

2021 STAR SCHOLARS ABSTRACT BOOKLET



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

A Message from the Director
p. 6

2020 Summer & Fall/Winter Outstanding Mentors of the Year
p. 7

2020 (Spring/Summer) & 2021 STAR Scholar Abstracts
(by Faculty Mentor's department)
p. 10

Antoinette Westphal

College of Media Arts & Design **p. 11**

Architecture, Design, and Urbanism p. 11
Design & Merchandising p. 13
Digital Media p. 14
Fashion Design p. 15
Film & Television p. 16
Graphic Design p. 17
Product Design p. 19

Bennett S. LeBow

College of Business **p. 20**

Accounting p. 20
Decision Sciences p. 22
Finance p. 23
General Business p. 27
Management p. 28
Marketing p. 29
School of Economics p. 32
Sport Management p. 33

Close School of Entrepreneurship **p. 34**

Table of Contents

College of Arts & Sciences	p. 35
Biodiversity, Earth & Environmental Sciences	p. 35
Biology	p. 40
Chemistry	p. 51
Communication	p. 53
Global Studies & Modern Languages	p. 54
Mathematics	p. 55
Physics	p. 56
Politics	p. 57
Psychological & Brain Sciences	p. 58
Sociology	p. 63
WELL Center	p. 64
College of Computing & Informatics	p. 65
Computer Science	p. 65
Information Science	p. 71
College of Engineering	p. 74
Chemical & Biological Engineering	p. 74
Civil, Architectural, & Environmental Engineering	p. 78
Electrical & Computer Engineering	p. 84
Materials Science & Engineering	p. 88
Mechanical Engineering & Mechanics	p. 93
College of Nursing & Health Professions	p. 102
Creative Art Therapies	p. 102
Health Administration	p. 104
Nutritional Sciences	p. 105

Table of Contents

Dana and David Dornsife School of Public Health	p. 108
Community Health & Prevention	p. 108
Epidemiology & Biostatistics	p. 109
 Drexel University College of Medicine	 p. 111
Biochemistry & Molecular Biology	p. 111
Neurobiology & Anatomy	p. 117
Pharmacology & Physiology	p. 126
 Other	
Drexel Autism Support Program	p. 127
 Pennoni Honors College	 p. 128
 School of Biomedical Engineering	 p. 129
 School of Education	 p. 143
 Frances Velay Fellows	 p. 145
 Index by Student Last Name	 p. 146
 Special Thanks	 p. 148

A Message From THE DIRECTOR

The STAR Scholars Program engages highly motivated first-year students in faculty-mentored research, scholarship, or creative work, usually during the summer between their first and second years as Drexel undergraduate students. The COVID-19 pandemic required us to adjust the program to ensure that early undergraduate students could still participate in STAR during the last two academic years, resulting in this, our very first summer in which students from two cohorts of STAR Scholars were on campus, participating in research, scholarship, and creative work.

Our 2020 STAR Scholars were given the option to participate in remote research last summer or to delay their participation in STAR until the academic year, during which they could conduct part-time research over two academic terms. Of our 151-student cohort, 21 students opted to participate in part-time research over the Spring & Summer terms, while also taking classes; their experience has culminated in presenting their work during the 2021 STAR Scholars Showcase.

Our 2021 STAR Scholars, on the other hand, had a closer-to-normal experience this year. These students were able to live on campus this summer in Bentley Hall, the new home of the Pennoni Honors College. For many in this cohort, this summer was their first introduction to living and working on campus, having remained remote throughout their first three terms as Drexel students. While we continued to host virtual programming and events for our students throughout this summer, we were still able to see our STAR Scholars mostly return to hybrid or fully in-person research and scholarship.

All of these students have displayed extraordinary resilience, adaptability, and commitment to their education. We are incredibly proud of our 2020 and 2021 STAR Scholars, who chose to engage in deep and immersive learning during a time that has asked so much of them. Congratulations to all of our 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 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 further his or her research with undergraduate students. Since 2011, this award has been given to 13 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.

2020 STAR Scholars – Summer OUTSTANDING Mentor of the Year

**We are pleased to honor Dr. Thomas Heverin (CCI) for Summer and Dr. Dane Ward (CoAS) for Fall/Winter as our Outstanding Mentors of the Year for the 2020 STAR Cohort.
Thank you, mentors!**

Dr. Thomas Heverin

Thomas Heverin, PhD, CISSP, is an associate teaching professor and teaches classes in the BS in Computing & Security Technology program, including classes in ethical hacking, computer forensics, network forensics, cloud security and cybersecurity. Dr. Heverin virtually mentored two STAR Scholars in Summer 2020, Catherine Lopez and Ansh Chandnani.



Catherine Lopez said: “Dr. Heverin is the definition of going above and beyond. He is passionate about his work and about his desire to help students grow and realize not only their potential, but their own abilities. His passion for learning has inspired us to go beyond what was expected of us to the point where we are working with him to submit a paper to an academic cybersecurity conference based on our research, something that we would never have considered if it wasn’t for Dr. Heverin.”

Ansh Chadnani added: “Dr. Heverin is a very empathetic mentor who understood our background and skills when it came to a research project and mentored us, teaching us how to effectively research, gather information, draw conclusions, and most importantly, compile our work in an organized timely manner. Even beyond the project, he has guided me to better manage my time, think critically about issues and hurdles, and contributed to my professional as well as personal growth.

2020 STAR Scholars – Fall / Winter OUTSTANDING Mentor of the Year



Dr. Dane Ward

Dane Ward, PhD is an assistant teaching faculty in the Department of Biodiversity, Earth, and Environmental Science at Drexel University. Dr. Ward mentored two STAR Scholars during the Fall & Winter Quarters, Mikayla Traini and Elizabeth Otruba.

Mikayla Traini and Elizabeth Otruba said: “Dr. Dane C. Ward is an outstanding mentor because of his adaptability as an educator, support of POC and LGBTQ+ individuals, and his research conduct during the pandemic. I could not imagine a better mentor than Dr. Ward, and for this reason, we believe he is the most outstanding mentor.... We were drawn to Dr. Ward as a mentor because of his teaching style. He takes care of each one of his students in class, adapting his teaching style to better suit the needs of the classroom. This skill carries over into his mentoring as well. Dr. Ward is adaptable in a mentor setting and does all he can to ensure that each of his mentees are getting the experience they want and deserve.

In addition to being a mentor for all because of his teaching skills, he is also a mentor for all because of his strong stances as an outspoken antiracist and an ally to the LGBTQ+ community. One of the main goals of the Ward Lab is to create space for POC and LGBTQ+ individuals who may not be given the space or highlighted in the scientific field otherwise. It is an accepting and uplifting community to be a part of. Dr. Ward is always looking for ways to improve for all individuals involved with his mentoring.”

2020
SPRING/SUMMER
&
2021 ABSTRACTS

Antoinette Westphal College of Media Arts & Design

Serenity Baruzzini

College of Engineering
Engineering



Faculty Mentor: **Prof. D.S. Nicholas**
Architecture, Design & Urbanism

Healing and Learning in Living Spaces: Workshop series guided by STEAM education, reflection cycles, and salutogenic design

Stress prevention is essential to building a healthy lifestyle, and addressing this issue in childhood development promotes healthfulness at an early age. Salutogenesis is an approach to design that supports health and wellbeing through stress prevention strategies among other things, as opposed to a traditional process driven by diagnostic health measures. Urban planners and architects often engage in a form of salutogenesis called biophilic design aimed at making people's spaces more natural. Students living in disadvantaged communities have little access to such spaces. COVID-19 has displaced many students, complicating accessibility even more.

I designed a program focused on STEAM education, mindfulness skills, and self advocacy that allows students to transform their space into a more supportive salutogenic environment no matter their income level. Sensitive to accessibility, flexible with requirements, this kit is useful whether the student is learning in the classroom or from home. As the pandemic has increased stressors in many underserved homes, this project supports recovery, and encourages reflective thought and STEAM education.

Antoinette Westphal College of Media Arts & Design



Ben Wohlbowne

Antoinette Westphal College of
Media Arts & Design
Architecture

Faculty Mentor: **Prof. D.S. Nicholas**
Architecture, Design & Urbanism

An appreciative approach to asset zones in Powelton Village and Mantua

The West Philadelphia Promise Zone was created by the federal government to address civic health, poverty, and displacement in urban areas. Since this Promise Zone encompasses Drexel University, there is a responsibility from the university to foster positive change in these neighborhoods. The Integral Living Research Lab at Drexel University, as part of a community participatory based study, was tasked to develop cohousing models to promote well-being in the West Philadelphia Promise Zone. As a part of this team, I am visually organizing and connecting existing resources within the Promise Zone to maintain and improve livability in the community. This research took shape as an accessible, appreciative map that connects important locations, organizations, and resources. By visually linking neighborhood assets, the research team, community groups, and residents can be better connected to existing programs and locations. These maps serve as a positive resource for the community, allowing them to shift the narrative of broken promises in their neighborhoods. The asset maps and the work of Drexel and the Integral Learning Research Lab contribute to the trust and relationship of the community-university partnership.

Antoinette Westphal College of Media Arts & Design

Aishwarya Bahl

Antoinette Westphal College of Media
Arts & Design
Design & Merchandising



Faculty Mentor: **Prof. Chris Baeza**
Design & Merchandising

Co-Mentor: Eliezer Eisenman

The Use of Biomaterials in the Fashion Industry

As one of the world's most dynamic industries, fashion is also criticized for its large carbon footprint, and as a result companies are evaluating their production practices. However, tangible change is only possible when materials are prioritized. There has been a growth in innovations focused on 'biomaterials'. This field typically consists of strategic partnerships between scientists and designers, in the form of biotechnology companies, as well as brands diving into in-house R&D. Many companies have been developing bio-based materials for several years, but there have been barriers to scale. The link between their development and eventual ascension to recognition in the industry is still broken. We analyzed the fundamentals of biomaterials and what it means for a textile to be bio-based, using data collection and reports from the industry. Further research was conducted through interviews with professors, company representatives and environmentalists. We discovered why funding from trusted brands and investors is most crucial during the scaling stages. Unfortunately, bio-based textiles in the industry remain an ambiguous category, making its commercial application a delayed process.

Antoinette Westphal College of Media Arts & Design



Durando Angiulo

Antoinette Westphal College of
Media Arts & Design
Interactive Digital Media

Faculty Mentor: **Dr. Glen Muschio**
Digital Media

Co-Mentor: Jervis Thompson

Designing A Digital Cultural heritage Website

My STAR project takes place within the field of digital cultural heritage. Digital cultural heritage can be described as a process that uses digital technologies to study, explore, display, and share manifestations of culture. Digital cultural heritage work extends from cultural diffusion over the internet to interactive experiences designed to engage audiences and contribute to cultural impressions. At Drexel, students, faculty, researchers, and other professionals interested in Digital cultural heritage, have designed engaging digital experiences over the years. These projects have been crafted in a variety of ways such as through the manipulation of digital 3D objects, visual storytelling, animations, and interactions with avatars. However, due to lack of exposure, most people in the University and especially those in the wider Digital community don't know these projects exist. My solution to this issue My STAR project was to design and produce a responsive website with three goals: One; to raise awareness about the digital cultural heritage works being produced at Drexel. Two; to inspire others to become involved in Digital cultural heritage. And three; to share these ongoing projects with an audience beyond the University.

Antoinette Westphal College of Media Arts & Design

Sam Gleit-Weinstein

Pennoni Honors College
Custom-Designed Major



Faculty Mentor: **Prof. Elizabeth Shane Quinn**
Fashion Design

Seeking Solutions to More Eco-Friendly Footwear Through Material Innovation and Upcycling

The footwear industry is infamous for its use of tanned leather and synthetic materials, which are not biodegradable. However, as global warming threatens the health of the earth's ecosystems, a push for the use of "sustainable" biomaterials is on the rise. These materials are often made with agricultural waste, including, but not limited to Apple Leather and Piñatex® Pineapple Leather, while some, like Desserto® Cactus Leather or Mylo™ Mycelium Leather, are grown and harvested specifically to produce a plant-based leather. Although these materials are certainly better for the environment than tanned leather or something that is entirely synthetic, none of them are plastic-free or biodegradable. This project is focused on the use of a recycled-newsprint-based leather alternative, while exploring the use of upcycled materials and the exclusion of virgin materials (except for adhesives) in footwear. After learning how to make paper from recycled-newsprint pulp, I experimented with muslin as a composite material. The resulting material was a paper fabric which mimics leather in density and suppleness. This paper fabric was constructed into the upper of a pair of mules made almost entirely from biodegradable and upcycled materials.

Antoinette Westphal College of Media Arts & Design



Ethan Binder

Antoinette Westphal College of
Media Arts & Design
Screenwriting/Playwriting

Faculty Mentor: **Prof. Matthew Kaufhold**
Film & Television

“Lovers”: Contemplations on Love in the 21st Century

Lovers is a feature-film screenplay, a creative project about what would happen if the lines between true love and the illusion of romance blurred beyond repair. The story serves as a broader exploration of the nature of love and human connection as well as a personal exploration of the process of writing a feature film. It examines concepts such as para-social relationships, female exploitation, and commodity fetishism as the script contemplates how we are losing our ability to form genuine relationships. Lovers centers around a young man named Casey, a lonely, hopeless young man who fantasizes about being a renowned artist. In order to show his parents that he's finding direction in his life, he hires Penny, from a corporation called Lovers, to pretend to be his girlfriend. Soon, however, the lines blur between what aspects of Casey and Penny's relationship are real and what are merely an illusion. In the end, Casey realizes that none of it was real; he was projecting his own romanticism onto Penny in a way that she never wanted. From there, he discovers that he needs to be honest with himself as well as others if he ever wishes to find success in his personal life or his career.

Antoinette Westphal College of Media Arts & Design

David Fetherston

Antoinette Westphal College of
Media Arts & Design
Graphic Design

Faculty Mentor: **Prof. Mark Willie**
Graphic Design

Beneath The Layers: The Importance of Grids in Historic Polish Posters

During every STAR Summer term, graphic design students get the chance to uncover a piece of Poland's history. The Frank Fox and Kenneth F. Lewalski Polish Posters Collection, located in Drexel's URBN Center, contains over 2,500 Polish Posters from the 1930s through the 90s. At the start of the pandemic, 500 additional Soviet-era Polish posters, a gift of collector Saul Zalesch, were sitting awaiting archiving in the URBN Center. This summer my fellow STAR student and I had the honor of unveiling and cataloging these posters for the first time. This immersive process taught me the delicate yet bold nature of Polish artists. Created in a time of totalitarian control and wartime destruction, these posters do not capitalize on the darkness of these times. Rather, they reveal what is beneath the darker layers: rebellion, surrealism, humor, and beauty. Focused on posters using grid structures, my job is to preserve the ideologies of these artists. Especially during modern times—in a world full of futuristic NFT's and industries reliant on digital practices—the state of the visual world is undoubtedly unique. How do we fuse the ideologies, artistry, and decisions of the past in a time where a new history is being created?

Antoinette Westphal College of Media Arts & Design



Cora Hochstetler

Antoinette Westphal College of
Media Arts & Design
Graphic Design

Faculty Mentor: **Prof. Mark Willie**
Graphic Design

The Women Designers of the Polish Poster Collection

During the Summer of 2021 I focused my STAR Scholar research on the woman designers of the Polish Poster collection. Westphal's URBN Center is home to over 3,000 Polish Posters from the Frank Fox and Kenneth Lewalski collections, representing one of the largest collections of Soviet era posters. These posters promote various cultural events, ranging from films, theater productions, the circus as well as political propaganda. All the posters contain colorful and vivid graphic design elements that express the unique ideologies and artistry of the time. While there are many different artists from the collections, one notable detail is that most of them are male designers. Due to the conditions of the time under the totalitarian government and Soviet controlled era's, the social norm for women was to stay at home with their children and take care of the house. With the handful of women that did attend the Polish Poster School and create beautiful works of art, they are still not recognized as much as their male counterparts. I wanted to use this research experience to learn more about these talented women and highlight their work that has helped shape the Graphic Design industry.

Antoinette Westphal College of Media Arts & Design

Edward Kim

Antoinette Westphal College of
Media Arts & Design
Product Design

Faculty Mentor: **Prof. Raja Schaar**
Product Design

Accessibility in Footwear

Footwear has been sold to consumers over many generations with new innovations driving the industry. From the introduction of air into midsoles all the way to incorporating recycled materials into shoes; the footwear industry exemplifies progressivism and technological evolution. Aside from evolving into more efficient products, companies and brands have adopted more inclusive business practices. Apex brands like Nike and Adidas have widened their markets as well as consumers, leading to the production of accessible and sustainable footwear. Although a huge leap forward, there have been many concerns along with controversies pertaining to these new shoe innovations. Ironically, the accessible shoes have not been accessible for the intended consumers (the disabled, elderly, individuals who cannot put on shoes, etc). Over the summer, I plan on researching the history of accessible shoes more as well as their components; resulting in an accessible shoe design of my own. In addition, I will look into currently available accessible products, sustainable materials, and other methods of footwear production in the industry

Bennett S. LeBow College of Business



Samantha Gedeon

Bennett S. LeBow College of Business
Economics, Finance

Faculty Mentor: **Dr. Johnny Jiung-Yee Lee**
Accounting

Does Race Matter?: Small Business Financial Stability in the Face of Recession

This research project was designed to identify a difference in how a recession impacted the financial stability of small businesses that differed in the owner's race. After researching other ways race differentiated small businesses, the most important statistic found was that minority owned businesses had a higher denial rate than white owned business for bank loans.

