analysis we found that some of the second-generation analogs reduced expression of E2F1 and FASN as compared to first-generation analogs. Our results suggest that some of these new ACSS2 inhibitors, specifically 4855, are potent inhibitors of BCBM cell growth and support further testing of novel ACSS2 inhibitors using *ex vivo* and *in vivo* models.

Devesh Bungatavula

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **Dr. Jennifer Hope**
Microbiology & Immunology

Co-Mentor: Laura Cort; Katie Hausman

The Development of Novel Reagents Aiding in the Study of Anti-Tumor CD8+ T Cell Responses to Pancreatic Cancer

Advances in cancer research such as immune checkpoint blockade therapy highlight the important role for T cells, particularly CD8+ T cells which can recognize and eliminate infected or cancerous cells. Despite the protection provided by our immune system, cancer cells can develop mechanisms to evade or suppress the immune response. Our research aims to uncover ways to enhance anti-tumor activity of immune cells and overcome the barriers the tumor microenvironment imposes. Our current studies are focused on developing novel reagents to aid in the study of anti-tumor CD8+ T cell responses to pancreatic cancer. Mouse pancreatic tumor cells (KPC.4662) were retrovirally transduced to express ovalbumin peptides with low T cell receptor affinity to mimic low affinity antigens observed in patients. Future validation studies include in vitro studies of T cell activation and T cell-mediated cytotoxicity of tumor cells. These novel cell lines will aid our overall goal of studying antigen-specific T cell responses and differentiation in the pancreatic tumor-immune microenvironment.

Kayla Jacobo

College of Nursing & Health Professions
Nursing

Faculty Mentor: **Dr. Jennifer Hope**
Microbiology & Immunology

Co-Mentor: Laura Cort, Katie Hausman

Evaluating the Impact of PSGL–1 Signaling on CD4$^+$ T Cells

Immune checkpoint blockade therapy leverages the immune system's ability to target tumors such as through CD8$^+$ T cells' ability to eliminate cancerous cells and limit T cell exhaustion. A key focus in our studies is P-selectin glycoprotein-1 (PSGL-1), an adhesion molecule that drives the development of T cell exhaustion. Using melanoma mouse models, we aim to uncover how PSGL-1 shapes T cell differentiation in CD4$^+$ T cells, a subset of T cells pivotal in aiding CD8$^+$ T cell responses. Via in vitro T cell culture assays, the present study evaluates activated T cells from wild-type mouse spleens using CD3 and CD28 antibodies to generate Th1, Th2, Th17, and Treg CD4$^+$ T cell subsets validated by staining and flow cytometry. Future tests will compare CD4$^+$ T cells from wild-type and PSGL-1 knockout mice to discern the effects of PSGL-1 absence on CD4$^+$ T cell differentiation. This process will elucidate how PSGL-1 signaling intrinsically affects CD4$^+$ T cell activation and regulates CD8$^+$ T cell responses against tumors, providing key insight into its potential role as a therapeutic target in immune dysregulation.

George Li

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **Dr. Jessica R. Barson**
Neurobiology & Anatomy

Manipulation of PACAP+ Cell Activity in the Paraventricular Thalamus of Binge-eating Mice

Binge eating disorder is the overconsumption of palatable food in a short period. Our laboratory is investigating the contribution to binge eating by pituitary adenylate-cyclase activating polypeptide (PACAP)-containing neurons in the paraventricular thalamus (PVT). PACAP-Cre mice engaged in binge eating with limited access (2 hrs/d, 4 d/wk) to Milk Chocolate Ensure Plus®. Using Cre-dependent excitatory (n = 4 males; 3 females) or control (n = 3 males; 2 females) designer receptors exclusively activated by designer drugs (DREADDs) to activate PACAP+ PVT cells with systemic delivery of the designer drug, clozapine N-oxide (CNO, i.p.) compared to saline, we found that PVT PACAP activity inhibited binge eating. We then gave a final injection of CNO or saline and perfused, extracted, and sectioned the mouse brains. To ensure that the DREADDs activated PVT PACAP+ cells, we performed immunohistochemistry for c-Fos (to mark neuronal activation), PACAP, and Cre. Images of the PVT were taken on an epifluorescent microscope and are being quantified. We anticipate that the mice injected with excitatory Cre-dependent DREADDs and CNO before sacrifice will show more c-Fos labeling in Cre+ PACAP cells than those with saline or the control virus.

Diya Patel

School of Biomedical Engineering,
Science & Health Systems
Biomedical Engineering

Faculty Mentor: **Dr. Michael A. Lane**
Neurobiology & Anatomy

Co-Mentor: Kayla A. Schardien

Does Intermittent Hypoxia Training Effect Spinal Interneuron Connectivity After Spinal Cord Injury?