For this study three different convenience stores of White, Hispanic and Black ownership, all established within 5 years of each other, were interviewed about their financial status (measured by the amount of expenses, revenue and cash balances) before, during and towards the end of the COVID-19 pandemic. The White owned store was prevailing before the pandemic because of the revenue it was bringing in. During the pandemic, the Hispanic and Black owned stores were forced to close as the number of customers depleted which cause the cost of expenses to rise as the revenue depleted. The White owned store did stay open as there were enough customers to bring in a revenue during the time although it was less than normal. To further this study, it would be essential to reach out to customers to understand why they contribute to the revenue of one store versus another.

Bennett S. LeBow College of Business

Shaily Panwar

Bennett S. LeBow College of Business
Finance, Business Analytics



Faculty Mentor: **Dr. Jonathan Liss**
Accounting

Impact of Covid-19 on Small Businesses in Aligned with Consumer Behavior

In the second quarter of 2020, the e-commerce business jumped about 44% compared to the second quarter of 2019. This research analyzes the impact of the pandemic on small businesses. Small businesses have adapted e-commerce by using online resources in different ways. The results of this study are based on a survey conducted to assess consumer behavior and how small businesses reacted to the pandemic. The survey results showed that about 65% of consumers are trying to buy locally to be supportive of small businesses. The efforts of small businesses made in online sales and marketing are partially recognized by consumers. However, the survey results also showed that 30% of consumers prefer to buy from online stores like Amazon more often, indicating there are better chances of success if small businesses start selling through e-commerce supportive platforms. Furthermore, the approaches used by small businesses to reach the consumer are not working to their full strength. There are several reasons consumers purchase from small businesses, but convenience is a key factor. Therefore, expanding their reach is an important solution. Lastly, above 60% of consumers believe that they are being supportive of small businesses.

Bennett S. LeBow College of Business



William J. Park

Bennett S. LeBow College of Business
Business Analytics

Faculty Mentor: **Dr. Murugan Anandarajan**
Decision Sciences, MIS

How has the Pandemic led to changes in Investment Behaviors?

The GameStop incident in January involved traders from the popular Reddit platform, banding together to drive the GameStop stock upwards. This event alongside new brokerage trading apps such as Robinhood have created new investing demographics following the global pandemic in 2020. To understand the main differences between this new generation of investors, a survey was created to investigate how they made investing decisions, financial goals, and risk averseness. Of the 127 responses collected, 73% were from 18-24 year olds, with the remaining data being amongst older participants. From these responses, a frequency analysis was conducted, looking at the differences of subgroups within the age group (gender, investing experience). A consensus for this age group was the lack of focus on information such as debt-to-equity ratios, expected earnings, or dividend rates to determine whether they would invest in a stock, instead relying on news from social media. On top of this, this age group also sees investing as a source of entertainment and enjoyment, rather than for their financial goals. This shows the difference in values and perspectives for different age groups and the ways in which the stock market has changed from the past.

Bennett S. LeBow College of Business

Alina Semykina

Bennett S. LeBow College of Business
Finance, Business Analytics



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

The Role of Investment and Technological Expertise in Boards of Directors

Boards of directors are becoming increasingly more responsible for the well-being of the firm. Therefore, it is important to elect directors possessing critical skills capable of assisting in the oversight of risks and making weighted decisions regarding the direction of corporate assets. These directors can help drive revenues, improve financial performance, and mitigate risks.

By examining the matrices of directors' skills listed in firms' financial statements, we can better understand the role of investment and technological experience in companies' boards. Using a large sample of S&P 1500 firms, we find that these skills are becoming more valuable in the current financial market. Further, our analyses suggest that few firms list investments as a skill, but over half of directors on these boards are experienced in investments. Technology skill, however, is a more common skill listed, yet not many directors actually possess this skill. Further examination shows that firms experience positive stock price change after hiring directors experienced in both investments and tech. Overall, our research suggests that adding directors with technology and investment skills can enhance the value of a firm.

Bennett S. LeBow College of Business



J. Carter Mitchell

Bennett S. LeBow College of Business
Finance

Faculty Mentor: **Dr. Gregory Nini**
Finance

Data Collection from SEC Filings via Automated Search Tool

Publicly traded companies are required by the Securities and Exchange Commission (SEC) to file annual (10-K) and quarterly (10-Q) reports. These documents are useful to investors because they provide insight into a company's financial performance and risk factors. These filings are available on the SEC's EDGAR website, a public database containing all the required SEC documents submitted by publicly traded companies. With the plethora of information available, it becomes difficult to manually navigate EDGAR for relevant data.

We use Python, a programming language frequently used in data science, to collect data more efficiently. We use web scraping to collect relevant information on the file from EDGAR. In addition, we develop an automated search tool in Python that counts keywords within the filing. For this research, we record the name, industry, and business address from 8792 companies and count mentions of COVID-19 within the 10-K and 10-Q filings. This method of data collection will be useful for future research as well. It can identify keywords relating to many different aspects of corporate governance discussed in the filings, such as compliance with debt contracts or changes in leadership.

Bennett S. LeBow College of Business

Z. Egenaz Ozvural

Bennett S. LeBow College of Business
Business & Engineering



Faculty Mentor: **Dr. Gregory Nini**
Finance

Developing an Automated Search Tool for SEC Filings

The Securities and Exchange Commission (SEC) requires public companies to file forms explaining their annual (10-K) and quarterly (10-Q) performance, including financial operations. To this date, investors and academic scholars have been scanning these filings manually to find keywords related to their research. By creating an automated tool to search through filings, we aim to ease the process, especially when investors need to filter down their search results by several categories.

We scrape URLs directing to the 10-K and 10-Q filings by using a Python library called “edgar.” Then, we create a Python script that sends automated requests to these URLs and collects data regarding business address, period of report, and industry. In the next step, the user of our automated tool enters the keyword they want to search for and receive the frequency of the keyword in a specific filing, period, or industry. For example, we have used the automated tool to search for mentions of “COVID-19” in filings during the last two years, among 10 industries.

Another application of this tool would be to create a web program that detects covenant violations with the further usage of Deep Learning Models and Natural Language Processing (NLP).

Bennett S. LeBow College of Business



Naomi Bravman

Bennett S. LeBow College of Business
Marketing, Legal Studies

Faculty Mentor: **Dr. Bradford Sodowick**
Finance

Implications of Legalizing Marijuana

The criminalization of marijuana has disproportionately affected communities of color, resulting in racial inequalities and over-incarceration. Blacks are nearly 4 times more likely to get arrested for marijuana than whites (ACLU, 2020). Records of crimes committed prior to legalization prevent individuals from becoming fully integrated members of the work force. As highlighted by Michelle Alexander, civil rights activist, "So many aspects of the old Jim Crow are suddenly legal again once you've been branded a felon..." (DuVernay, 2016). Legalization by states will benefit the economy through new jobs, tax revenue, and will reform criminal justice, allowing improved employment by expunging minor drug crimes. It is vital to have unified regulatory and licensing departments to make cannabis business labor participation less restrictive. Prior to federal legalization, these steps must be taken on a state level while also rehabilitating areas that have been heavily impacted by the criminalization of marijuana. Further research must be done to determine how to convert black or gray markets to the legal market and how to ensure that social equity programs are reaching intended outcomes.

Bennett S. LeBow College of Business

Emily Diana Daly

Bennett S. LeBow College of Business
International Business, Marketing



Faculty Mentor: **Prof. Dana D'Angelo**
General Business

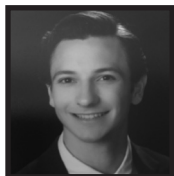
Co-Mentor: Jodi Cataline

The Personal and Professional Impacts of the Global Classroom During COVID-19

The Global Classroom (GC) is an educational approach that hones the professional knowledge, skills, and attitudes (KSA's) of Drexel University students and their international peers. However, during the unprecedented global pandemic of 2020, the college experience and the GC were drastically altered as universities transitioned to remote learning. As a continuation of prior research regarding the effectiveness of the GC in terms of KSA's, this study seeks to understand how the GC impacted the wellbeing of first-year students in the LeBow College of Business through the lens of this pandemic. Through a survey with a 33% response rate and interviews with ten students from the 2020-2021 freshman cohort, I confirmed that the GC helped these students develop such skills as teamwork, communication, and a diverse worldview, even during a pandemic. The majority of students found that the bonds formed with their teammates improved their overall wellbeing, emphasizing the importance of strong networks during the pandemic and as a college freshman. These results provide new information about the pandemic overall and will add additional knowledge to the extended study of the GC by my mentors, Professors Dana D'Angelo and Jodi Cataline.

2021 STAR Scholar

Bennett S. LeBow College of Business



Nicholas Palmer

Bennett S. LeBow College of Business
Marketing

Faculty Mentor: **Dr. Vadake Narayanan**
Management

Dealing with “Fake News” In a New Age

The pluralization of media in the age of the internet has allowed what many consider “fake news” to flourish. The term “fake news” can be better defined as misinformation or disinformation, where the difference is intent. The spread of false information threatens the rights of consumers to be fully and accurately informed. Because of the velocity of information, the speed by which information travels, and a changing environment of information sharing, there is generally a lack of accountability from online sources. “Fact-checkers” can act as watchdogs online but are often ignored by users, and some fact checkers have fallen under scrutiny for ties to political agendas. This study will explore fact checking practices primarily amongst major media outlets. This is done through a qualitative process of structured interviews with journalists from prominent media organizations. Interviews will be coded for practices that deal with fact checking and this will be summarized for further examination and recommendations.

Bennett S. LeBow College of Business

Semaila Islam Dulon

Bennett S. LeBow College of Business
Finance



Faculty Mentor: **Dr. YanLiu Huang**
Marketing

Text Therapy with Emojis

The introduction of emojis to online communication is very recent yet gained increased popularity in the past years as it enhances communication by portraying feelings. Numerous research has been conducted on emoji usage to understand its impact on the brand relationship and purchase intent. However, minimal research has been conducted in relation to text therapy, a new form of counseling that allows clients to text with a therapist. This study makes an attempt to understand how emojis used by therapists impact the overall counseling experience.

The study, consisting of different conditions, revealed that the usage of emojis does not always lead to a positive impact. Emojis have a negative impact when present in long texts; however, emojis used in concise texts are appreciated. This effect might be the result of the mindset that long texts tend to be more straightforward and serious. On the other hand, emojis in concise texts make the therapist appear more empathic and understanding. Moreover, it was also discovered that patients favored emoji usage when conversing about family-related issues, stress, and work-life balance. Future studies should focus on other mediating processes involved in our effects.

Bennett S. LeBow College of Business



Joanna Scorese

Bennett S. LeBow College of Business
Marketing

Faculty Mentor: **Dr. YanLiu Huang**
Marketing

Co-Mentor: Farhana Nusrat

Love at First Touch: How Using A Computer Dating Website versus Mobile App Influences Consumer Preferences in Online Dating

As of 2020, about 44.2 million people in the United States use online dating services, and just over 60% of those people use dating apps. Considering how successful online dating is now, it is important to understand what drives attraction across different online dating platforms (ODPs). Extant research has explored various dimensions of online dating including users' attitudes, attraction, presentation strategies, and gender differences. Yet no research has examined how the type of device used (computer vs. smartphone) in online dating affects customers' decision-making. To address this gap, we designed a correlational survey study that explored real ODP users' decision-making, and the effects of device and gender. Although results did not show significant gender-device interaction, there was a difference in behavior of smartphone and PC users, placing higher values on attractiveness and compatibility, respectively. Data also showed that mobile app users who went on real dates had higher levels of enjoyment and matched expectations relative to PC users. This research supports previous findings that smartphone users tend to make decisions based on physical characteristics, and extends this theory to the world of online dating.

Bennett S. LeBow College of Business

John Raleigh Armentani

Bennett S. LeBow College of Business
Finance, Marketing

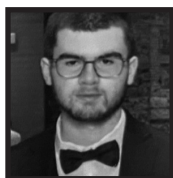


Faculty Mentor: **Dr. Chen Wang**
Marketing

The NBA Bubble: Did it Use A Flawed or Fantastic Marketing Strategy?

The NBA is one of the most grossing professional sports to date. During the 2019-2020 NBA season, players were forced to play in a bubble in the absence of fans, due to COVID-19. To maintain viewership, the NBA employed a new marketing strategy by placing social justice messages on the back of player's jerseys. Did it turn out to be a success? My research aims to examine the effectiveness of this marketing strategy. Through conducting interviews and a survey, my main finding is that this strategy caused mixed opinions among viewers. Some thought that this was a great way for players to express their opinions, while others thought that it was ruining the game by taking away from the actual sport being played. Specifically, according to my data, 43% of viewers reported that these social justice messages had a negative effect on their viewing experience, another 43% reported no effect at all, while 14% reported a positive effect. I also found that although many people did not enjoy the social justice messages on the back of the jerseys, the majority of survey participants could accept mixing sporting events with various social justice issues.

Bennett S. LeBow College of Business



Anri Gavasheli

Bennett S. LeBow College of Business
Economics

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

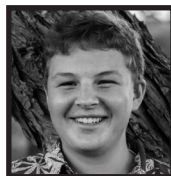
To what Extent was the Paycheck Protection Program (PPP) Effective in Helping Small Businesses Survive the Pandemic?

This research investigates whether the Paycheck Protection Program (PPP) that provided loans to small businesses as a part of the 2020 CARES Act was effective in targeting industries and regions most affected by initial economic distress from Covid- 19 pandemic. In this research, I combine employment data of small establishments from the U.S. Bureau of Labor Statistics (BLS) with loan-level microdata from Small Business Administration (SBA). At the sectoral and state levels, the loan amounts per worker are not correlated well with percentage changes in employment. My results indicate that, on average, the industries, or regions with largest initial declines in employment did not receive adequate funding from PPP. Based on these results and considering that PPP was rolled out at an unprecedented pace to assist businesses in desperate need of funds for payroll expenses, a certain trade-off might exist between targeting and speed of governmental, crisis relief programs.

Bennett S. LeBow College of Business

Levi Smith

Bennett S. LeBow College of Business
Economics



Faculty Mentor: **Dr. Joel G. Maxcy**
Sport Management

Is Baseball Really a “Dying” Sport?

Known as “America’s Favorite Pastime,” Major League Baseball (MLB) was once one of the most popular sports in the United States of America. With the growth of the internet and social media as well as increasing popularity of other sports, accessing baseball games has actually become more difficult--MLB has created their own streaming service through which fans are not even able to watch their local teams. Though baseball is widely considered a “dying sport” due to less consistent viewership ratings and youth participation, numbers will go to show that it is actually not so. Why is that? Decreasing accessibility and slowed gameplay has significantly diminished baseball’s mainstream cultural impact, and the baseball fans of the 20th century are not getting any younger. Despite these apparent flaws in its marketing and actual gameplay, Major League Baseball and its teams continue to grow their respective revenue streams from year-to-year. When compared to the National Basketball Association, an organization seen in the public eye as an exciting sport with a growing young fanbase, it actually closely competes, despite popular belief.

Close School of Entrepreneurship



Janis Niv

Close School of Entrepreneurship
Entrepreneurship and Innovation

Faculty Mentor: **Prof. Scott Quitel**
Entrepreneurship

School's Out!

Professor Quitel is currently founding a grassroots school called School's Out! This school will be outdoors, and teach practical and empowering subjects like invention, entrepreneurship, empathy, environmental stewardship, and urban gardening to combat the food desert phenomenon. Professor Quitel is also writing a book describing the methods, theory, and story behind School's Out! by investigating a breadth of problems in traditional public education. This involves a literature review investigating inequities and pitfalls in education since the birth of the US up to the present at a national, state, municipal, and neighborhood level. While redlining and other overtly racist practices are outlawed, the effects still linger in places like Philadelphia. The first step towards closing these gaps is empowering students to fight issues like climate change and pursue social and environmental justice. By teaching entirely outdoors, the potential for better student engagement, improved mental and physical health, environmental stewardship, and increased self-efficacy is boundless.

College of Arts & Sciences

Sophie Kujawski

College of Arts & Sciences
Geoscience



Faculty Mentor: **Dr. Amanda Lough**
Biodiversity, Earth & Environmental Science

Mapping the continental-oceanic transition subsurface of the Cameroon Volcanic Line (CVL)

Little is known about the volcanic mechanism underlying the Cameroon Volcanic Line (CVL). Located within the African tectonic plate, the structure extends into Cameroon, Equatorial Guinea, and Nigeria. The CVL is an example of intraplate volcanism, unique worldwide for spanning both continental and oceanic crust. However, existing explanations for the origins of analogous structures elsewhere do not match the CVL's history. Mantle and lithospheric behavior beneath the CVL may provide insights to its origins. I used data sets from seismograph stations in Cameroon and Equatorial Guinea, collected in 2006-2007 and 2017-2019 respectively, to map the locations of earthquake events. The data were then mapped three-dimensionally and analyzed relative to time, depth, and magnitude to better understand the CVL's subsurface behavior. Event clusters—areas of increased stress—followed a consistent pattern, indicating the locations of subsurface structures, possibly magma chambers, beneath the study sites. Due to the limited scope of data collection, mapping was only effective to a depth of 60 km. Future directions include building on current data set.