About 60% of spinal cord injuries (SCI) occur at the cervical level, which pose life-threatening risks like respiratory dysfunction. However, spontaneous plasticity, partially mediated by spinal interneurons, allows for partial recovery. These interneurons forge new connections that can be enhanced by interventions like activity-based therapies. Our study aims to characterize these interneurons' role in spontaneous and therapeutic plasticity following high cervical SCI. A left lateral hemisection was performed at the cervical level(C2) in Wild Type mice, denervating the ipsilateral phrenic motor circuit controlling the diaphragm, the primary inspiratory muscle. One-week post-injury, mice began daily respiratory training of repeated normoxia and hypoxia cycles(120 minutes, 5 days/ week for 4 weeks). One-month post-injury, a transsynaptic retrograde tracer was applied to the left hemidiaphragm to label motor neurons and interneurons in the injured phrenic network. Immunohistochemistry mapped this network, and single-cell RNA sequencing will analyze interneuron phenotypes. This data will provide insight into the contributions of different interneuron subtypes to spontaneous and therapeutic plasticity of the phrenic network post-SCI.

Nicholas Barbi

School of Biomedical Engineering,
Science & Health Systems
Biomedical Engineering

Faculty Mentor: **Dr. Ramesh Raghupathi**
Neurobiology & Anatomy

Impact of Aerobic Conditioning on Cognitive Recovery Following Mild Traumatic Brain Injury

Concussions are a form of mild traumatic brain injury (mTBI) that occur in people who participate in contact sports. The hallmark of sports-related concussions (SRC) is their repetitive nature. The Raghupathi lab has developed a model of SRC by subjecting young adult male mice to 5 episodes of mTBI. Male C57Bl6 mice were delivered one impact to the intact skull once every 48 hours over 9 days. 4-6 weeks after the last impact, brain-injured animals exhibited a deficit in spatial learning as well as reduced reactivity to acute stress. This study attempts to refine this model of SRC by subjecting adolescent mice to forced physical activity over a 5-week period prior to mTBI. The forced physical activity followed a treadmill-based high intensity interval training (HIIT) regimen. Animals were returned to their home cages and allowed to recover for 4 weeks after the training period. Between 4-5 weeks, animals will be tested for spatial learning (using the Morris water maze), acute stress reactivity (using the Elevated Plus Maze) and depression (using the Forced Swim Test). This will test the hypothesis that exercised mice will not be as behaviorally impaired as animals that received no exercise prior to injury.

Milind Sangani

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **Dr. Ramesh Raghupathi**
Neurobiology & Anatomy

Co-Mentors: Tiffany Briscoe, Brielle Coe

The Effects of Physical Activity on Behavior Post-Concussion

Sports-related concussions (SRC) occur frequently in contact sports, especially among adolescents and young adults. The Raghupathi lab has developed a model of SRC in young adult mice by subjecting C57Bl/6 mice to 5 impacts to the intact skull using the paradigm of 1 impact per day every 48 hours over a 9-day period. At 4-6 weeks after injury, mice exhibited spatial learning deficits as well as deficits in response to acute stress. The current standard of treatment for SRCs is complete rest, where a patient refrains from all physical activity and does not return to play until the effects of the head injury subside. However, recent clinical data suggest that a gradual return to physical activity beginning a few days after the concussion may help reduce behavioral deficits. The current study was designed to test the hypothesis that a 5-week period of forced physical activity using a high-intensity interval training (HIIT) beginning at 3 days after the last impact will reduce behavioral deficits. At the end of the training, mice will be tested for spatial learning (using the Morris water maze), response to acute stress (using the Elevated Plus Maze), and depression (using the Forced Swim Test).

Carrie Gordon

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **Dr. Kazuhito Toyooka**
Neurobiology & Anatomy

Overexpression of TUSC5 in Cortical Neurons

Genetic approaches to health conditions have been increasing in popularity as more sophisticated technology has surfaced in the medical fields. However, there is limited knowledge regarding genes associated with Autism Spectrum Disorder, lissencephaly, and other genetic brain conditions, and therefore therapeutic approaches are hard to come by. Fellow researchers and I analyzed the overexpression of genes known to be linked to these conditions in order to determine its impact on patients, including the BHALHA9 and TUSC5 genes in cortical neurons. Because morphology of neurons is vital to their function, we compared the dendrite size of impacted neurons to that of control cells to determine the impacts of this overexpression. It was observed that control cells tend to have shorter dendrites than those with overexpressed genes, which may contribute to impaired communication between neurons. Further testing must be conducted to confirm these results, as well as to determine if both genes must be overexpressed simultaneously for the difference to be apparent.