College of Arts & Sciences



Rachel Miller

College of Arts & Sciences
Environmental Science

Faculty Mentor: **Dr. Sean O'Donnell**
Biodiversity, Earth & Environmental Science

Co-Mentor: Meghan Barrett

Comparing External Sensory Systems Between Morphologically Distinct Males in *Centris Pallida* Bees

Centris pallida is a species of solitary bee that lives in the Sonoran Desert. To reproduce, mature females create underground brood cells, and when the adult bees emerge to mate in the spring, morphologically distinct large and small males employ two unique mating behaviors: patrolling and hovering. Large males patrol the desert ground, using their sense of smell to find females. Small males hover above the mating arena, relying on their vision to locate females. Past research has shown that the brains of large and small males are different: large males have larger antennal lobes and small males have larger optic lobes, supporting their divergent behaviors. The main objective of this project was to examine and quantify the external sensory systems of *C. pallida* bees to determine if they were similarly distinct between the large and small males. Eye casts were photographed under a camera microscope and the number, size, and distribution of ommatidia (sensory units of the eyes) were analyzed using imaging software. The sensilla (sensory units of the antennae) were characterized using scanning electron microscopy. This research is part of a larger project to understand how sensory resources are allocated as insects evolve.

College of Arts & Sciences

Caroline Gallen

College of Arts & Sciences
Environmental Science

Faculty Mentor: **Dr. Sean O'Donnell**
Biodiversity, Earth & Environmental Science

Wasp Body Allometry: Exploring the Brain's Effect on Head and Body Size Relationships

The size relationships among an organism's body parts determine its morphology. Research in the O'Donnell lab is exploring the possibly brain-driven evolution of limits for head to body size relationships in wasps. My study examined the relationships between the average head and body weights of wasp species from two genera. Earlier studies found a nonlinear relationship between head size and brain size in Vespidae wasps, indicating that smaller species have large brains relative to their heads. Examining head to body ratios can reveal if the need to hold a relatively larger brain impacts wasp body morphology. In this study I sampled 9 *Agelaia* species and 17 *Polybia* species. I collected the average dry weights of heads and bodies for each species. A log-log analysis plotting body size to head size produced a slope of 0.88, a slope significantly less than 1.0 and suggestive of a lower limit for wasp head size. When analyzed separately, both genera had similar head-to-body size slopes, showing this pattern is found in both genera. This work sheds light on the effect of brain size on head to body size relationships, implying that factors that affect brain size, such as the evolution of sociality, ultimately impact an organism's body.

College of Arts & Sciences

Sydney Eben

College of Arts & Sciences
Environmental Science

Faculty Mentor: **Dr. Dane C. Ward**
Biodiversity, Earth & Environmental Science

How does the enduring generalist adapt to the effects of climate change: How does beach geomorphology impact the horseshoe crab spawning density?

The horseshoe crab, *Limulus polyphemus*, has persisted for millions of years, yet the field of science has so little context to its role in the environment and how that's changing based on human interaction. As a keystone species, horseshoe crabs play a pivotal role in supporting populations of shorebirds like the red knot, which depend on their eggs for food during their yearly migration north. Humans also rely on their blood to sterilize vaccines and the crab's offspring as fertilizer in agriculture. This study censused horseshoe crabs on one of the densest spawning beaches for this species in the Delaware Bay. Spawning surveys were conducted on nights with a full or new moon and during the receding high tide. Later, we returned to the beach to observe and measure the sediment size with a gravelometer. Spawning density data were then correlated with beach sediment size. It was observed that the crabs were most dense in areas with smaller grain size and few on-shore obstructions. This study has rendered valuable data into horseshoe crab preferred geomorphology and can provide essential insights into managing the Delaware Bay beaches as sea levels rise in the name of climate change.

College of Arts & Sciences

Leah Doran

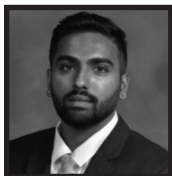
College of Engineering
Environmental Engineering

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

Are soil conditions preventing plant recolonization in a newly restored coastal salt marsh?

The Elkhorn Slough is a Central California estuary in Monterey Bay, California that contains the second largest area of salt marsh in California. To rebuild marshes that subsided due to a tidal restriction, 200,000+ cubic yards of sediment was deposited to raise the elevation of the marsh area. After three years, some areas of the restoration have seen robust plant recolonization, however, in other areas recolonization has been sparse. We compared soil conditions in areas with robust vs. sparse recolonization to understand whether soil conditions are promoting or preventing recolonization. These soil samples were examined for their particle size and salinity. Our analysis showed that 1/3 of the samples had good vegetation re-growth and these areas had soil with a smaller average particle size. The salinity values varied greatly from about 6 to 30 ‰ but the averages of the two classes were very similar, at around 16 ppt. This study suggests that soil salinity is not driving differences in recolonization, but differences in particle size deserve further investigation.

College of Arts & Sciences



Abhi Bhamidipati

College of Arts & Sciences
Biology

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

Co-Mentor: Akanksha Bhatnagar

Testing effects of SK609 analog in a *Drosophila* model of Huntington's Disease

Huntington's disease (HD) is an inheritable neurodegenerative disease which causes progressive loss of neurons in the brain. An autosomal dominant disease, HD is caused by a genetic mutation which manifests by promoting neuron degeneration, hindering dopamine transmission between neurons, and impairing attention and cognitive function. There is presently no cure for HD. Previous experiments have shown that SK609 drug improves sustained attention deficits in rats by binding selectively to the Dopamine 3 Receptor (D3R) without inducing its desensitization. Here, we test the ability of a SK609 analog (C2) to rescue locomotor and longevity defects associated with the *Drosophila* HD model. For longevity, survival of 160 flies from wild type, HD model and HD model with C2 drug food was tracked 3 times a week over a 10-week period. As of Day 60 time point, administration of C2 drug has prolonged lifespan of HD model flies closer to wild type flies, suggesting the drug is able to rescue longevity defects. For locomotion assay, the number of grid lines crossed are recorded for 25 larvae in wild type, HD model and HD model with C2 drug food. The assay is presently ongoing to observe if C2 drug improves locomotion in HD model flies.

College of Arts & Sciences

Gabrielle Lynn Greco

College of Arts & Sciences
Biology



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

Co-Mentor: Ellen Armour

Environmental enrichment stimulates activity-dependent nuclear shuttling of Tip60 in the *in vivo* Drosophila brain

Activity-dependent gene expression is critical for long-term memory formation, but the mechanisms by which epigenetic modulators control this process are largely unknown. Previous work has shown the histone acetyltransferase (HAT) Tip60 shuttles into the nucleus *in vitro* to regulate activity-dependent genes involved in cognition-linked processes, such as learning and synaptic plasticity. Whether Tip60 shuttles into the nucleus *in vivo* upon natural stimulation induced by social behaviors is currently unknown. The present study aimed to explore Tip60 nucleocytoplasmic shuttling in response to natural stimulation in the *in vivo* brain. *Drosophila* were either housed in isolation or in groups for environmental enrichment (EE). *Drosophila* brains were dissected after 5 days, and immunohistochemistry was used to observe Tip60 subcellular localization in the nucleus and cytoplasm. Upon EE, the amount of Tip60 shuttling into the nucleus was significantly higher than that of *Drosophila* housed in isolation. Future work will explore whether the increase in nuclear Tip60 upon EE causes increased activity-dependent gene expression of synaptic genes, which will further elucidate the importance of Tip60 nuclear translocation in cognitive function.

College of Arts & Sciences



Aayush C. Mehta

College of Arts & Sciences
Biology

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

Co-Mentor: Ellen Armour

Tip60 HAT and HDAC2 Nucleocytoplasmic Shuttling and Crosstalk: Implications for Alzheimer's Disease

Alzheimer's disease is becoming increasingly common in the aging population. Despite this, there are minimal treatment options currently available to treat symptoms and delay the onset of Alzheimer's. Previous work has identified the histone acetyltransferase (HAT) Tip60 as a potential therapeutic target. Tip60 HAT is an epigenetic enzyme that attaches acetyl groups onto histone tails, causing the chromatin to open and allow for transcription to occur, thus regulating gene expression. Tip60 targets genes involved in maintaining brain health and neuroprotection. In contrast, the antagonistic enzyme, HDAC2, a histone deacetylase, removes acetyl groups from histone tails, condensing DNA and repressing neuronal gene expression. Thus, Tip60 HAT and HDAC2 work together to regulate activity-dependent gene expression of proteins critical in neuroprotection. The present study observed HDAC2 localization in an *in vivo* *Drosophila* brain and studied the activity-dependent nuclear translocation of HDAC2 using immunohistochemistry. Researching Tip60 HAT and HDAC2 localization will help reveal how epigenetic mechanisms and nucleocytoplasmic shuttling regulate activity-dependent gene expression, especially in genes involved in neuroprotection.

College of Arts & Sciences

Vedasri A. Madala

College of Arts & Sciences
Biology

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

Co-Mentor: Srikar Donepudi

Defining binding properties of HSP-12.6 chaperone in *C. elegans* protein aggregation myopathy model

Under cellular stress, proteins are prone to misfolding and combining to form aggregates which increase cell toxicity. To mitigate cell toxicity, stress-inducible molecular chaperones—known as small heat shock proteins (sHsps)—bind to and detoxify aggregates. For example, mutations in some sHsps are linked to muscular myopathies associated with protein aggregation. To understand how sHsps function in disease, we use myopathy models in the model organism *C. elegans*. Worm sHSP, HSP-12.6, is selectively and strongly induced in the muscle cells of animals that are known to be resistant to proteotoxic stresses (dauer), suggesting that it may function to protect the muscle cell under high stress.

Our lab has found that HSP-12.6 indeed protects muscle cells from polyglutamine toxicity (polyQ), but surprisingly does not bind to polyQ aggregates. Instead, it selectively binds to and protects myofilament proteins. Since it also binds to A β amyloid aggregates, my project aims to define the binding preferences of HSP-12.6 by testing whether it binds to amorphous or prion aggregates. Defining HSP-12.6 binding preferences can provide insight into how sHsps function in myopathies.

College of Arts & Sciences

Zoe Moreland

College of Arts & Sciences
Biology

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

Co-Mentor: Jana Smuts

Quantifying PERK Activity in the R240H Variant in Relation to Neurodegenerative Disease

Within the Unfolded Protein Response (UPR), PERK is a key regulator for proteostasis in cells and helps reduce cellular stress caused by the accumulation of unfolded proteins. The PERK pathway is associated with neurodegenerative diseases such as Alzheimer's Disease (AD). Findings on the relationship between PERK and neurodegenerative disease are contradictory in that PERK activity can either be harmful or protective. Increased PERK activity found in post-mortem brain samples of patients with AD supports the idea that the chronic activation of the PERK pathway and subsequent long-term attenuation of translation cause neurodegeneration. However, recent studies show that a common PERK variant (Haplotype B) that is linked to tauopathy is a hypomorph, having reduced activity. In order to determine whether neurodegenerative disease is caused by reduced rather than increased PERK activity, this project aims to quantify PERK activity in the R240H variant found in a Dutch population with AD.

College of Arts & Sciences

Sally Ehlers

College of Arts & Sciences
Environmental Science



Faculty Mentor: **Dr. Mary Katherine Gonder**
Biology

Co-Mentor: Tyler Andres-Bray

The Handedness and Manual Dexterity in Termite Fishing of Nigeria-Cameroon Chimpanzees

Lateralization is the preferential use of one side of the body. In humans, this heritable trait is shaped by learning and culture. Handedness (the tendency to use one hand more frequently than the other) and manual dexterity (the ability to skillfully grasp an object to complete small, precise movements) are used to study the origins of human lateralization. I studied handedness and manual dexterity in a population of Nigeria-Cameroon chimpanzees (*Pan troglodytes ellioti*) from camera trap videos of termite fishing, a tool-use behavior requiring fine-scale manual movements. The hand used, digit position, action length, and whether the action resulted in termite consumption were coded from videos of 13 chimpanzees. A handedness index and z-scores were calculated to determine hand preference. Four of the subjects were left-handed, two were right-handed, and three were ambidextrous. Several different grips were observed, but the only grip used by all 13 chimpanzees was between the thumb and index finger. There was considerable variation in individual hand preference and digit position in this population. The observations suggest that handedness in chimpanzees may be partially attributed to trial-and-error learning during development.

2021 STAR Scholar

College of Arts & Sciences



Max Olstad

College of Arts & Sciences
Biology

Faculty Mentor: **Dr. Kari F. Lenhart**
Biology

Co-Mentors: Tiffany Roach, Beth Kern, Carlos Billini

Investigating the Coordination Between Stem Cell Proliferation and Cytokinesis for Tissue Homeostasis

Many niches contain multiple stem cell populations and must coordinate daughter cell production. The mechanism of this coordination is unknown. I am using the *Drosophila* testis to investigate stem cell coordination as it contains two distinct but cooperating stem cell populations: germline stem cells (GSCs) and somatic cyst stem cells (CySCs). Germ cell differentiation requires that each GSC daughter, a gonialblast (Gb), is encysted by two cyst cells produced by CySCs. GSCs and CySCs divide asynchronously but achieve the required 2:1 daughter cell ratio through delayed completion of GSC cytokinesis. Abscission, the final step of cytokinesis, occurs in GSC-Gb pairs late in G2 of the cell cycle. Therefore, unlike typical cells, GSC proliferation and abscission are not linked. To determine if there is any co-regulation between cell cycle and cytokinesis timing in GSCs, I am using the Gal4/UAS system to genetically alter expression of cell cycle factors in GSCs. I am investigating if/how the GSC cytokinesis program responds to cell cycle changes using live and fixed imaging of the GSC cell cycle and identifying changes in GSC cytokinesis timing and/or failure of GSC abscission, the latter of which could implicate tumorigenesis.

College of Arts & Sciences

Aanchal Sengupta

College of Arts & Sciences
Biology



Faculty Mentor: **Dr. Kari F. Lenhart**
Biology

Co-Mentor: Tiffany Roach, Beth Kern, Carlos Billini

Investigating coordination of proliferation rates between two stem cell populations in the *Drosophila* testis niche

Adult stem cells rely on cues from their environment, or niche, to balance production of self-renewing and differentiating daughter cells. Moreover, many niches must control the proliferation rates of distinct stem cell populations to maintain tissue homeostasis. The mechanisms underlying coordination of stem cell proliferation rates remain elusive. The *Drosophila* testis niche contains two stem cell populations: germline stem cells (GSCs) and somatic cyst stem cells (CySCs). While tissue homeostasis requires coordinated production of daughter cells from these two stem cell lineages, how this occurs is still unknown. Preliminary work from our lab suggests that CySCs can non-autonomously regulate the proliferation rates of GSCs, but the mechanism has not been explored. Therefore, by genetically increasing the CySC cycling rates to observe how this alters the cycling rates of GSCs. By using the Gal4/UAS system to express a constitutively active form of the mitotic initiating factor CDK1 in the CySCs, we successfully increased CySC cycling rates. Future directions will determine whether altered CySC/GSC proliferation rates alters tissue homeostasis and stem cell integrity with age.

College of Arts & Sciences



Gokul Karthikeyan

College of Arts & Sciences
Biology

Faculty Mentor: **Dr. Jerome Ricard**
Biology

Direct Interactions of TUCAN, DRAL, Caspase-9, and p53 with the EphA4 and EphB3 Receptors Governing Dependosome Regulation and Assembly

Cell death is a process regulated by specific biological pathways. Though natural during development, neuronal death can arise from trauma to the central nervous system, which has far-reaching and debilitating effects. The process of central nervous system injury does not, however, result in instant cell death. Cellular receptors act to recruit other proteins, creating a complex that ultimately induces cell death. This project is focused on the EphA4 and EphB3 receptors that complex with proteins such as TUCAN, DRAL, caspase-9, and p53; this dependosome complex induces cell death. The goal of the project is to identify the direct interactions between the proteins in order to better understand how the dependosome is regulated and assembled. Before determining direct protein interactions, it was essential to obtain DNA clones and sequences of translation for each protein being used in this study. This was done through recombinant DNA cloning with a plasmid vector. Using recombinant vectors with inserted genes of interest, *E. coli* were transformed and plasmids of the colonies expressing the gene of interest were sequenced. DNA clones for the proteins were obtained for future yeast two-hybrid assays to exemplify direct interactions.

College of Arts & Sciences

Naomi R. Bass

College of Arts & Sciences
Biology



Faculty Mentor: **Dr. Elias T. Spiliotis**
Biology

Co-Mentor: Benjamin P. Robinson

Examining the effect of septin depletion on endolysosome association with microtubules

Endosomes and lysosomes are intracellular organelles critical for cell metabolism, signaling and degradation. Defects in endolysosome maturation are implicated in the pathogenesis of disorders such as Alzheimer's and atherosclerosis. Endosomes mature as they use the microtubule (MT) cytoskeleton to move from the periphery to the center of the cell. Previously implicated in trafficking regulation, septins are a group of GTPases that bind to the actin/MT cytoskeleton. Here, we examine how the loss of septin 7 (SEPT7) affects the association of endosomes with MTs. MDCK cells expressing SEPT7 shRNA (KD) and scramble control were stained for endogenous SEPT7 and analyzed. SEPT7 signal reduction in the KD validated the shRNA effectiveness. Subsequent experiments in SEPT7 KD cells examined MT association with early endosome marker EEA1-GFP and MVB marker CD63-GFP; MVBs are specialized endosomes that form intraluminal vesicles and fuse with lysosomes. Fiji analysis software produced individual endosome outlines that were overlaid on the MT channel. EEA1 and CD63 showed over 95% MT association regardless of KD status, though EEA1 showed a slight increase with SEPT7 KD. Follow-up experiments are needed to further evaluate this observation.