Julia Wiafe-Jackson

College of Arts & Sciences
Global Studies

Faculty Mentor: **Dr. Jacqueline Barker**
Pharmacology & Physiology

Co-Mentor: Dr. Mark Namba

EcoHIV Effects on Reward Seeking Behavior and Striatal Microglia Function

Human immunodeficiency virus (HIV) remains a substantial public health problem that is highly comorbid with substance use disorders (SUDs). There is a lack of preclinical studies investigating the impact of HIV infection on operant reward learning, which hinders medication development efforts for people living with HIV. Here, we utilized the EcoHIV model, which is a chimeric HIV construct that infects rodents. We investigated whether EcoHIV infection in male mice impairs operant reward self-administration. Mice were trained to press an active lever (ALP) to self-adminster sucrose. Each sucrose delivery was paired with light and tone cues. Self-administration was followed by extinction training, where ALPs were no longer reinforced with sucrose or cues. EcoHIV had no effect on sucrose self-administration but impaired extinction learning, where EcoHIV mice failed to suppress ALPs despite no reward or cue delivery. These data suggest that EcoHIV selectively impairs extinction learning without altering initial reward learning and motivation. Ongoing work is investigating Eco-HIV-induced impairments in corticostriatal microglia, the primary HIV reservoir in the brain, as a potential mechanism underlying these behavioral deficits.

Shreeya Gounder

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **Dr. Alessandro Fatatis**
Pharmacology & Physiology

Co-Mentor: Anna Zhang

Investigating the Mechanism of Action of the CX3CR1 Inhibitor FX-68

The chemokine receptor CX3CR1 and its ligand CX3CL1 (FKN) have been shown to play an important role in cancer metastasis. Small subsets of cancer cells surface CX3CR1 initiate tumors upon disseminating target organs, behaving as metastasis initiating cells. We have shown in pre-clinical animal models that pharmacologic targeting of CX3CR1 with the novel and potent antagonist FX-68 is able to arrest progression of disseminated tumor cells or cause their regression. Interestingly, FX-68 does not directly affect cancer cell proliferation or survival in vitro, suggesting FX-68 impairs vital CX3CR1 functions of cancer cells colonizing the tissue microenvironment of target organs. Despite the anti-tumor effects observed in pre-clinical studies, the mechanism(s) of action of FX-68 are still undefined. The aim of this project was to generate two reagents to address this. To this end, the Fucci-Bob reporter system was stably expressed in cancer cells to ascertain whether FX-68 impairs cell cycle progression. We generated cells stably expressing a bioluminescent ERK reporter to assess the role of FX-68 on cancer cells' proliferation and survival via the MAPK pathway. The functional validation and in vitro assays will be discussed.

Nikki Rastogi

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **Dr. Andreia C. K. Mortensen**
Pharmacology & Physiology

Evaluating Potential Neuroprotective Effects of Novel Compounds in Models of Ischemic Stroke

Ischemic stroke is an event in which an individual's brain is deprived of a normal oxygen level due to reduced blood flow. Currently, one FDA-approved drug for the treatment of stroke exists, tissue plasminogen activator (tPA), which dissolves a clot in the brain. However, it must be administered within a 3-hour window from the onset of the stroke for it to be successful, which results in many stroke patients not getting treated.

One key event during stroke is excessive release of glutamate, the main excitatory neurotransmitter in the brain. We have identified the novel compound NA-014 which increases the activity of EAAT2, the main transporter in the brain that clears glutamate from the synapse into glial cells, and also used LDN-0212320 (LDN), which increases expression levels of EAAT2. Our study included the use of both in vivo and in vitro models. After middle cerebral artery occlusion in rats, our data suggests that NA-014 resulted in a smaller infarct size. Similarly, after oxygen glucose deprivation in cells, NA-014 increased glutamate uptake, whereas LDN-0212320 was able to increase glutamate uptake and EAAT2 expression. Future studies will include more time ranges and doses, and behavioral analysis for cognitive deficits.

Alli Taylor

College of Arts & Sciences
Psychology

Faculty Mentor: **Dr. Diana Robins**
AJ Drexel Autism Institute, Early Detection and Intervention Research Program

Co-Mentor: Dr. Andrea Wieckowski

A preliminary look into Primary Care Clinicians' Ability to Accurately and Confidently Identify Autism Spectrum Disorder in Toddlers

Autism spectrum disorder (ASD) is characterized by persistent deficits in social communication and interaction, and restricted and repetitive behaviors. Parents typically notice ASD symptoms prior to 2 years, however the average age of diagnosis is 4 years old and females are often diagnosed at later ages than males. These findings indicate delayed access to ASD-specific early intervention. For these reasons, the A.J. Drexel Autism Institute is conducting research to improve early diagnosis. I worked as part of an ongoing study to develop preliminary analyses to evaluate how confident and accurate the clinical impressions of ASD in young children made by primary care clinicians (PCCs) are compared to expert clinicians after an evaluation. I also am examining whether sex differences relate to PCC impressions. To collect this data, PCCs and expert clinicians fill out a survey to report their impressions of whether or not the child has ASD, their confidence in this impression, and what led to their impression. If the PCCs are confident and accurate in identifying ASD in young children, this research may lead to earlier diagnosis and better prognosis for children diagnosed with ASD, as this would allow them earlier access to care.

Jodi Gahn

College of Arts and Sciences
English

Faculty Mentor: **Dr. Melinda Lewis**
Pennoni Honors College

Slaying Monsters on Page and Screen: Adaptation Theory in The Witcher

Film adaptations of novels were among the first films ever made, and continue to impact the film and literature industries. As technologies advance, video games have joined the adaptation scene as well. Adaptation theory is a field of study that analyzes adaptations and attempts to understand how they are created and how they interact with their sources and other texts. I began with a review of previous research on adaptation theory, and then I used The Witcher franchise, a fantasy series that follows monster-slayer Geralt of Rivia, as a case study for my own research. I compared different versions of The Witcher (two short story collections, the first season of the TV show, and the third RPG game), and read articles and reviews about The Witcher and other adaptations. Using this background, I determined three questions that are helpful to analyze adaptation: What is being adapted? What is the goal of adaptation? What is the role of fidelity in adaptation? Finally, I used these three questions as guidelines to write my own short story and create outlines for a short film and a video game adaptation of the story.

Symone Mosby

Bennett S. LeBow College of Business
International Business

Faculty Mentor: **Dr. Melinda Lewis**
Pennoni Honors College

Coming to you as a (Black) woman

Over the past 10 weeks I have spent time investigating the quality of the Black female characters in film and television. The Black woman consumer was seen as a "niche" market for TV producers and they realized that with the power of visuality they could make more money and pull in a larger audience if people (Black women) were able to see themselves. However, the encoded messages sent with the quality of this character representation sends out "signals" about how Black women are to be perceived in certain spaces most of which are negative. So, with this project I created a zine to produce my findings on the background of media studies and black consumption. Choosing the medium of a zine was a strategic one that was aimed to be accessible to a wide range of audiences as opposed to a purely academic research paper using philosophical/academic jargon. In short, I made something people want to look at that is academically informed and challenges the audience to re-think the current quality of the Black woman representation and characterization in television and film media.

Johanna McPhail

School of Biomedical Engineering,
Science & Health Systems
Biomedical Engineering

Faculty Mentor: **Dr. Hasan Ayaz**
Biomedical Engineering

Co-Mentors: Dr. Cândida Barreto, Yiğit Topoğlu, Zuhal Ormanoğlu

Various Applications of Neuroergonomic Technologies: Autism Spectrum Disorder (ASD) Facial Analysis, Human-Robot Interaction (HRI), and Brain-Computer Interfaces (BCI)

In the field of neuroergonomics, many technologies are aimed at improving lives through a deeper understanding of brain function while people interact with their environment. At the Ayaz lab, researchers work to better understand ASD, HRIs, and develop enhanced BCIs. ASD affects 1 in 36 children in the U.S. In the first study, we analyze/compare brain activity and facial expressions of children with and without ASD. As technology reliance grows, understanding human-tech interaction is vital. In the second study, a humanoid robot performs five tasks with a human, with the goal to analyze the long-term bonding in HRIs and evaluate humanoid robot traits through brain activity of human operators. BCI research aims to help those with neuromuscular disabilities to control/communicate by converting brain activity into a desired output. However, current BCI systems have low reliability. In this third study, we test a mobile BCI system's performance and explore potential uses to be applied in clinical and home settings. In all three studies, wearable/mobile neurotechnologies have been used to gather new data in naturalistic settings. These insights into the brain provide valuable information that may improve the quality of life for many.