College of Arts & Sciences



Nisha Patel

College of Arts & Sciences
Biology

Faculty Mentor: **Dr. Jennifer Stanford**
Biology

Co-Mentor: Emily Sterner

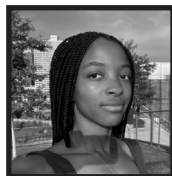
Uncovering the Interactions Between Kismet and HATs/ HDACs in Axon Pruning in *Drosophila Melanogaster* Gamma Neurons

Axon pruning (AP) is a normal neurodevelopmental process that refines synaptic connections. In *Drosophila melanogaster*, AP in gamma neurons is driven by the steroid hormone ecdysone binding to its receptor (EcR). Kismet (Kis) is a chromatin reader that recognizes epigenetic marks and, upon binding to the EcR locus, promotes additional epigenetic modifications. Loss of Kis and subsequent loss of EcR transcription prevents proper AP, and this loss is associated with defects in immediate recall memory in the adult fly. Kis cannot modify chromatin alone. It is thought to recruit enzymes that can modify histones, such as histone acetyltransferases (HATs) and histone deacetylases (HDACs). The specific HATs and HDACs that regulate EcR expression are not known. We used pharmacological inhibition and RNA interference (RNAi) to ask which HATs and HDACs regulate the EcR locus. We are looking to see whether these specific inhibitor or RNAi treatments lead to changes in axon pruning or EcR expression, which would suggest that these enzymes are relevant to regulating this process. Understanding how HATs and HDACs affect AP will expand our knowledge of epigenetics while providing leads for therapeutic targets of neurodevelopmental conditions.

College of Arts & Sciences

Alexis Drew

College of Engineering
Chemical Engineering



Faculty Mentor: **Dr. Haifeng Ji**
Chemistry

Co-Mentor: Jerica Wilson

Discovery and Design of Novel TIPE2 Inhibitors

TIPE2 is a lipid transport protein that controls the innate and adaptive immune response. The binding to TIPE2 and subsequent transport of two phosphoinositides, PIP2 and PIP3, controls leukocyte polarization; enabling leukocyte movement into areas of inflammation. When leukocytes are localized into areas of inflammation, they can prompt angiogenic and tumorigenic factors thus establishing a framework necessary to initiate and sustain tumor growth. TIPE2-deficient leukocytes show a substantial decrease in polarization. Thus, a small molecule inhibitor targeting TIPE2 would be beneficial to the fight towards suppressing tumor growth and establishment. In this study we utilize an in silico docking pipeline to determine novel inhibitors for the TIPE2 enzyme. Initial large databases (~3 million) were docked using Glide and AutoDock into the TIPE2 active site previously determined and characterized by Zhang et al. These predictions allowed us to determine 3 hit compounds that have initial KD values in the 50 ug realm as determined by surface plasmon resonance (SPR). These compounds have been designed to have superior ligand substrate affinity, solubility, and predicted ADME properties.

College of Arts & Sciences



Sky A. Harper

College of Arts & Sciences
Chemistry

Faculty Mentor: **Dr. Haifeng Ji**
Chemistry

Co-Mentor: Matthew Mieles

In Situ Polymerization of Acrylic Acid Using DBD Plasma For Remote Polymerization in Mesoporous Materials

Polymers can be found everywhere; both naturally occurring or artificially synthesized; from toothpaste to starch. Due to their mechanical and chemical properties: such as strength, hardness, and storage, polymer synthesis is highly researched. Properties can be influenced by polymer length, concentration of the monomer, or polymerization conditions. This research investigated a novel dielectric-barrier discharge (DBD) non-thermal plasma-based approach to prepare poly(acrylic acid) (PAA) in situ.

The goal was to achieve a reduction in the energy and preparation required to prepare PAA on specific surfaces such as porous materials, which has proven a challenge for different methods of polymerization such as UV, thermal, and traditional hot plasma polymerization.

This work generated data that will provide guidance for the overall efficiency, such as cost and polymerization time of the DBD plasma approach for the treatment of polymer coatings. This research will study the polymerization of PAA and prove the concept of remote polymerization. This efficient method could be applied in the industrial setting. The DBD plasma synthesized PAA kinetics and mechanisms will also be compared against other PAA data sets found in other studies.

College of Arts & Sciences

Angela Graff

College of Arts & Sciences
Global Studies and Modern Languages

Faculty Mentor: **Dr. Rachel Reynolds**
Communication

Co-Mentor: Dacia Paje

“And the Rapist is You”: Exploring the Transnational Appeal of “A Rapist in Your Path” Through Lyrical and Performative Analyses of American and Chilean Performances

My research focuses on the portrayal of sexual violence in the powerful Chilean anti-rape song, “A Rapist in Your Path,” drawing implications for a broader discussion around rape culture. The song and its accompanying flash mob performances were created to introduce and popularize feminist theory among those outside the elite academic sphere. While initially a Latin American phenomenon, the song soon spread to over fifty different countries, being adapted for each local performance context. The aim of my research concerning “A Rapist in Your Path” was to answer how the song was able to garner such a transnational appeal, especially given the fact that it was performed in countries where patriarchy takes inherently different forms. To answer this question, I analyzed the lyrics and performative attributes of two Chilean and two American performances of the song, utilizing multimodal analytic techniques. Through my analyses of these four performances, I uncovered universal themes of victim-blaming, patriarchal subjugation, and state paternalism, ultimately revealing that intersectionality and connective action is what drove the impetus for the transnational social rebellion behind “A Rapist in Your Path.”

College of Arts & Sciences



Makayla Collins

College of Arts & Sciences
Political Science

Faculty Mentor: **Dr. Steve Vásquez Dolph**
Global Studies & Modern Languages

Puerto Rican Diaspora Post-Hurricane Maria: Reparations and Rebuilding Broken Communities

This project examines the Puerto Rican diaspora post-Hurricane Maria, an environmental and political catastrophe that displaced thousands, aggravated Puerto Rico's already crippling debt, devastated already neglected infrastructure, and limited civilian access to health and resources. The goal of this community-based participatory research project is to begin to understand the needs of Puerto Ricans, both diasporic and island-based, in order to provide proper remediation and resources for issues exacerbated by economic crisis and environmental destruction. Diaz (2017) found that current island residents suffer from trauma, colonial neglect, and displacement. Hinojosa (2018) explains the importance of community-building post-Maria, which created a diaspora of half a million Puerto Ricans to the United States mainland. By surveying and synthesizing extant academic literature, we will provide our community partner, Plenitud PR, a grassroots non-profit based in the mountains of western Puerto Rico, with evidence-based research to aid them in their grant applications designed to meet current and future needs of their local community.

College of Arts & Sciences

Siddhanth Agrawal

College of Computing & Informatics
Computer Science



Faculty Mentor: **Dr. Thomas G. Stojsavljevic**
Mathematics

SEIRV Model of SARS-CoV-2 with Global Sensitivity Analysis

The SARS-CoV-2 outbreak originated in Wuhan, China in late 2019 and has quickly spread around the world. Mathematicians around the world have been working extensively to develop powerful tools that will help us understand how the virus is spreading and one such effective tool is mathematical modeling. Most of the research done to date focuses on an SEIR compartmental model which includes Susceptible(S), Exposed(E), Infected(I) and Recovered(R) states in the model. Currently, the effect of large-scale vaccination on the population is being investigated. We focused on developing a mathematical model, based on a set of non-linear differential equations, which focuses on a two-part Vaccinated state – V_1 (People who got only one dose of covid vaccine), V_2 (People who got both the doses of the vaccine). We also divided the infected population into two parts – symptomatic and asymptomatic as the latter, which is usually left out of the system, has a significant effect on the transmission of the virus. We setup a system of 7 differential equations and 13 parameters which were then simulated using MATLAB. Further analysis was done to investigate the sensitivity of the model across its parameter space.

College of Arts & Sciences



Matt Callaway

College of Arts & Sciences
Physics

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

Co-Mentor: Weixiang Yu

Classifying Astronomical Objects Based On Features Of Their Density Maps

With data being collected from sky surveys becoming larger as newer telescopes are built, such as the LSST (Legacy Survey of Space and Time) telescope being constructed in Chile, there is a more urgent need to expedite the process of identifying and classifying objects contained in these sky surveys. The most efficient way to go about this would be to automate the process, which can be done by using a machine learning algorithm to classify objects as a quasar, star, or galaxy. By using data from the sky surveys being taken by telescopes, we can generate density maps of these objects. Further experimenting with properties used for plotting these maps will optimize the process and lead to a more accurate identification program that requires substantially less human guidance than is currently required.

College of Arts & Sciences

Ariana Scheuer

College of Arts & Sciences
Environmental Studies and Sustainability

Faculty Mentor: **Dr. Christian Hunold**
Politics

Where is the “urban” in urban environmental education? Visual representations of nature in Philadelphia environmental education centers

Critical research on “urban nature” emphasizes the role of environmental education in communicating complex entanglements of nonhuman ecologies with urban settings in the 21st century. Drawing on visual studies, we ask to what extent imagery used by urban environmental education centers in Philadelphia, PA fosters more attentive ways of seeing nonhuman nature in the familiar contexts of everyday urban life. Imagery was collected from the visitor centers and websites of ten environmental education centers. Analysis of the treatment in these visual materials of nature/culture relationships, human and nonhuman communities, and “the urban” in general and Philadelphia in particular shows that all of the centers perpetuate a conception of nature as separate from the urban. To set foot in one of these centers is to enter an oasis—a nature exhibit—and to leave the city behind. Beyond this surprising finding, however, the quality of the information provided, visitor demographics, accessibility, and other factors such as attention to ecological scale differ considerably. There remains a wide gap between the guidance of critical urban environmental education scholarship and the practices of urban environmental education centers.

College of Arts & Sciences



Rebecca S. Graubart

Pennoni Honors College
Custom-Designed Major

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

Co-Mentor: Hayley O'Donnell

Altering Cognitive Flexibility with Noninvasive Brain Stimulation Over Left Prefrontal Cortex

Cognitive flexibility (CF) is defined as one's ability to adapt to unexpected changes by shifting strategies and discovering new solutions to problems. Previous studies have demonstrated that the brain region mostly associated with CF is the prefrontal cortex (PFC); accordingly, influencing the neural activation of the PFC could have an effect on one's ability to be cognitively flexible. Our primary goal for this study was to examine the effect of neurostimulation over the left lateral PFC on CF performance. We increased the likelihood of neural excitability of the left PFC via transcranial Direct Current Stimulation (tDCS), a non-invasive neuromodulatory method involving the application of small electric currents through electrodes on the scalp. Participants were administered a series of cognitive flexibility tasks, including the Water Jar task and the Forward Digit Span task. During these two tasks in particular, participants received excitatory, inhibitory, or sham tDCS stimulation over the left PFC. The results of the study contribute to our understanding of the potential neural mechanisms that promote flexible thinking, as well as support the development of treatments for cognitive flexibility impairments.

College of Arts & Sciences

Katelynn Rudolph

College of Arts & Sciences
Psychology



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

Understanding Goal-oriented Problem Solving Using a Novel Task

Every day, people are presented with situations that require problem-solving. Within cognitive neuroscience, creative problem-solving can be defined as the ability to achieve a goal in a new and unique way. For example, one may substitute nails for an adhesive when hanging a family portrait. This kind of flexible thinking has been studied through various methods aimed at identifying and measuring creativity. A well-known method is the Alternative Uses Task (AUT), where participants are prompted with a common object and generate alternative uses. Although the AUT captures how individuals can create novel ideas, it does not fully test real-world creativity. To address this knowledge gap, the purpose of this study was to validate a new measure of real-world problem solving, the Alternative Objects Task (AOT). The AOT presents participants with a goal first, and the participant must subsequently generate unusual objects that can achieve the goal. Participants were administered via an online questionnaire the AOT, as well as the AUT, and other measures of personality and creative achievement. Our analyses allow us to examine whether the AOT captures unique aspects of creative thinking relative to well-established creativity measures.

College of Arts & Sciences



Aleda Jomy

College of Arts & Sciences
Biology

Faculty Mentor: **Dr. Kathryn Devlin**
Psychological & Brain Sciences

Beyond Race-Correction: Using Reading Level to Optimize MCI Diagnosis in Diverse Older Adults

Actuarial diagnoses of mild cognitive impairment (MCI) rely on appropriate norms but have not been adequately tested in diverse groups. Normative data often adjust for race to account for sociocultural influences on test scores. A better approach may be to use reading level instead of race. We compared 3 normative adjustments to determine the most accurate method of diagnosing MCI in Black and White older adults. 345 older adults without dementia (69% White, 29% Black) completed cognitive tests. We adjusted scores for age, sex, and 1) education, 2) education and race, or 3) reading level, and assigned MCI diagnoses using actuarial criteria. We assessed the 3 methods' agreement and prediction of diagnostic, cognitive, and functional change. Agreement was strong in White participants but moderate in Black participants. Methods 1 and 3 showed the most agreement, while method 2 diagnosed fewer Black participants. Methods 1 and 3 best predicted diagnostic progression and cognitive change. All methods predicted functional change similarly well. Adjusting for reading level predicted longitudinal outcomes better than adjusting for race. Using reading level as a normative adjustment enables better cross-cultural validity in MCI diagnosis.

College of Arts & Sciences

Jillian D'Souza

College of Arts & Sciences
Psychology

Faculty Mentor: **Dr. Michael Lowe**
Psychological & Brain Sciences

A Literature Review of the Power of Food Scale

The Power of Food Scale (PFS) is used to measure hedonic hunger (eating in the absence of physiological need) in food abundant environments. The PFS is divided into three subset measures that include food available (e.g., food is not closely present), food present (e.g., food is within the vicinity), and food tasted (e.g., food has been tasted but not consumed). Through this review, research on variables such as gastric bypass surgery, food preferences, weight loss, eating disorders and other related content was examined. This review looked at the degree to which the first and second factors relate to these variables versus the degree to which the third does. These factor comparisons were examined in literature that reported separate data for the three different subscale measures. Results suggest that the first and second factor vary the greatest from the other subscale measure. This relationship can show how prolonged stimuli exposure in food abundant environments affect neurotransmitter release, more specifically, dopamine release. Future research should examine the neurological causal basis behind the variation found among subscale factors in the PFS as it would be important to eating disorder and weight loss research.

College of Arts & Sciences



Sanjana Oak

College of Arts & Sciences
Psychology

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

Effects of Asian Representation in Western Media on Asian Descendants' Sense of Self

In the United States, the media's portrayal of ethnic minority groups tends to be insufficient, especially in fictional TV shows. Prior research shows that, despite ethnic minorities making up about 40% of the population, ethnic minorities are underrepresented in the media (about 25%), with most depiction involving negative imagery (Prot et al., 2014). With such imagery being the main representation of ethnic groups, minority audiences may be socialized into believing these negative portrayals, identifying with the characters, and not question the accuracy of the content (Ramasubramanian et al., 2017).

This current study aims to examine (1) whether the representation of Asian characters lead to internalizing of negative stereotypes of those who identify as Asian, (2) whether those who do not identify as Asian (outgroup) recognize portrayals of Asian Americans (ingroup) as stereotypes, and (3) the effects of the stereotypes presented in the media on Asian Americans' ethnic pride and self-esteem. Results are expected to show that both the outgroup and ingroup are aware of the stereotypes that characters portray. Further, negative stereotypes will have a negative effect on the ingroup's ethnic pride.

College of Arts & Sciences

Kaylee Wilson

College of Arts & Sciences
Sociology



Faculty Mentor: **Dr. Jay Orne**
Sociology

COVID-19 and the Shifting Landscape of Sex

The COVID-19 pandemic has significantly changed the ways in which we make negotiations, shifting from in-person exchanges to virtual, resulting in a collective reevaluation of the ways that we negotiate trust through long-term online discussions, rather than face-to-face calculations. Sexual interactions have been affected by these shifts, as many were forced to seek sexual satisfaction through virtual chats and/or monetary exchanges on platforms like Grindr and OnlyFans. Using data collected through 25 interviews in a CDC-funded study among MSM in the Philadelphia area, we found that many participants had begun using dating apps for the purpose of social interactions and seeking sexual connections differently, to avoid risks related to COVID-19. We also examined in a different case, through an online exploration of the digital platform OnlyFans, that the platform had observed an increase in use as a result of the transition to virtual interactions and exchanges, rather than in-person sex work (Jarvey, 2020). Using this data, we analyze the new ways that people are calculating risks and negotiating exchanges in a socially distanced world, as well as the implications of these social shifts on a post-COVID-19 world and beyond.

College of Arts & Sciences



Karaan Raj M. Kothari

Dornsife School of Public Health
Public Health

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WELL Center

Do Sociocultural Attitudes Towards Thin Appearance Influence Levels of Body Dissatisfaction in Daily Life?