Velay Fellow

School of Biomedical Engineering, Science & Health Systems

Hannah McGinty

School of Biomedical Engineering,
Science & Health Systems
Biomedical Engineering

Faculty Mentor: **Dr. Sriram Balasubramanian**
Biomedical Engineering

Development of a Congenital Early Onset Scoliosis Finite Element Model

Early Onset Scolosis (EOS) is a progressive spine and ribcage deformity that affects children under 10 years of age. EOS is a deformity which can be caused due to reasons such as congenital birth defects, neuromuscular conditions, and other syndrome related reasons. Due to this varied nature of deformity in patients, there is limited consensus among clinicians regarding surgical treatment options. Finite Element (FE) modeling is a great tool to select methods of intervention. Such techniques involve the usage of patient-specific computational models to personalize treatment options. This study aims to create a template for a 3D osteo-ligamentous thoracic and lumbar spine FE model with ligaments and ribcage of a congenital EOS patient. After IRB approval, chest and abdominal CT scans of a 4-year-old female congenital EOS patient were acquired from CHOP. Using the CT scans, 3D geometries of the rib cage and thoracic/lumbar vertebrae were reconstructed using 3D Slicer. The geometries was then meshed with hexahedral elements using Ansys. Spinal Ligaments and IVDs were added to the meshed spine in Hypermesh. Such FE models can aid in parametric simulations of surgical techniques such that best patient outcomes can be achieved.

School of Biomedical Engineering, Science & Health Systems

Onyekachi Abonu

School of Biomedical Engineering,
Science & Health Systems
Biomedical Engineering

Faculty Mentor: **Dr. Vikas Bhandawat**
Biomedical Engineering

Co-Mentors: Marcello Codianni, Andrew Marku, Helene Babski

Investigating the Sense of Space in Flies

Sensory processing intricately shapes our actions, and unraveling these processes offers insights regarding how animals find resources such as food and return to them: they possess a plethora of mechanisms to monitor their position in space. Previous research shows that flies can conduct targeted searches even without visual, olfactory, or pheromonal cues: they persisted in revisiting an original food location when it was moved. This reliance on idiothetic, not allothetic, cues show that flies center searches based on recently found food.

Employing Drosophila's genetic tools, I investigated the impact of activating Gr5a+ Gustatory Receptor Neurons (GRNs) responsible for sugar perception on navigation. Through precise optogenetic manipulation, the control of neurons using light-sensitive proteins, we were able to precisely control GRN activity and record its effects on the locomotion of flies freely moving in a behavioral arena.

Results revealed striking changes in the fly's behavior during ectopic positive Gr5a+ GRN activation compared to control conditions. Hence, giving more insight into the mechanisms governing GRN responses and illuminating the neural basis of behavioral modulation in Drosophila in space.

Hassanatu Kamara

School of Biomedical Engineering,
Science & Health Systems
Biomedical Engineering

Faculty Mentor: **Dr. Valentina Graci**
Biomedical Engineering

Occupants' pedal behavior during critical takeover in semi-autonomous vehicle scenarios

Introduction. Previous studies examined steering-wheel takeover behavior in semi-autonomous vehicles, but pedal behavior has yet to be characterized. The goal of this study is to examine the occupant's pedal behavior during a pre-crash maneuver takeover in semi-autonomous vehicles.

Methods. A sled apparatus mimicked pre-crash swerving events. Sixteen occupants were instructed to turn the steering wheel as fast as they could, as the sled moved, no pedal instructions were given. Occupants performed 10 takeovers. Pedal behavior was video-coded.

Results. Overall, little use of pedals was observed before the sled motion (24.8%) and was mostly represented by the foot being on the accelerator for the female adults. During the sled motion, in 46.6% of the trials, the pedals were used, with most action on the brake (28.7%) except for the male teens which only pressed the brake.

Conclusion. Adults showed more use of the pedals during takeover than teenagers. Females showed more preparedness to press the accelerator. There are sex and age differences in pedal use in takeover actions that need to be taken into consideration when designing future autonomous vehicle.

Velay Fellow

School of Biomedical Engineering, Science & Health Systems

Alexandra Nickel

School of Biomedical Engineering,
Science & Health Systems
Biomedical Engineering

Faculty Mentor: **Dr. Steven Kurtz**
Biomedical Engineering

Co-Mentor: Tabitha Derr

The Effect of Thermal Treatments on Long Term Hip Implants

Total hip arthroplasty (THA), or hip implants, can be life-changing, returning lost freedom of movement and increasing quality of life. However, the polyethylene liners of THAs degrade over time, leading to revision surgeries that require further bone removal and potential future issues.

This study analyzes the long-term effects of two different thermal treatments, annealing and remelting, on retrieved polyethylene THA liners implanted for >10 years.

Each liner had wear data collected using a digital micrometer on the superior and inferior sides. The liners were microtomed to 200 μm thick slices and boiled in heptane to remove contaminants. Then Fourier Transform Infrared Spectroscopy (FTIR) was used to take oxidation values of the back, bearing, rim, and locking mechanisms on both sides of the liner slice.

The wear rate did not differ much between the two treatments with remelted averaging 0.09 μm/y and annealed 0.04 μm/y. However, the sample sets did differ in oxidation. The remelted treatment had much lower oxidation than the annealed with average oxidation indices, remelted 0.4 and annealed 2.6.

In conclusion, the remelted liners seemed to fare better for long-term implantation.

Sanjna Srinivasan

School of Biomedical Engineering,
Science & Health Systems
Biomedical Engineering

Faculty Mentor: **Dr. Anita Singh**
Biomedical Engineering

Co-Mentors: Virginia Orozco, Dr. Sriram Balasubramanian

Extent of Vascular Damage at Varying Degrees of Stretch in Hypoxic Neonatal Brachial Plexus

In complex birthing scenarios, the brachial plexus (BP) nerves may be overstretched with additional complications of hypoxia. Characterizing extent of vascular damage in hypoxic neonatal BP at varying degrees of stretch can further our understanding of BP injury thresholds. All procedures were approved by Institutional Animal Care and Use Committee. Eleven neonatal piglets (3-5 days old) were anesthetized and exposed to FiO2 of 7% for 1 hour to induce hypoxia and re-perfused to FiO2 of 21%. BP nerves were exposed and stretched at a rate of 500 mm/min to predetermined low (<15%) and high (>15%) strains. Post-stretch, BP nerves were harvested and OCT-embedded. Ten-Âµm-thick serial longitudinal sections were stained with Hematoxylin-Eosin. Using Olympus BX53 motorized microscope, stained slides were imaged at 10x magnification along nerve length. Using a custom MATLAB script, each stitched image was split into regions of interest (ROI). An independent-blinded observer scored each ROI for vascular damage on a scale of 0-2 (0-no damage, 1-torn vessel, 2-scattered blood cells). Preliminary results show vascular damage increases with increasing stretch and similar degrees of damage were observed in central and peripheral regions.

School of Biomedical Engineering, Science & Health Systems

Phoebe Ellin Chua

School of Biomedical Engineering,
Science & Health Systems
Biomedical Engineering

Faculty Mentor: **Dr. Kara Spiller**
Biomedical Engineering

Co-Mentor: Ricardo Whitaker

Tuning Drug Release from PLGA Particles

Nanoparticles have been used in various biomedical applications including drug delivery. Particle size influences critical factors such as cellular uptake and drug release. However, the current laboratory protocol for poly(lactic-co-glycolic acid) (PLGA) particle synthesis yields a broad particle size distribution, leading to inconsistent results. Here we developed a protocol to isolate particles of various sizes and assessed the relation between particle size and its drug release kinetics. Particles were synthesized using the double emulsion method and separated by size via centrifugation. Using Dynamic Light Scattering (DLS), we verified that particles were separated into 50 nm increments using the newly developed method. Preliminary data show that smaller particles display a higher drug release at early timepoints than larger particles. In addition, we also observed that same-size particles with higher Molecular Weight (MW) exhibit a slower drug release. These findings improve particle synthesis and expand our ability to tune particle properties. We are currently investigating the effect of particle size, and therefore drug release kinetics, in macrophage phenotype using Drug 1, a potent anti-inflammatory drug as the cargo.

School of Biomedical Engineering, Science & Health Systems

Damian Mozier

School of Biomedical Engineering,
Science & Health Systems
Biomedical Engineering

Faculty Mentor: **Dr. Kara Spiller**
Biomedical Engineering

Co-Mentor: Lyssa Buissereth

Engineered Gelatin Scaffold for Macrophage Phenotype Modulation and Wound Regeneration

Chronic wounds compose 2-4% of Western healthcare costs. Despite flaws in current standards of care, which show a 5-year mortality rate akin to cancer, a promising solution emerges in biomaterial-mediated treatments. Key players are macrophages, vital immune cells for inflammation and tissue repair. In chronic wounds, macrophages reside in a prolonged inflamed state and a poor transition to a reparative phenotype hinders healing. Given the flaws in current standards of care and uncontrolled macrophages, the goal of this study is to engineer a tunable pro-regenerative scaffold.

Scaffolds were prepared by dissolving gelatin in 1X PBS, crosslinking, freezing, and lyophilizing. Different iterations of these manufacturing steps were evaluated for their effects on scaffold properties. Bottom-up freezing via liquid nitrogen produced aligned pores. Crosslinker concentration, for EDC/NHS and genipin, was inversely proportional to water absorption, porosity, and degradation. Noticeably, mixing EDC/NHS and genipin granted finer control over scaffold properties. Here we developed pro-regenerative scaffolds with similar mechanical properties to commercially available options. Next, we will evaluate scaffold effect on macrophage phenotype.