High body dissatisfaction (BD) advances binge eating spectrum disorders (B-EDs). BD is maintained by internalization of sociocultural attitudes towards thin appearance (SATTA). Research has associated SATTA with BD, yet the influence of these attitudes in the lives of those with B-EDs is undetermined. Studying this relation may generate focused interventions for BD. Our study compares SATTA and daily BD fluctuations in those with B-EDs. We hypothesize lower variability in BD in those with greater SATTA. 22 females with B-EDs who participated in a study to assess daily fluctuations in BD completed the SATAQ-4 at baseline. Women expressing greater family, peer, and thin internalization demonstrate low variability in BD daily (Family pressure $b = -0.17$, $p = 0.04$; peer pressure $b = -0.03$, $p = 0.03$; thin internalization $b = -0.17$, $p = 0.04$). Women with greater social media use show higher variability in BD daily ($b = 0.09$, $p = 0.02$). Replicated findings may imply treatments for BD. Interventions targeting coping deficits of external pressures and internalization to be thin may benefit women with high and stable levels of BD while teaching coping skills for social media use may help women with higher variability and BD fluctuations.

College of Computing & Informatics

Dishika Goel

College of Computing & Informatics
Computer Science



Faculty Mentor: **Dr. Mark Boady**
Computer Science

Automated Derivative Calculator for Laplace-Dirichlet Eigenvalues in Racket

Derivatives are a fundamental tool of calculus, and software such as Wolfram Alpha, Mathway, and Symbolab are widely used to calculate them. The Calculus of Moving Surfaces (CMS) is a specialized calculus that applies to surfaces that change shape over time. This is useful in boundary variation problems. One such problem is the Laplace Dirichlet-Eigenvalue Problem that is of importance to researchers studying the eigenvalues of various surfaces. The higher-order variations of this problem provide greater accuracy and additional quantitative results. This problem has remained largely intractable for hand calculations due to complexity and an exponential increase in the number of terms in the expression. We have tried to advance the solution to this problem through automation. Using the programming language Racket, we have created an algebraic simplification system that generates a database of derivatives related to this problem. The program applies a set of rules through recursive symbolic coding on the expression to further calculate higher variations. The generated database will allow the researchers to look up expressions instead of calculating by hand and will facilitate further research.

College of Computing & Informatics

Jasmine Ben-Whyte

College of Computing & Informatics
Computer Science

Faculty Mentor: **Dr. Edward Kim**
Computer Science

Audio Signal Decomposition and Its Potentials

Day after day, humans receive countless stimuli which they subconsciously organize and interpret due to the complex nature of the brain. Computers, however, are not naturally as brilliant as humans but are steadily being developed to learn and imitate such complexities. Advancements and breakthroughs in Deep and Machine Learning have made the end goal even more feasible and neural networks are gradually becoming more and more suited for signal decomposition of many forms. With the presence of background sounds, or transmission noises may lead to the main sounds we want to hear being undermined and sometimes overshadowed. The current research looks to decompose audio signals into their component parts, to make the filtering of the irrelevant parts of an audio input easier and more accessible. We reviewed currently relevant neural networks and tried to train a neural network of our own to analyze audio signals and identify constituting elements to make understanding and processing simpler for both humans and computers. We believe this can reduce the inconveniences associated with receiving audio messages from monitoring and communication devices, as well as potentially be used to examine signals of other forms.

College of Computing & Informatics

Hung Do

College of Computing & Informatics
Computer Science



Faculty Mentor: **Dr. Edward Kim**
Computer Science

Understanding Variational Autoencoders

An autoencoder is an artificial neural network tasked to understand efficient coding of unlabeled data. It has two main components: the encoder which lays out the input onto the code, and the decoder which lays out the code to a reconstruction of the input. Thus, understanding and developing allows for some useful applications such as detecting anomalies, processing images, etc. The focus of this research project, however, is to understand variational autoencoders (VAE) which are used to compact the input into a constrained multivariate latent distribution to make a possibly accurate reconstruction. Therefore, the purpose of this research is to interpret them better by determining if it's possible to find a canonical digit using the MNIST Dataset, graph it, and then tweak its sigma values to see how it impacts that graph. The entire program is executed via Keras and done in Jupyter Notebook in Visual Studio Code.

College of Computing & Informatics



Brian Nguyen

College of Computing & Informatics
Software Engineering

Faculty Mentor: **Dr. Edward Kim**
Computer Science

Audio Mixture Decomposition using Independent Component Analysis

Independent Component Analysis (ICA) is a computational method used to decompose multivariate signals into their source components. Known for its popularity as a blind source separation technique, ICA has a wide number of applications including artifact removal in brain wave activity, image denoising, and audio separation. ICA operates under the following preliminary conditions: the original sources must be statistically independent, and furthermore non-Gaussian (i.e., non-normal). One idea to consider is that an arbitrary set of independent components may have overlapping dependencies – it follows that the superposition (mixture) of these components will then contain these unwanted dependencies in the dataset. Therefore, one facet of my research involved understanding how superficial correlations can be removed among mixed audio signals. In addition, I investigated the means by which a latent mixing matrix can be computed for the purpose of restoring the original audio sources.

College of Computing & Informatics

Lev Saunders

College of Engineering
Computer Engineering

Faculty Mentor: **Dr. Ali Shokoufandeh**
Computer Science

Gesture Recognition Models For Textile Capacitive Touch Sensors

Recent work has shown the feasibility of weft knitted capacitive touch sensors as a viable interactive sensor modality. These sensors, having reduced hardware and construction complexities, shift those to the algorithms used to interpret the output. Machine Learning models have shown significant promise and capability in signal interpretation for gesture recognition tasks. Current models combine feature extraction components using CNN and their temporal dependencies using LSTM architectures and have shown a high degree of accuracy for recognition tasks. What this system is missing is a compact means of quickly evaluating gesture samples from the sensor using said models. This work introduces a method for implementation of a gesture recognition model on a single board computer. We demonstrate the use of a Python script for deployment of trained models for performance analysis. We also explore potential alternative architectures for the model to improve accuracy in gesture recognition tasks, including attention models as well as Deep and Cross models.

College of Computing & Informatics

Di Huynh

College of Computing & Informatics
Computer Science

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

THE LEARNED HELPLESSNESS EXPERIMENT ON AN ADAPTIVE FINITE STATE MACHINE FOR ARTIFICIAL INTELLIGENCE

One objective of artificial intelligence is to mimic the general intelligence of a human being and to produce plausible models of natural intelligence; that is to be able to solve complex, real-world problems, perform complicated tasks, make decisions, and process natural language. Dr. Stuart's Cybernetic Automaton, an adaptive finite state machine with probabilistic outputs and satisfies many of the goals for artificial intelligence mentioned above, is used in this research. Particularly, the computational model mimics some significant aspects of natural learning classified as classical conditioning and instrumental learning. The classic Skinner box is the most common experimental setup for instrumental learning. This research focuses on reproducing results in other biological and psychological literature and analyzing the way the model reacts to illustrate its natural intelligence. In this model of learning, my research is aiming to imitate the phenomena of the Learned Helplessness experiment, in which the subject's responses reduce if there's a state of punishment presented at the beginning of the experiment. We wanted to test if the results are consistent with behaviors of the real subject to prove that the model is clearly capable of simulating low levels of learning.

College of Computing & Informatics

Sanjana Suresh

Bennett S. LeBow College of Business
Finance & Business Analytics



Faculty Mentor: **Dr. Thomas Heverin**
Information Science

Using Semantic-Web Technologies to Facilitate Cyber Defenders' Decision-Making Tasks

Industrial control systems (ICS) are complex systems that have many unique devices that contain various software, firmware, and operating systems. ICS are major targets of cyber-attacks, as they are able to control critical physical infrastructure. Cyber-attacks on ICS can result in serious damage, negative financial impact, disruption to business operations and communities, and possibly the loss of life. Programmable logic controllers (PLCs), a type of ICS device, are ruggedized computers that are used for industrial automation. PLCs are responsible for constantly monitoring inputs in order to make informed decisions about outputs. ICS cyber defenders protect ICS from cyber-attacks by performing situation assessment tasks. ICS cyber defenders manually sift through data to identify vulnerabilities and mitigations for the vulnerabilities. This research aims to ameliorate cyber defenders' responsibilities by exploring the use of semantic-web technologies, including ontology modeling and semantic queries, to automate the situation assessment tasks conducted by cyber defenders.

College of Computing & Informatics

Aalekh Ray Chaudhury

College of Computing & Informatics
Computer Science

Faculty Mentor: **Dr. Weimao Ke**
Information Science

Is there a better way to automate text classification?

The research is focused on term weighting for text classification. We compare a novel method based on the Discounted Least Information Theory of Entropy (DLITE) with the classic TF*IDF term weighting scheme. We develop the DLITE method in the Jupyter Notebook environment based on an open-source implementation of a TF*IDF transformer and its associated vectorizer in Python's sklearn library. We test the two methods, namely DLITE and TF*IDF, on a collection of text messages that have been labeled as "ham" or "spam". Each method tokenizes the text collection and produces vectors of term weights to represent the text messages, which are automatically classified into (predicted as) "ham" or "spam" using a Bernoulli classifier (a Naïve Bayes algorithm). We compare predicted results to existing labels (ground truth) in a confusion matrix, which shows DLITE reduces classification errors by 18%. In the future, we plan to test these methods on other benchmark datasets such as the RCV1 Reuters Corpus.

College of Computing & Informatics

Harshil Thakur

College of Computing & Informatics
Software Engineering



Faculty Mentor: **Dr. Christopher MacLellan**
Information Science

Convolutional Cobweb Model for Image Classification

We built a new computer vision system that resembles human learning and incrementally classifies images. Building on the Cobweb algorithm, our approach uses convolutions to break down an image in order to classify it. The model is sequentially presented with images. For each image, the system predicts its label before updating its knowledge. At the end of training, it generates a hierarchical representation of learned visual concepts for displays in a web browser. We tested the approach using the mnist dataset, which consists of handwritten digits, to verify the performance of our new model. We compared our approach to the standard cobweb model as well as a convolutional neural network. Even though our model makes mistakes initially, it revises its knowledge over time and ultimately learns the correct knowledge. This means our model can learn from its mistakes and make improvements accordingly. Our preliminary results show an increase in performance for our new model over the standard cobweb model and we have plans to compare the approach to a convolutional neural network. This model could be applied into many other fields including license plate reading, smart doorbells with cameras, robot technologies, and self-driving cars.

College of Engineering



Livia Cilleruelo Fernandez del Moral

College of Engineering
Chemical Engineering

Faculty Mentor: **Dr. Nicolas J. Alvarez**
Chemical & Biological Engineering

Co-Mentors: Dr. Thamires Lima, Ann Sitarz

Rheology of peanut butter and yogurt in relation to their physical attributes

Food texture research is a growing field due to rising consumer demand for products that accommodate dietary restrictions. These modified foods have a different food texture compared to their standard counterparts, which can affect total product sales and performance. This research examined the physical properties of four different brands of peanut butter and yogurt to better understand the relationship between each product's rheology and physical attributes. In the case of the peanut butter, the three most popular standard brands were compared to an "all-natural" product (containing no ingredients apart from peanut); in the case of the yogurt brands, three standard brands (each with different levels of fat and protein) were compared to a coconut-milk-based yogurt. All brands were tested using shear and extensional rheology to probe differences in viscosity, modulus, Hencky strain, etc. These numerical results were compared to physical attributes perceived in the mouth (thickness, smoothness, stickiness). The coconut-milk-based yogurt and the all-natural peanut butter both presented moduli and viscosity more than an order of magnitude lower than that of regular products, making them less attractive to the buyers.

College of Engineering

Adil Zeinullayev

College of Engineering
Mechanical Engineering



Faculty Mentor: **Dr. Nicolas J. Alvarez**
Chemical & Biological Engineering

Large-Scale LCD Composites Printer

Liquid-crystal display (LCD) printing is one of the most affordable and convenient resin 3D printing methods currently used. Unlike digital light processing (DLP) printing, where a digital image is generated and then projected onto the resin, LCD printing projects ultraviolet (UV) light from a light source, like a 405 nm LED array, and masks the light with an LCD panel to generate the digital image. Both approaches use the projected light to harden the resin and form a solid layer, but LCD printers are typically more compact than DLP counterparts, reducing the quality losses associated with DLP printing. Commercial LCD printers are designed primarily for hobbyist printing and have limited capacity for more advanced printing. Consequently, a new printing platform needs to be developed to leverage advances in resin printing.

In this project, a new, large-form-factor composites printer was developed. This printer focuses on the compatibility with fiber-deposition systems that would automate the composite-manufacturing process. This printer features a sliding resin vat that moves out to receive fibers between print layers and a large resin vat to accommodate fiber deposition and increase print size.

College of Engineering



Mansi C. Patel

College of Engineering
Chemical Engineering

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

Co-Mentor: Caroline Cameron, Sherif Khalifa

Modeling the Effect of a Circular Economy on Wind Turbine Blade Waste

The U.S. is increasingly utilizing renewable resources to decarbonize and fulfill the future's energy requirements, with wind power predicted to supply 35% of national end-use electricity demand by 2050. Wind turbines transform the kinetic energy of the wind into electrical energy as the wind rotates their 100-200 ft. blades. Since wind turbine blades have a finite lifetime of about 20 years, a cumulative total of 6.9 million tons of wind turbine blade waste could be landfilled in the U.S. by 2050. A circular economy for wind turbine blades would allow for their glass-fiber-reinforced composite materials to be reused in the wind industry and second markets rather than be sent to landfills. This project developed a Python model to predict the effect of circular economy practices (i.e. lifetime extension, reuse, repurposing) on wind turbine blade waste from 2001-2050. Input parameters such as yearly energy demand, blade lifetime, and recycling efficiencies led to predictions of future blade material requirements and waste. Future applications of the model involve conducting life cycle assessments that consider the impact of wind turbine blades on carbon emissions, human health, ecosystems, material resources, and more.

College of Engineering

Emily M. Fedon

College of Engineering
Chemical Engineering

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

Co-Mentor: Sophie Lee

Colorimetry for Battery Diagnostics

Based on sustainable energy improvements, lithium-ion batteries have the potential to become a green-energy solution to climate change and replace depleting nonrenewable energies. However, these batteries include many parts that are prone to short circuits or failure. Because of this issue, battery producers need quality control methods to ensure they're processing functional batteries. A possible solution is using a color change as a control. In this work, we use microscopy and electrochemistry to study that color change during a redox reaction as a potential diagnostic tool for malfunctioning batteries. We find that sodium diphenylamine-4-sulfonate behaves well as a color indicator of this reaction with gold working electrodes. In solution, this chemical changes from clear to dark red when voltage is applied, which can be seen through reproducible images during reaction. Our results demonstrate that colorimetry can be used as a diagnostic method for lithium-ion batteries, and, with more work, could be standardized for implementation to save time and money in manufacturing.

College of Engineering

Liam J. McNally

College of Engineering
Architectural Engineering

Faculty Mentor: **Dr. Amir Yaghoob Farnam**
Civil, Architectural, & Environmental Engineering

Co-Mentor: Parsa Namaki Araghi

Additive Manufacturing of Bio-Inspired Reinforcements for Concrete

Additive manufacturing with polymers has allowed manufacturers and consumers to create detailed physical objects with 3D computer models that are easy to understand and modify. These manufacturing methods excel in creating complex patterns that are customizable and repeatable and can decrease labor needed for manufacturing as well as material waste. 3D printing could be used to manufacture biology-inspired reinforcement materials that replace traditional steel reinforcements in concrete. However, these polymeric materials do not have the inherent mechanical tensile strength of traditional reinforcement, thus an investigation on the effect of printing parameters, including print nozzle size, print speed, and infill orientation, was conducted to determine the optimal method to manufacture these parts. Testing included pure tensile tests of dog-bone specimens, and each printing parameter showed to influence tensile properties. In addition to the tensile test, a void analysis study and image analysis of fracture surfaces for these specimens was conducted to try to observe microstructure defects and correlate these to mechanical results. Further research in this study will involve 4-point flexural and other mechanical testing.

College of Engineering

Ariel Hiterer

Goodwin College
First-Year Exploratory Studies



Faculty Mentor: **Dr. Joseph B. Hughes**
Civil, Architectural, & Environmental Engineering

Location and Demographic Analysis of Destruction Data in Manbij, Syria

Manbij is a city in Syria that experienced extensive damage during the Syrian Civil War from 2013 through 2018. The city was ruled by the radical Islamic group, ISIS, for several years and became a target for bombing by the United States, Turkey, and Russian Air Forces. Attacks have stopped and officials are now turning efforts towards reconstruction. Before any actual work can be done effectively, it is important to understand what was destroyed and who was affected. To answer these questions, surveys were conducted across the city collecting demographic, socioeconomic, and destruction data. This data was then integrated using geoprocessing software and analyzed. Information maps were created to understand the spatial variability of destruction, and a voronoi polygon algorithm was used to calculate the density of destruction throughout the city. Data was divided into sub-neighborhoods and the three sub-neighborhoods with the highest mean destruction percent were analyzed for mean house size, high school education percentage, and Manbij origin percentage. This analysis determined that the 3 neighborhoods leading in destruction percentage had populations with higher high school education percentage than other neighborhoods.