School of Biomedical Engineering, Science & Health Systems

Peter Willard

School of Biomedical Engineering,
Science & Health Systems
Biomedical Engineering

Faculty Mentor: **Dr. Yinghui Zhong**
Biomedical Engineering

Co-Mentor: Ruixuan Liu

Optimization of chitosan concentration in an agarose hydrogel scaffold to support neuronal stem cell attachment, growth, and differentiation

To mimic a 3D in-vivo environment, it is necessary to combine the biomaterial chitosan with agarose hydrogel scaffold, as cells will not adhere directly to agarose. Chitosan possesses a positive charge that interacts with the negative surface of Neural Stem Cells (NSC), facilitating their attachment to a scaffold. Three varieties of agarose were paired with various concentrations of chitosan to assess the attachment and proliferation of NCSs.

The agaroses used were 1.5% SeaPrep, 0.5% SeaPlaque, and 0.5% SeaKem. The chitosan concentrations applied were 0.3%, 0.2%, 0.15%, 0.1%, 0.05%, and 0%. Each agarose was paired with each chitosan concentration. Stability tests, release tests, and cell-on-gel studies using NSCs were conducted on these hydrogels. Results indicated that for SeaPlaque, the optimal chitosan concentration was 0.15%. For SeaKem, the concentrations were found to be 0.2%, 0.15%, and 0.1%. Lastly, for SeaPrep, the concentrations were 0.15%, 0.1%, and 0.05%. These concentrations were established through a comparison with a 2D plate coated with PEI. This study contributes to our understanding of the optimal chitosan concentration required to support NSCs and paves the way for further experiments in hydrogel scaffolding.

School of Biomedical Engineering, Science & Health Systems

Emily Woodland

School of Biomedical Engineering,
Science & Health Systems
Biomedical Engineering

Faculty Mentor: **Dr. Amy Throckmorton**
Biomedical Engineering

Co-Mentor: Giselle Matlis (STAR 2018)

Drexel Dragon Heart: Next Generation Blood Pump Design for Pediatric Patients with Heart Failure

The treatment of children with heart failure is a formidable challenge. Heart transplantation, when available, becomes the only lifesaving option. Children could benefit from a blood pump: a medical device designed to assist the ailing heart with pumping blood. Blood pumps for children, however, lag behind those for adults. While adult devices have been employed in children, the operation of these adult pumps off-design increases the risk of blood cell damage and clotting. Pediatric patients have limited options due to the anatomy of childhood heart disease and increased cardiovascular demands of physical growth. To address this unmet clinical need, we have innovated *The Dragon Heart,* which uniquely integrates multiple pediatric blood pumps. This compact device (60mm x 50mm) suspends the pumps in a magnetic field, thus facilitating a long operational lifespan and lower blood cell trauma. We performed high-quality modeling of two new pump designs, which produced target performance; 40-180 mmHg for 0.5-4 L/min at 2000-3000 RPM. Internal fluid forces were below 2.5 N, and fluid stresses were at acceptable levels. This work serves as the foundation for the next phase of prototype benchtop testing, moving toward animal studies.

Teagle Fellow

Derrick Banks Jr.

Antoinette Westphal College of Media Arts & Design
Game Design & Production

Faculty Mentor: **Dr. Kareem Edouard**
ExCITe Center, Illest Lab

Co-Mentor: Panote Nuchprayoon (STAR 2019)

Sneaker Design: The Process

The world of sneakers can be pretty intimidating in the modern day, with designs seemingly flying in out of left field. However each design has a reason to exist, and while some make it to home base others may strike out with consumers.

Sneakers focus on two things, form, and function, and exploring these converging points of comfort and style will help to create products that appeal to a larger audience. They can also implement pop culture, with designs pulled from movies and games. To make my own shoes, I want to take into account all of these factors.

To create something that stands out in sneaker culture, finding what's "hype" is essential. By researching mood boards, magazines, and seeing current fashion trends, a list of the hottest new drops, and styles can be formed. Then through interviewing all types of people, I'm able to see what styles of shoe are the most popular based on these guidelines and create based upon those factors. As a designer, understanding what's hype can provide direction, but truly understanding sneaker culture is paramount. This insight allows me to craft designs that resonate with enthusiasts and also allows for deeper creativity and exploration in sneaker design.

Daryn Lam

Antoinette Westphal College of
Media Arts & Design
User Experience & Interaction Design

Faculty Mentor: **Dr. Jennifer Katz-Buonincontro**
Policy, Organization & Leadership

Project NICE: Examining creative mindsets in engineering students' design process

Initially funded by the Drexel Office of the Provost, Project NICE (New Indicators of Creative Experience) examines how senior engineering students design problems as novices. Student attitudes about creativity may be influenced by various experiences, including the classroom, co-ops, and awareness of their level of mastery of creative skills in engineering. In this experiment, three conditions were designed to parse out perceived future feedback from either instructors, peers, or self-reflection, while completing a task to redesign a library. Data on students' heart rate and skin conductance were collected, as well as ratings of the design task, creativity beliefs and the recordings and transcripts of 58 interview responses which were later coded for evidence of creative growth, partial creative growth, or creative fixed mindsets and emotional blocks to creativity. The resulting data tables were presented alongside other project findings at the APA (American Psychological Association) 2023 Convention.