College of Engineering



Emily Simkovich

College of Engineering
Mechanical Engineering

Faculty Mentor: **Dr. Joseph B. Hughes**
Civil, Architectural, & Environmental Engineering

Co-Mentor: Aaron Lutz

Gun Violence in Philadelphia

In August of 2019, Pennsylvania Governor Wolf signed an executive order that declared gun violence a public health crisis. In 2020 the COVID-19 pandemic struck and communities were put under lockdown. The Philadelphia police department maintains a database of all incidents of gun violence that happen in the city. This is a unique situation where we have data on two emergencies that have happened at the same time. I am one of the first people to get to study and analyze this situation. Understanding why a major spike in gun violence has occurred is critical so that policy makers can implement solutions to stop the needless loss of life. I used cumulative sum graphs to determine that gun violence rose by 41% in 2020 and third standard deviation analysis to determine on what specific days. COVID-19 and the political and social unrest that happened in 2020 have exacerbated the rise in gun violence but they were not the direct cause of the spike. This conclusion is supported by the fact that gun violence continues to rise to this day even with the lessening of the majority of COVID-19 restrictions and shrinking unemployment. My next step with this research will be to look into the correlation between gun violence and unemployment rates.

College of Engineering

Avani Kavathekar

College of Engineering
Environmental Engineering



Faculty Mentor: **Dr. Franco Montalto**
Civil, Architectural, & Environmental Engineering

Co-Mentors: Korin Tangtrakul, Sloane Woerdeman

Urban Heat Island Intensity in Hunting Park

The Urban Heat Island (UHI) effect, caused by a lack of natural landscapes, heat-absorbing infrastructure, and high energy demands in cities, leads to higher temperatures in urban areas as compared to rural areas. Studies have shown that the Hunting Park neighborhood in Philadelphia is the most heat vulnerable area in the city and its UHI threatens human health and infrastructure. This project quantified the urban heat island intensity, relative humidity, and dew point in Hunting Park by comparing it with surrounding rural areas to determine the disparity in heat experienced by the residents. They were compared with various rural locations for multiple different months and for daytime and nighttime hours to analyze the difference that location, elevation, season, and time of day can make. The temperatures in Hunting Park were consistently higher and the relative humidity consistently lower than surrounding rural areas despite location, elevation, or season. Nighttime UHI and relative humidity were higher than daytime measurements in all scenarios. This data analysis supports previous studies to substantiate the heightened risk of UHI in Philadelphia and demonstrates the need for heat mitigation strategies in vulnerable areas.

College of Engineering



Alyssa Kemp

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Environmental Engineering

Faculty Mentor: **Dr. Franco Montalto**
Civil, Architectural, & Environmental Engineering

Co-Mentors: Korin Tangtrakul, Sloane Woerdeman

A Community-Focused Analysis of the Heat Mitigation Techniques in Hunting Park, Philadelphia

Along with rising temperatures, the number of days over 90 degrees is rising in Philadelphia. Historically, Philadelphia averaged 21 days at 90 degrees or higher yearly; however, July 2020 recorded 21 days in the nineties. Projections show Philadelphia will double the number of 90-degree days by 2030. Increasing heat unequally impacts low-income communities and communities of color. The Hunting Park neighborhood of mostly Hispanic and Black residents records surface temperatures more than 22 degrees hotter than greener areas in the city. Drexel University, the Philadelphia Office of Sustainability, and the non-profit Esperanza, funded by the William Penn Foundation, collaborated to install cooling structures of umbrellas and planter boxes in the neighborhood to combat heat. This study initiates the quantitative analysis needed to examine the effectiveness of the cooling structures. Comparisons of temperatures between blocks will be used to analyze the capability of the cooling structures to reduce the overall heat. With the help of Civic Scientists, the localization of urban heat islands will be determined to help assess areas within Hunting Park at risk of increased heat so that future cooling structures can be implemented there.

College of Engineering

Katelyn Singh

College of Engineering
Environmental Engineering



Faculty Mentor: **Dr. Franco Montalto**
Civil, Architectural, & Environmental Engineering

Co-Mentors: Korin Tangtrakul, Sloane Woerdeman

Assessing The Effectiveness Of Hybrid Poplar Trees For Urban Stormwater Management

Global climate change leads to more intense and frequent rain, which causes flooding and combined sewage overflows (CSOs). CSOs are a leading cause of water pollution, transporting litter and pollutants into waterways. To prevent CSOs the city of Philadelphia is implementing Green Stormwater Infrastructure (GSI), such as rain gardens and increased tree planting. Limited space calls for vegetation that can most effectively reduce stormwater runoff. Evapotranspiration (ET) rates are indicative of how quickly vegetation can manage water, and larger ET rates indicate effective stormwater management. The U.S. Forest Service has found that fast growing hybrid poplar trees use large amounts of water making them an ideal candidate for GSI. This study compares the effectiveness of hybrid poplars at different growth stages for stormwater management based on ET and soil infiltration rates. Soil moisture data has shown that young hybrid poplars have higher ET rates than common vegetation and bare soil. Their above-ground biomass correlates with ET rates and can serve as an indicator of water use. Greater ET rates may also increase the soil infiltration capacity, allowing faster infiltration during rain events and decreasing stormwater runoff.

College of Engineering



Nathan B. Judd

College of Engineering
Computer Engineering

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

Co-Mentor: Md Abu Saleh Tajin

Medical Applications of RFID Technology

Medical IoT is an interconnected network of sensors that collects and analyzes patient data. Ultra high frequency radio frequency identification (UHF RFID) is a technology that allows a reader to send out signals that can be responded to by tags in the immediate area that return received signal strength indicator (RSSI) values. The flexible antenna developed in our lab called the Bellypatch is compressed and relaxed as one breathes, changing its RSSI value. This data can be constantly monitored using a machine learning algorithm to not only monitor the breathing of patients but also allow for early detection of respiratory related illnesses.

During my time at STAR, I was charged with running experiments on the Bellypatch sensor. This includes trials involving a Simbaby that mimicked breathing and human trials. In another vein, I have been modifying handheld RFID interrogators to give real-time RSSI data. This RSSI dependent data collection is being applied to many different medical applications other than respiration such as monitoring fluid levels in an IV. The ultimate goal is to have a range of different sensors that can collect data on many different vitals all communicating with each other and oversee patient health.

College of Engineering

Claudia Offutt

College of Engineering
Computer Engineering



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

Co-Mentor: Md Abu Saleh Tajin

Wearable Health Sensing Systems

The Medical Internet of Things is a system of connected sensors and medical devices communicating over various protocols. The Drexel Wireless Systems Lab is using Radio Frequency Identification (RFID) and Bluetooth Low Energy (BLE) to design a wearable health monitoring system comprised of a temperature sensor, blood oxygen sensor, and respiration sensor.

The respiration sensor is passive RFID tag, which runs on energy wirelessly transmitted from an external interrogator, with a fabric antenna. It is worn on the abdomen and stretches as the wearer breathes, making the signal replicate the respiration pattern. The other sensors use BLE, allowing the devices to communicate for an extended period using little power. We created the temperature sensor prototype using a TIDA-01624B printed circuit board and a custom copper antenna. To track blood oxygen, we used Wireshark to access the raw data of a commercial sensor. Due to the nature of BLE advertising, users in proximity will detect each other's signals, enabling contact tracing. Once the individual sensors are operational, the data will be integrated into a mobile application where users can monitor their health and participate in contact tracing for diseases like COVID-19.

College of Engineering



Rebecca Moroz

College of Computing & Informatics
Software Engineering

Faculty Mentor: **Dr. Youngmoo Kim**
Electrical & Computer Engineering

The Integration of Art into STEM Education using Minecraft

In collaboration with the Young Dragons Program offered by Drexel's ExCITE Center, I administered a variety of innovative science, technology, engineering, art, and mathematics (STEAM) activities for free to middle school students from the West Philadelphia Promise Zone. The West Philly Promise Zone is a two-mile area in which organizations work to increase education, health, and economic successes for communities living, working and learning in its boundaries. Participants collaborated on tasks, built problem-solving structures, and learned through an interactive experience in Minecraft, an affordable "sandbox" video game available for multiple devices. An infinite 3D environment made of blocks, Minecraft allows for limitless creation, unrestricted by physics, and promotes critical thinking through accepting mistakes and perseverance. Minecraft bridges systemic gaps in STEM education using art-based learning to inspire students and focuses on a positive mindset towards the creative process rather than technical knowledge. Normally an in-person program, Young Dragons shifted to a virtual program due to COVID-19 and used the app Discord for communication to continue its mission of fostering students' agency and creative expression.

College of Engineering

Abigail Jackson

College of Engineering
Computer Science

Faculty Mentor: **Dr. Matthew Stamm**
Electrical & Computer Engineering

Understanding Synthetic Media For The Threat Of Misinformation

In this age of technology, Artificial Intelligence (AI) has prompted the creation of synthetic media, namely deepfakes. Deepfakes are videos in which a person's features are digitally altered – replaced with another individual's likeness. This media presents a misinformation threat to society, disrupting the social and political atmosphere. Unfortunately, due to the current era of digital media, deepfake creation software has become widely accessible to the general populace. This project examines the various deepfake generation technologies that are publically available. The researcher identified and cataloged the uses of such software, ranging from Reface (a simple mobile application) to Deepface Lab (an open-software deepfake system). After determining the most suitable deepfake application (Deepface Lab), the researcher developed a small dataset of synthetic media – videos. To further scrutinize the threat of such software, the researcher examined the dataset using a forensic media verification algorithm.

College of Engineering



Jaronn K. Sigey-Ronoh

College of Engineering
Mechanical Engineering

Faculty Mentor: **Dr. Michel W. Barsoum**
Materials Science & Engineering

Co-Mentor: Tarek El Melegy

The production of MAX & MAB Phases and a study of their oxidation & bulk properties

The MAX/MAB phases are ternary nitride, carbide, and boride ceramics. Unlike current metal alloys, some of these ceramics are oxidation resistant up to 1200°C under air environments, at which point most metals cannot be used. This property renders some MAX/MAB phases useful in a variety of applications from jet engines to nuclear powerplants. These materials could reduce costs and increase efficiency in these applications. However, although these ceramics show a lot of potential in many areas, it is important to study the entire class of materials & their properties as some MAX & MAB phases have not yet been researched in depth or at all. Some of these ceramics include titanium aluminum gallium carbide & iron aluminum germanium gallium boride. In this work, I tried to find the best processing parameters to fabricate predominantly single-phase samples of $\text{Ti}_2\text{Al}_{0.75}\text{Ga}_{0.25}\text{C}$ and $\text{Fe}_2\text{Al}_{1.1}\text{Ge}_{0.05}\text{Ga}_{0.05}\text{B}_2$ with some success.

College of Engineering

Duc Nhat Nguyen

College of Engineering
Materials Science and Engineering



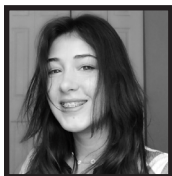
Faculty Mentor: **Dr. Hao Cheng**
Materials Science & Engineering

Co-Mentors: Pu Zhu, Yucheng Zhu

2D Materials Modification

2D materials is a new form of single-layer materials that shows promising properties in energy and biomedical application. With their unique structure and high volume-surface ratio, researchers are trying to expand their research on the materials' applications, including drug delivery. However, as a foreign substance, 2D materials trigger severe immune responses after being administered into the body. Therefore, my research focuses on the modification of the surface of the 2D materials to improve their biocompatibility. First, I explore different conditions such as pH and solvents that are suitable for the material to bond with the desired substance. Then I examine whether the modified material induces less immune response by testing the plasma protein adsorption on the material's surface, using the western blot and silver staining techniques.

College of Engineering



Amanda Luca

College of Engineering
Chemical Engineering

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

Co-Mentor: Mikhail Shekhirev

Synthesis of Two-Dimensional Hafnium Carbide

MXenes are a type of 2D materials discovered in 2011 at Drexel University with an abundance of potential applications, making them ideal candidates for integration into flexible electronic devices. My project is to synthesize hafnium carbide, Hf_2C , a new MXene, which was predicted to be a semiconductor when terminated with oxygen surface groups. No other semiconducting MXenes have been reported, making Hf_2C an attractive candidate to study. There are several precursors with similar chemical formulae, for example $\text{Hf}_2\text{Al}_3\text{C}_4$ and $\text{Hf}_3\text{Al}_5\text{C}_5$, which will result in MXenes Hf_2C and Hf_3C_2 , respectively. Thus, to synthesize pure Hf_2C flakes, we first found conditions for the synthesis of the precursor, $\text{Hf}_2\text{Al}_3\text{C}_4$, through trials of varying annealing times and elemental ratios. The desired structure was confirmed with X-ray diffraction analysis. Then, we found specific conditions, namely concentration of acids, time, and temperature, to selectively etch aluminum from the precursor and fabricate layered structure of hafnium carbide. A series of characterization techniques, including scanning electron microscopy, was used to confirm the presence of single-layer MXene flakes, demonstrating the successful synthesis of two-dimensional hafnium carbide.

College of Engineering

David Zheng

College of Engineering
Electrical Engineering



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

Co-Mentor: Lingyi Bi

Screen Printed MXene Supercapacitors on Textiles

Functional Fabrics, the forefront of wearable technologies, aims to seamlessly bridge textiles and electronics by providing a foundation for electronics to operate on fabrics. Through harnessing the power of electrical properties like conductivity and energy storage, we can provide a new world of utility to the clothing that we wear. The challenge becomes how we can modify fabrics to have those properties. In this project, we will take advantage of MXenes, a family of 2D transition metal carbide and nitrides with properties of conductivity and energy storage to screen print supercapacitors on fabrics. Due to the many parameters involved in screen printing: like mesh density, print passes, ink viscosity, and snap-off heights, we first tested those parameters to find the ideal printing setup. With the necessary background in screen printing, we created samples of MXene supercapacitors of different print passes to test the conductivity and capacitance using tools like the Multimeter, 4-Point Probe, and Potentiostat. These measurements will allow us to analyze the change in conductivity and capacitance across different passes and evaluate if we were successfully able to create a fabric that has a working supercapacitor printed on it.

College of Engineering



Lia DiMitri

College of Engineering
Materials Science & Engineering

Faculty Mentor: **Dr. Christopher Li**
Materials Science & Engineering

Co-Mentor: Mark Staub

Crystallization-directed Multicomponent Polymer Crystalsomes

Utilizing the crystallization of semicrystalline biocompatible polymers at the curved liquid/liquid interface of a miniemulsion droplet creates nanosized, hollow, and spherical morphologies. These structures are called crystalsomes and can act as innovative capsules for biomedical applications due to their novel structure. Thus far, these crystalsomes have been fabricated using one crystalline polymer. This project utilizes a blend of two semi-crystalline and biocompatible polymers, poly (L-lactide) (PLLA) and poly (ϵ -caprolactone) (PCL), in the mini-emulsion crystallization process. Blending these two polymers can provide a platform for a multifunctional crystalsome where properties such as permeability and surface chemistry can be controlled by the blend phase structure. A combination of electron microscopy, thermal analysis, and X-ray diffraction was utilized to study the structure and morphology of the blended crystalsomes. These structural deductions showed a PLLA/PCL blend crystalsome is attainable and our results show the properties of the blend crystalsomes highly depend on the PLLA to PCL ratio.

College of Engineering

Andy Ngo

College of Engineering
Chemical Engineering



Faculty Mentor: **Dr. Antonios Kontsos**
Mechanical Engineering & Mechanics

Co-Mentors: Dr. Pablo Huang Zhang, Hadi Khezam,
Dhruv Shah

Effect Of Fused Deposition Modeling Printing Parameters On Tensile Mechanical Property Of Acrylonitrile Butadiene Styrene Printed Products

Additive manufacturing plays an important role in the manufacturing domain as it enables the creation of 3D objects with complex shapes and specialized materials. More specifically, the fused deposition modeling (FDM)-type 3D-printing method builds parts by depositing thermoplastic materials layer by layer in a precisely controlled fashion. The combination of several parameters controls the quality of printed objects, which in turn impact their mechanical properties. This project focuses on examining the impacts of infill density, the number of contours (perimeters), and printing orientation on the tensile strength of acrylonitrile butadiene styrene (ABS) thermoplastic using the Raise3D Pro2 (Irvine, CA) printer. Each printing parameter was studied independently using mechanical testing of dogbone geometries (ASTM 638-14). Experimental tensile strength values were compared to several publications. The results show that while increasing the infill density does strengthen the printed objects, increasing the number of perimeters also has a comparable effect. Further studies need to be conducted to understand and optimize more parameters, including the number of contours, for additional geometries.

2021 STAR Scholar

College of Engineering



Munazzah Al Hashim

College of Engineering
Mechanical Engineering

Faculty Mentor: **Dr. Jonathan E. Spanier**
Mechanical Engineering & Mechanics

Co-Mentors: Aleksandr Plokhikh, Dongfang Chen

The Effect Of Annealing Temperature On The Structure And Piezo-Response Of Bismuth Ferrite Films

Bismuth ferrite (BFO), a multiferroic material has uses in non-volatile memory and photovoltaic energy storage and photocatalysis. The purpose of our research was to study the effects of annealing temperature on the structure, composition, and piezo response of BFO films. BFO was deposited on silicon based thin films using atomic layer deposition. $\text{Fe}(\text{thd})_3$, $\text{Bi}(\text{Ph})_3$, Ozone, H_2O , and $\text{Al}(\text{CH}_3)_3$ were the reactants and precursors. The composition of the films was confirmed using Energy dispersive X-ray spectroscopy and Scanning Electron Microscopy. The films, except one, were annealed in a furnace at temperatures from 500°C to 650°C . The morphology of the films was studied using Atomic Force Microscopy and their piezo-response using Piezo-force microscopy. The film that was not annealed had an amorphous structure and almost no recorded piezo response. Those annealed, showed varying degree of crystallinity. Smaller, scattered grains of BFO and weaker piezo response were observed below and above the temperatures of 550 - 600°C . At 550°C and 600°C the films showed larger and concentrated deposition of BFO and a greater piezo response. These temperatures were the optimum annealing temperature for the BFO films within our experimental limits.

College of Engineering

Cassius Ali Garcia

College of Engineering
Computer Engineering



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

Space Repair Robot Design

With the increase in space odysseys and trips to the International Space Station, the need for onboard maintenance has increased. This increased need for repairs exposes the crew members to the dangers of leaving their station more often. Because of this, the need to automate these tasks becomes greater. The pilot project pushes to create a robot that will manage regular maintenance on the International Space Station or any other large space vehicle. Implementing such an autonomous robot would decrease the risk of crew member injury and the expenses involved in extravehicular activity.

A team of two, Hope Wilson and myself, was created to complete this project. The goal is to design and build a robot capable of transporting itself and conducting repairs. This was accomplished by using an Arduino Uno R3 with a motor shield stacked on top of it. Three DC motors and four servos were connected to the motor shield and were remote-controlled by a wireless Xbox One controller via Bluetooth. Overall, this project is a successful proof of concept for a future autonomous repair vehicle onboard the International Space Station.

College of Engineering



Jared N. Matlis

College of Engineering
Mechanical Engineering

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

External Repair Robot for Space Stations

The International Space Station (ISS), established on November 20th, 1998, was humanity's first step to having a constant presence in space. IN order to achieve this, the ISS had to be maintained. This was completed by astronauts through extravehicular activities (EVA), which carry significant risk. Therefore, this project, alongside the Artificial Astronaut Project, aimed to create a proof-of-concept for a method of remote ISS maintenance. This culminated in the Stairway to Heaven, a CubeSat designed as the test module for the Artificial Astronaut (a remote-controlled maintenance drone), housing, testing, and supplying power for the machine. This project resulted in two designs, the Earth Test Model (ETM), which is our physical prototype, and the Space Test Model, which can be implemented with NASA resources. Specifically, the ETM has an opening acrylic chassis and rail to test the Artificial Astronaut. By contrast, the STM has a sealed aluminum alloy chassis and uses NASA's Ion Propulsion. Therefore, the Stairway to Heaven is able to test the experimental Artificial Astronaut and could be the predecessor to future methods of safe maintenance on space stations.

College of Engineering

Brandon S. Parento

College of Engineering
Mechanical Engineering



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

Autonomous Solar Tracking Stewart Platform

The energy crisis is one of the most crucial challenges facing the world today. With conventional energy resources limited and costly, governments and consumers are in demand of an alternative energy resource. While advancements in solar panel technology are answering the call, a viable approach to optimizing solar panel efficiency is solar tracking technology. Compared to standard trackers, ours is designed to move in six degrees of freedom (roll, pitch, and yaw). Following inverse kinematics, each Servo leg is programmed to orient itself relative to the bottom and top platform from solar input. As the sun moves overhead, our PID control program commands the servos to rotate in the direction of the maximum voltage of a photoresistor, relative to the total voltage of all photoresistors. As the panel absorbs light, solar energy is facilitated through a battery charging board into a 15-volt Li-ion battery pack. With the ability to power itself, a buck converter reduces the battery voltage to a manageable voltage output for the Servos. In practice, our platform can increase solar efficiency by 40% compared to standard solar panels. With the intent to advance solar technology, our device can see many applications in cities and beyond.

2021 STAR Scholar

College of Engineering



Khushi Patel

College of Engineering
Mechanical Engineering

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

Mobility Testing for External Repair Robot in Space

CubeSats are 10 cm by 10 cm by 10 cm satellites that have recently advanced to utilization in large interplanetary missions. The research will involve the combination of these cubic satellites to create a system made for an extravehicular robot that will be maintaining and repairing the space station. Currently, astronauts use risky EVAs to perform simple maintenance, which can be reduced by the creation of this new technology. The system my teammate, Jared Matlis, and I created will be used to demonstrate the mobility of the robot which we have named the "Stairway to Heaven". We took the dimension of three CubeSats and created a box that unravels into a railway. The lower end of the box will house the robot which is mounted on to rails that extend to the opening door. The box will unravel when the robot's arm pushes against the magnetic system of the closing mechanism. The Stairway to Heaven houses the power source using a 9-voltage battery which will be run through the rails. Lastly, there is a rung that the robotic arm will grab onto and pull on, like a ladder system. The Stairway to Heaven we worked on, is a model we created for testing on Earth. In a real space situation, there would be many alterations to this system.

College of Engineering

Mari Takizala

College of Engineering
Computer Engineering

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

Application of a Parallel Kinematic System for Solar Tracking

Solar energy is one of the most ideal energy sources for sustainability in applications for technology because of its abundance. The most common way to harness solar energy is via a solar tracker, an automated device that orients solar panels towards the sun at the position of its maximum flux to optimize energy for photovoltaic conversion. The purpose of this research was to propose a prototype for a parallel-kinematic solar tracker which moves following readings from an analog sensor. The mechanical system of choice for the device was the Gough-Stewart platform, a tilting platform that relies on 6 linear actuators programmed by inverse kinematics calculations for input-based movement. In addition to this, solar panels wired in parallel were attached to the top of the platform to charge 4 lithium-ion batteries used for the device's power. The analog sensor of the device was composed of four light-dependent resistors (LDRs) placed in individual quadrants divided by walls to isolate light. With all components in the sensor incorporated in a voltage-divider circuit, analog readings from light collected by each LDR under PID control were utilized to autonomously move the platform in the direction receiving the least amount of light.

College of Engineering

Jason Walat

College of Engineering
Mechanical Engineering

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

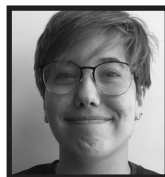
Solar Tracking Stewart Platform with PID Control

Solar power is the most prevalent method of power generation for spacecraft ranging from small CubeSats to the International Space Station. However, most spacecraft solar panels face efficiency problems due to their lacking mechanisms to maintain constant interaction with the sun. To remedy such a problem, I have begun work with partners Seth Parento and Mariane Takizala on designing, constructing, and programming a custom solar tracking platform. The platform is a six-motor Stewart platform designed and constructed in Drexel's Innovation Studio programmed with Arduino to move via pulse-width modulation of its six motors as calculated by conducting inverse kinematics operation on the platform's target motion in six degrees of freedom: x, y, and z translation; roll, pitch, and yaw. To track the sun's motion, our platform utilizes proportional integral derivative control to orient itself to receive the most sunlight possible. Our intent behind this project is to develop a new type of solar tracking platform with possible uses both on and above the planet.

College of Engineering

Hope Wilson

College of Engineering
Mechanical Engineering



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

Autonomous Repair Robot for Space Stations

Currently, astronauts must suit up and leave the space station to survey damage or repairs, exposing them to the great dangers of outer space. This project seeks to design a proof of concept EVA repair robot for the space station. Rather than send astronauts out into space to review and repair potential damage, this robot would use the outside of the space station to move, and provide feedback and conduct simple repairs. The robot would be sent up using a cubesat, so all components must fit within a 10cm cube for launch. We worked as a team of 2, with myself managing the mechanical design, and my partner Cassius Garcia providing all of the computer engineering, working with an Arduino microcontroller. I designed the robot in CAD software using Fusion 360, and used that to 3D print a large portion of the final robot. I also used this software to verify that my center of mass calculations were correct. The design consisted of an assembly to traverse along a rail system, an arm and claw to grab a rung to lock positioning, and a utility arm to repair any simple damage. The utility arm has 3 pivot points, with a small drill chuck design on the end, allowing the user to use a myriad of tools at any angle.

College of Nursing & Health Professions

Swetha Rao

College of Arts & Sciences
Psychology

Faculty Mentor: **Dr. Joke Bradt**
Creative Arts Therapies

Co-Mentor: Brigette Schneible

The Impact of Music Therapy on Chronic Pain Management and Opioid Use in Cancer Survivors

Many cancer survivors continue to struggle with chronic pain after the conclusion of their cancer treatment and search for nonpharmacological interventions to combat prolonged opioid use. Music therapy is a viable intervention for pain management, but its effects on opioid use have not yet been studied. The purpose of this project is to analyze qualitative data from a larger mixed methods pilot study aimed at examining the impact of music therapy on chronic pain and opioid use in cancer survivors. Participants were randomly assigned to 10 weeks of music therapy or verbal support sessions and were each invited to two interviews, one post-intervention and one at a 3-month follow up, which were then coded using thematic analysis and analyzed for overarching themes. The preliminary findings suggest that music therapy offered emotional and physical support, which aided participants in the tapering process. Music therapy techniques such as psychoeducation on music for pain management and interventions aimed at relieving psychosocial stressors were helpful in managing low to moderate pain. We concluded that music therapy may provide cancer survivors with the resources and support needed to reduce opioid use and help manage chronic pain.

College of Nursing & Health Professions

Lindsay Ryan Nakai

Antoinette Westphal College of
Media Arts & Design
Dance



Faculty Mentor: **Dr. Minjung Shim**
Creative Arts Therapies

Co-Mentor: Monica Gaydos

Delivering Telehealth-based Dance Interventions to Chronic Back Pain Patients

In 2020, the world shut down due to the COVID-19 outbreak and during this time of isolation, it was crucial that we find alternative modes of delivering health interventions to help combat the detrimental impact of physical inactivity, psychological distress, and loneliness. A feasibility study has been conducted to examine the feasibility, acceptability, and preliminary efficacy of two online social support groups (mindfulness-based dance/movement therapy and a verbal pain support group) on physical, cognitive, emotional, and social outcomes in individuals living with chronic back pain. As the STAR Scholar student, I conducted exit interviews and analyzed the qualitative data using a computer-assisted qualitative data analysis software, NVivo. The preliminary results of this ongoing study have shown positive outcomes as participants have expressed decreases in pain medication intake and increased physical activity, as well as learning how to better manage their pain. I also assisted the research team by creating a data extraction instrument in REDCap as well as extracting data for an upcoming systematic review regarding Telehealth-based dance interventions for health outcomes.

College of Nursing & Health Professions



Diem Quynh Thuy Bui

College of Nursing & Health Professions
Health Sciences

Faculty Mentor: **Dr. Sharrona Pearl**
Health Administration
College of Arts & Sciences
Center for Science, Technology, and Society

Masked in the Age of Facial Recognition: A Comparative Case Study of Hong Kong & the U.S.

Facial recognition technology has become almost ubiquitous and practically invisible. In daily life, we can use our faces to unlock our phones, log into our bank account, approve transactions touch-free, and identify others in a variety of contexts, including criminal justice. The COVID-19 pandemic has made the process less seamless. More specifically, the face mask has interfered with facial recognition AI, preventing it from recognizing masked faces. This was an obstacle until companies in Asian countries provided the new feature of masked face identification to be in immediate effect in various settings. AI used in the U.S. has yet to apply this capability. In this comparative case study, I argue that Hong Kong's fast AI progression is not a reflection of its technology being superior to the U.S. Hong Kong's societal, ethical, and political climate is what allows for existing software to be marketed as 'masked face' identification, a trend that has been resisted in the US.

College of Nursing & Health Professions

Nguyen Huong Do

College of Nursing & Health Professions
Health Sciences



Faculty Mentor: **Dr. Rose Ann DiMaria-Ghalili**
Nutrition Sciences

Co-Mentor: Zachary Hathaway

A CLINIMETRIC ANALYSIS OF WOUND MEASUREMENTS

Accurate measurements of wounds are critical to monitor healing in people with chronic wounds. Clinicians use the standard ruler method, which is prone to overestimation due to irregular wound borders, as it requires less time, costs less, and is accessible, instead of innovative wound measurement methods (e.g., digital planimetry or wound tracings). This study compares the reliability of wound measurements obtained by three methods: wound tracings, clinician and researcher ruler measures from an NIH study on the effect of low-frequency, low-intensity ultrasound on chronic wound healing and quality of life. We analyzed wound tracings on 20 patients and calculated wound size through MATLAB. Wound tracings were compared to ruler measures obtained by researchers and clinicians. The wound tracing method has higher intraclass correlation coefficients than ruler method, with 55% of cases with acceptable reliability ($r=.70$) compared to 35% respectively. There was no difference in reliability between clinician and researcher measures. Our preliminary findings suggest wound tracing is more reliable than ruler method and provides a more useful estimate of wound size for clinical research studies.

College of Nursing & Health Professions



Priyani Sharma

Dornsife School of Public Health
Public Health

Faculty Mentor: **Dr. Rose Ann DiMaria-Ghalili**
Nutrition Sciences

Co-Mentors: Zachary Hathaway, M.C. Coates

The Experiences of Health Care Providers Utilizing Telehealth Services During the COVID-19 Pandemic

COVID-19 has significantly increased the volume of telehealth usage in health care operations. Health care providers have faced different facilitators and barriers as they deployed telehealth throughout the pandemic. This study aims to measure the experiences of health care providers who used telehealth during the pandemic. Of the total 486 health care providers who took part in the Qualtrics survey, 131 of them were registered nurses, 60 were advanced practice nurses, 36 were physical therapists, 29 were mental health professionals, 24 were surgeons, 18 were registered dietitians, 19 were physician assistants and 169 were other provider types. Respondents in different categories showed similar concerns. The trend in the data suggests that most health care providers found that telehealth is easy to use, telehealth usage contained the risk of COVID-19 exposure, and providers received technological assistance that made the transition to telehealth easier. However, they experienced challenges with training and education regarding telehealth, technological reliability and connectivity issues, and patient's access to technology that supports telehealth platforms.

College of Nursing & Health Professions

Sofia Weingarten

College of Nursing & Health Professions
Nutrition and Foods



Faculty Mentor: **Dr. Jennifer Nasser**
Nutrition Sciences

Assessing Essential Protocol Variables for Generating Preliminary Data in a Pilot Study

This project involved development of a protocol for Pavlovian conditioning to promote a form of physical activity, namely fidgeting, to be used in a pilot study. Individuals who fidget have an easier time maintaining a healthy weight and reduced risk of lifestyle illnesses (i.e. obesity, diabetes). Since the Pavlovian conditioning paradigm will pair music and non-music cues, the main objective was to assess the most effective way to present elements of music to promote continuous movement within a 10-minute span. I also assessed the effect of pairing music with visual cues of hyper-palatable food, on the pleasantness of the music and food cues, and whether pairing upbeat music with visual cues of relaxing items (nature scenes, infant animals) can serve as a control. Additionally, I examined the effect of age and sex on the stated project objectives. I found that a tempo of 120 beats per minute, with melody and lyrics gave the longest span of continuous movement. I also found that younger (18-30 years), or female participants moved for a longer continuous time span than older (30-55 years), or male participants.

Dana and David Dornsife School of Public Health



Paula A. Garcia Sanchez

Dornsife School of Public Health
Public Health

Faculty Mentor: **Dr. Ana Martinez-Donate**
Community Health & Prevention

Co-Mentor: Leah Bakely

Understanding and Addressing Syndemic Health Conditions Affecting Latino Immigrants

Background: The main objective of the CRISOL research project is to understand and address the SAVAME syndemic among Latino immigrants in Philadelphia. The SAVAME syndemic refers to Substance Abuse, Violence victimization, HIV/AIDS, and MEntal health issues affecting Latino immigrant populations disproportionately. This study focuses on two factors of the SAVAME syndemic: violence and mental health.

Methods: A sample of 400 adult Latino immigrants living in Philadelphia are being surveyed using respondent-driven sampling (RDS). Interviews are conducted over the phone and responses are recorded using Qualtrics Online Survey. We used IBM SPSS statistics to estimate the prevalence of indicators of violence and mental health among a preliminary sample of 108 respondents.

Results: 65.7% of participants reported experiencing at least one type of violence over the course of their lives. The most prevalent type of violence was robbery (50%), followed by assault (36.1%) and shooting (34.3%), 59.3% of participants had never sought help for mental health issues.

Conclusions: These results suggest the need to develop targeted interventions for this population that simultaneously address the syndemic factors of violence and mental health.

Dornsife School of Public Health

Kara Mia Moran

College of Nursing & Health Professions
Health Sciences



Faculty Mentor: **Dr. Usama Bilal**
Epidemiology & Biostatistics
Urban Health Collaborative

Co-Mentor: Dr. Pricila Mullachery

The Connection Between the COVID-19 Pandemic and the Opioid Epidemic

The intersection of the COVID-19 pandemic and the Opioid epidemic is a threat to public health in the 21st Century. Opioid use disorders(OD)disproportionately impact racial and ethnic minorities. These groups have historically experienced limited access to healthcare, even before COVID-19 lockdowns were in place. This project aims to review literature on racial/ethnic disparities in OD outcomes in urban areas in the United States, and to examine how these disparities have shifted during the COVID-19 pandemic. We conducted a structured keyword search in PubMed, and excluded articles that did not report OD outcomes in urban areas for racial/ethnic minorities. We included a total of nine articles. Results largely indicate disparities in opioid outcomes in many US cities. In some cities, these disparities have worsened during the COVID-19 pandemic. Results also point to worsening of opioid outcomes among Black and Latinx individuals due to policies to mitigate the pandemic such as shelter-in-place orders. Future research should examine ways to minimize the impact of the pandemic among vulnerable groups with OD, including programs and policies to promote equitable access to healthcare, including medication assisted treatment.