Serena Osuagwu

College of Computing & Informatics
Computer Science

Faculty Mentor: **Dr. Jennifer Katz-Buonincontro**
Policy, Organization & Leadership

Co-Mentor: Dr. Paek Sue Hyeon

How does crisis affect prosocial creativity?

My research project focused on understanding why crisis might increase or inhibit prosocial creativity. The research made use of a survey study to shed light on how crisis can affect prosocial motivation which is creative problem-solving for social development. Using quantitative research strategies, we conducted a series of online surveys involving 107 diverse adults. The surveys contained questions that required them to find creative solutions to problems related to crisis concepts like uncertainty tolerance, perspective taking, prosocial motivation, and creative problem solving, and they were assessed on prosocial motivation concepts like social utility, fluency and originality. Our findings indicate that prosocial motivation is both directly and indirectly significant while perspective-taking is indirectly significant to creative problem solving. However, uncertainty tolerance had no significant correlation to creative problem-solving. Going forward we will explore a different path of these correlations to creative problem solving. This research is crucial to developing creative problem-solving techniques and understanding the relationship between creativity, prosocial motivation, and social instability.

Velay Fellow

Jordana Benblatt

College of Nursing & Health Professions
Health Services Administration, Psychology

Faculty Mentor: **Dr. Kristy Kelly**
Policy, Organization & Leadership

The Brass Ring in Academia: A Critical Feminist Analysis of the Promotion to Full Professor Process

The scholarship documenting how gender affects work relations and interactions, including organizational policies and structures, belies any claim to "œobjectivity" or "gender neutrality" in organization studies (Acker 1990). More recent literature documents how gender intersects with race-ethnicity (Ray 2019) global positionality (Berry and Bell 2011), and is often mobilized to reify heteronormative binary constructs (Mizzi 2013). Nevertheless, most academic institutions imagine their policies, process and practices as gender neutral. This is especially true when it comes to hiring and promotion of STEM faculty at universities. Findings from interviews with 18 department chairs at an urban, east-coast STEM university suggest a general concern for supporting women and minoritized faculty. However, inequalities exist in how their work is valued particularly in light of increasing pressure to excel at research, teaching and service during COVID and beyond while also managing unequal carework burdens at home.

FRANCIS VELAY FELLOWS

The 2023 STAR Scholars cohort includes our eighth cohort of Frances Velay Fellows, thanks to the generous support of the Panaphil Foundation. This year's cohort of 12 women in STEM are participating in the full STAR experience, including faculty-mentored research, while also having the opportunity to engage with each other in weekly meetings throughout the summer. These sessions have included meetings with women in STEM mentors, as well as the presence of a peer mentor, Annaliese Blowers (STAR & Velay 2022). Through this program, we are able to provide these exceptional young women with the structure and time to reflect on what it means to be a woman in STEM, to help them build their identities as women in research, and to introduce them to others at Drexel who support and encourage them in their future goals.

The Frances Velay Fellowships have been created in the memory of Frances Velay, a remarkable scientist, artist, musician, and citizen, to assist undergraduate women in the Greater Philadelphia area increase their opportunities to pursue science careers. This opportunity is provided to support individual research efforts in the hope that the Fellowship recipients will embody the spirit and determination Frances Velay brought to her work and life.

This program is jointly managed by the Center for Advancement of STEM Teaching and Learning Excellence (CASTLE) and Undergraduate Research & Enrichment Programs. We would like to thank the Panaphil Foundation for their generous support of undergraduate research and women in STEM, as well as the faculty mentors, graduate students, and industry professionals who come together to support these exceptional women.

DREXEL UNIVERSITY
Center for the
Advancement of
STEM Teaching and
Learning Excellence

DREXEL UNIVERSITY
Undergraduate Research
& Enrichment Programs
Pennoni Honors College

INDEX

by STAR Scholar's last name

INDEX

by STAR Scholar's last name

SPECIAL THANKS

We would like to extend our sincere gratitude to all Faculty Mentors, Graduate Students, and others at Drexel University who have helped teach, guide, and mentor these STAR Scholars.

The STAR Scholars Program helps shape these students' academic and profesional futures for years to come, and it would not be possible without your participation.

We applaud and thank you.

DREXEL UNIVERSITY

Undergraduate Research & Enrichment Programs

Pennoni Honors College