2021 STAR Scholar

Dornsife School of Public Health



Zoe Schneider

College of Arts & Sciences
Mathematics

Faculty Mentor: **Dr. Harrison Quick**
Epidemiology & Biostatistics

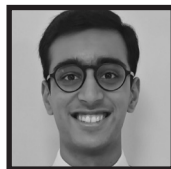
Spatial Analysis for Heart Disease Deaths in Pennsylvania Counties

Previous research demonstrates a steady decline in heart disease mortality, however, it remains the leading cause of death in the United States. On a more narrow scope, the rates of hypertensive heart disease continue to increase nationally. Hypertensive heart disease is defined as various heart conditions caused by high blood pressure. Prior research conducted by Dr. Harrison Quick, Ph.D. shows a similar rise in hypertensive heart disease across various counties in Pennsylvania. This project is largely focused on using the programming language R and data from the Center for Disease Control and Prevention (CDC) to evaluate disparities in hypertensive heart disease deaths on the accords of race, sex, and geographic location. By using the tools such as Poisson and Gamma distributions in R, we can combat barriers in the data, such as low or negligent death counts and suppressed data on the CDC's site. Another area of focus is a trend found in Dr. Quick's work, which highlights the increase in these deaths, particularly for black males. By evaluating this data, we leave room for further speculation and the bigger questions involving possible premises for work by Public Health officials.

Drexel University College of Medicine

Rudra Amin

College of Arts & Sciences
Biology



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

Co-Mentor: Kyle Yeakle

Studying the Effect of HIV-1 Tat Protein on HBV Replication and the Effect of HIV-1 Tat Protein and HBx Protein on NF- κ B Signaling

In the United States of America, about 5-10% of patients who are infected with the human immunodeficiency virus (HIV) are also infected with the hepatitis B virus (HBV). A chronic HBV infection is the most common cause of hepatocellular carcinoma (HCC). HIV-HBV coinfections lead to more rapid development of liver diseases, including HCC, compared to patients with only an HBV infection. HIV-infected cells produce the protein Tat, which is secreted from HIV-infected cells and can affect other cells in the body. HBV-infected cells produce the protein HBx, which is multi-functional. Both Tat and HBx have been found to increase NF- κ B signaling, which is a "pro-survival" pathway and can lead to the development of cancer, but which has also been shown to reduce HBV replication. Our project examines how the HIV Tat protein affects HBV replication in hepatocytes and how Tat and HBx may have a synergistic positive effect on NF- κ B signaling. We showed that Tat reduces HBV replication in both HepG2 cells and primary rat hepatocytes. This effect may be a result of Tat-mediated activation of NF- κ B signaling. To determine this, we used an NF- κ B-dependent luciferase reporter assay to look at the effect of Tat on NF- κ B signaling.

2021 STAR Scholar

Drexel University College of Medicine

Diana Gonzalez Baerga

College of Arts & Sciences
Biology

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

Co-Mentors: Aditi Shimpi, Pritika Shahani

The Role of Calcium Signaling in the Activation of AMPK and mTOR Pathways

Chronic Hepatitis B Virus infections are the leading cause of liver cancer. HBV produces HBx, a protein that influences cellular processes such as inhibition of cellular tumor-suppressing genes, HBV replication, and cellular transcription pathways. In the presence of HBx, HBV infected cells present elevated levels of cytosolic calcium. Moreover, adenosine monophosphate kinase (AMPK), an enzyme that senses the cell's energy levels, is also activated by HBx and calcium signaling. Mammalian target of rapamycin (mTOR) is also activated by elevated levels of calcium. We examine the role of HBx in the activation of AMPK and mTOR. Thus, we hypothesize that the ability of HBx to activate calcium signaling modulates AMPK and mTOR pathway. To this end, HepG2 cells were treated with a calcium chelator and Bradford assay was performed on cell lysates. Using the protein concentrations calculated we performed a western blot analysis. These results would help determine whether activation of the calcium signaling pathways alters the AMPK and mTOR pathways in the presence of HBx.

Ahmed Azhar

School of Biomedical Engineering, Science,
& Health Systems
Biomedical Engineering



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

Co-Mentors: Dr. Gabriela Canziani, Aakansha Nangarlia,
Farah Fazloon Hassen

Identifying key residues responsible for the Irreversible Inactivation of HIV-1 and SARS-CoV-2 by envelope entry inhibitors

Over 38 million and 165 million people globally are currently affected by HIV-1 and SARS-CoV-2, respectively. Functional studies with envelope inactivators (EIs), including PTs (Peptide Triazoles), PTTs (Peptides Triazoles Thiols), and cPT(T)s (Cyclic Peptides Triazoles (Thiols)), show irreversible inactivation of HIV-1 viruses. Similar irreversible inactivation of SARS-CoV-2 was observed in the presence of CVN, a lectin-based envelope inactivator. However, their mechanisms of action and sites of interaction on the envelope spikes are yet to be understood. As part of this project, site-directed mutagenesis on HIV and SARS-CoV-2 pseudoviruses were conducted to identify the key residue sites with which the various EIs cause irreversible inactivation of HIV-1 and SARS-CoV-2 virion. The variation in linker length between the thiol group and the pharmacophore of PTT played a crucial role in HIV-1 inactivation. Thereby, in HIV-1, the mutations were made in the thiol sites of the pseudoviruses to identify the initial site of PTT's and cPTT's thiol interaction. For SARS-CoV-2, the mutations were made in the glycan sites which prefer CVN binding.

Drexel University College of Medicine



Olivia Carton

School of Biomedical Engineering, Science,
& Health Systems
Biomedical Engineering

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

Co-Mentor: Dr. Charles Ang

Time Delay Distinguishes Conformational Activation and Disulfide Trigger Components of Peptide Triazole Thiol's Anti-HIV-1 Env Effect

Chaiken Lab has developed Peptide Triazole (PT) and Peptide Triazole Thiol (PTT) classes of HIV-1 entry inhibitors, targeting HIV-1's Env protein effecting entry into CD4+ immune cells. While PTs bind to Env, blocking CD4 interactions leading to infection, PTTs also disrupt the virus membrane, leaking its contents. Literature describes redox enzymes like Thioredoxin-1 (Trx1) acting in native infection and their inhibition blocks HIV-1 infection in vitro, but their modulation of metabolic reactions makes them poor inhibition targets. PTT and Trx1 both have free thiols, which we hypothesize react similarly with Env. Preliminary tests combining PT with Trx1 recapitulated PTT-like membrane disruption. This project examines time delays between PT and Trx1 components of this lysis effect to dissect PTT mechanism. HIV-1 pseudovirions were treated with PT and Trx1 at varying time delays and p24 release was measured for efficacy. Delaying Trx1 addition to 15 minutes after PT increased virus lysis the most, with delays up to an hour reducing effect. Starting with Trx1 and adding PT after showed little overall effect. This suggests a distinct separation between PT and Trx1/Thiol events, which will be used to improve PTTs as a drug class.

Drexel University College of Medicine

Monisha Gupta

College of Arts & Sciences
Chemistry



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

Co-Mentors: Dr. Gabriela Canziani, Aicha Bendia

Optimization of the pharmacophore that binds the CD4 pocket at residue x improves potency of synthesized cPT

In 2020, approximately 37.6 million people worldwide had ongoing HIV infections. Currently, there are some drugs on the market to slow down the spread of HIV, however there is no cure or vaccine. Therefore, it is imperative to work towards a drug which could prevent infection in the first place. Some of the current drugs on the market focus on inhibiting the process of viral replication within the cell by targeting enzymes such as integrase and protease. The gp120 trimer complex on the viral envelope on HIV is of particular interest as this spike attaches to host cells to allow entry of the viral proteins and genetic material. The Chaiken lab group focuses on developing a peptide to bind to the CD4 Phe 43 pocket to prevent viral entry. The cyclic peptide triazole N8 is the lead candidate to bind to the pocket. This summer, I focused on the synthesis of N8 and measured the compound's ability to bind to the targeted proteins of YU2 gp120. On the N8 compound reside three potential moieties for modification: the triazole, tryptophan and isoleucine groups. Moving forward, various modifications of these groups may improve N8's binding ability to its target gp120 complex.

Drexel University College of Medicine



Soumya Vavilala

College of Arts & Sciences
Biology

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

Co-Mentors: Chiaki Noguchi, Jessie Nagle, Leah Dobossy

Effects of Pyridostatin on Esophageal Keratinocytes

Esophageal squamous cell carcinoma is one of the deadliest of all cancers, with a poor prognosis even when patients receive treatment. Poor treatment outcomes have presented a need for new therapeutic approaches for this cancer. One potential therapy currently being researched is the drug pyridostatin. Pyridostatin stabilizes secondary DNA structures known as G4 quadruplexes that commonly form in guanine nucleotide rich sequences typically seen in telomeres. Stabilizing these structures makes them harder to replicate, inducing increased DNA damage. In cancerous cells, this may cause cell division arrest and stop tumor growth. This project focuses on the effect of pyridostatin at different concentrations on immortalized esophageal keratinocytes, with the goal of determining if pyridostatin kills these cells or causes division arrest. The keratinocytes were treated with pyridostatin at different concentrations and cell viability was analyzed using a trypan blue test, which found a negative correlation between cell viability and drug concentrations. This correlation suggests that treating these cells with pyridostatin at increasing concentrations causes greater cell death.

Drexel University College of Medicine

Glen Rogers

School of Biomedical Engineering, Science,
& Health Systems
Biomedical Engineering

Faculty Mentor: **Dr. Jessica Ausborn**
Neurobiology & Anatomy

Co-Mentor: Dr. Catherine von Reyn
School of Biomedical Engineering, Science, & Health Systems

Giant Fiber in the Full Adult Fly Brain

To study how the escape circuit in the fruit fly *Drosophila melanogaster* processes information, we must have a dataset that shows the extensive connections within the circuit. Currently, an electron microscopy (EM) dataset of the *Drosophila* hemibrain provided by the Janelia Research Campus is the best-annotated EM data available but lacks critical brain regions. In contrast, the Full Adult Fly Brain (FAFB) EM dataset is complete but contains limited annotations. The FAFB can be accessed using FlyWire, a program developed by Princeton University. I have used FlyWire to study the Giant Fiber, a neuron within the escape circuit of *Drosophila*, and the neurons that it connects to while also exploring tools available through FlyWire. One tool is a set of python code allowing access to an artificial neural network that has been trained to predict neurotransmitters for synapses from EM images. This neural network can potentially help researchers assert each neuron's role within the escape circuit based on its predicted neurotransmitters. I have developed code and processed over 5,000 synapses to investigate whether the predictions from the neural network will be viable for future analysis within the escape circuit connectome.

Drexel University College of Medicine



Medha Gupta

College of Arts & Sciences
Biology

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

Co-Mentor: Breanne E. Pirino

Verifying the Presence of Cre in Transgenic PACAP-Cre Mice

The neuropeptide, pituitary adenylate cyclase-activating polypeptide (PACAP), has been shown to be densely expressed in cells of the paraventricular nucleus of the thalamus (PVT) and may affect ethanol drinking and binge-like eating. To study these behaviors, we can manipulate the activity of the PACAP cells using chemogenetics. The purpose of this project was to ensure that, in the PVT of transgenic PACAP-Cre mice, PACAP is co-expressed with the Cre gene. To do this, we first transcardially perfused male and female transgenic mice with a preservative solution, using the circulatory system to fix the brain tissue. Then, we sliced the brain tissue on a cryostat. Next, we mounted sections from the PVT onto slides and processed them for dual in situ hybridization, which we viewed under a confocal fluorescent microscope to verify the presence of Cre mRNA and its colocalization with PACAP mRNA. In ongoing experiments, we hope to detect that cells expressing Cre mRNA are nearly always co-localized with those expressing PACAP mRNA, and vice versa. Ultimately, studying the behavioral effects of PACAP cell activity in the PVT can help advise drug development for alcohol use disorder and binge eating disorder.

Drexel University College of Medicine

Krishna S. Shah

College of Arts & Sciences
Biology



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

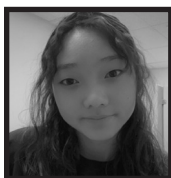
Co-Mentor: Breanne E. Pirino

Effect of pituitary adenylate-cyclase activating polypeptide in the paraventricular nucleus of the thalamus on affective behavior

In the paraventricular nucleus of the thalamus (PVT), the neuropeptide isoform, pituitary adenylate-cyclase activating polypeptide 27 (PACAP-27) has been shown to play a role in alcohol intake; however, its role in affective behavior remains unknown. To determine if overexpression of PACAP-27 in the PVT could alter affective behavior, we injected rats in the posterior PVT with a virus to overexpress PACAP (AAV9-CamKII-r-ADCYAP1-IRES-eGFP-WPRE) or a control virus (AAV9-CamKII-eGFP-WPRE). Through quantitative real-time PCR on tissue collected from female Long-Evans rats ($n = 8/\text{group}$), we confirmed that PACAP mRNA was upregulated in the posterior PVT by more than 700% at 4 weeks following injection. Next, in male Long-Evans rats ($n = 3/\text{group}$), we confirmed with immunohistochemistry that PACAP-27 but not PACAP-38 was the isoform affected at this time-point (+48% vs -8%). Finally, we tested female Long-Evans rats ($n = 9/\text{group}$) at the 4-week time-point on novelty-induced locomotor activity and anxiety in a light-dark box. Behavioral tests are ongoing and will provide the first evidence of the role of PACAP in the PVT in affective behavior. These findings will help us better understand the therapeutic potential of PACAP-based treatments.

2021 STAR Scholar

Drexel University College of Medicine



Nicole L. Ng

College of Arts & Sciences
Psychology

Faculty Mentor: **Dr. Wen-Jun Gao**
Neurobiology & Anatomy

Co-Mentors: Nancy R. Mack, Abby L. Keith

The impact of estrus cycle stages on anxiety and social behavior in female mice

Female mice have traditionally been less researched in biomedical studies due to the perceived complexity and lack of cohesive knowledge on behavioral changes caused by the estrus cycle. However, given that sex differences exist between neuropsychiatric diseases, studying female mice may be crucial in determining sex-linked impacts on behavior. In this study, we analyzed the estrus cycle in female mice using vaginal cytology following behavioral tests for social motivation, social memory, or anxiety-like avoidance. We hypothesized that performance in these tasks may be influenced by the estrus cycle stage. We found that, while there is no clear relationship between a particular estrus cycle stage and anxiety-like behavior, female mice may show reduced social motivation during metestrus and reduced social memory during diestrus. These results suggest that estrus cycle stage may impact performance on social behavior tasks in females. This study may provide insight into the relationship between estrus cycle stages and behavior, optimizing female mice studies. However, the mechanisms in which the estrus cycle impacts behavior requires further investigation, including therapeutic potentials and risk factors for disorders in females.

Drexel University College of Medicine

Darshan Patel

School of Biomedical Engineering, Science,
& Health Systems
Biomedical Engineering



Faculty Mentor: **Dr. Simon Giszter**
Neurobiology & Anatomy

Co-Mentor: Dr. Taegyo Kim

Novel Braided Multi-Electrode EMG Needle for Electrodiagnostics

Braided Multi-Electrode Probes are highly flexible ultrafine wires in a tubular microbraid used for neural recording & stimulation. Braids add capabilities in electrophysiology: specifically, allowing chronic recording & stimulation in brains and especially in spinal cords in freely moving animals. In new work, multisite recording benefits are hypothesized to allow clinicians to obtain single motor units by a single insertion (current EMG needles require multiple insertions with a single recording site): improving signal reliability and reducing pain. For this, we have proposed a novel EMG needle having microwires braided onto a conventional EMG needle to offer multi-recording sites. To braid onto a needle, we utilize our patented braiding machine. The braid/ needle assembly then undergoes a heating process to fuse the wire and needle for structural integrity of the assembly needed for smooth insertions. For fine wire cutting at microscale, we developed a mechanism for a 360° even cut. Recording sites are made on each wire by laser ablation. After mechanical insertion tests with the new braided needles, EMG recording tests will then be performed in animals. With conclusive results, we then hope to commercialize this design.

2021 STAR Scholar

Drexel University College of Medicine



Yashvi Shah

College of Arts & Sciences
Biology

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

Co-Mentor: Dr. Alessia Niceforo

Astrocyte to Neuron Reprogramming for Spinal Cord Repair

Traumatic spinal cord injury (SCI) destroys nerve cells and tissue, and is incapable of spontaneous repair, resulting in permanent loss of function. Currently, there are no treatments for individuals with SCI. The goal of our research is to address this gap and promote spinal cord repair. The present work targets one of the key cellular components of the central nervous system: astrocytes. Astrocytes increase in number and reactivity after traumatic SCI, but limit the reparative capacity. This study genetically reprogrammed astrocytes into neurons using the reverse tetracycline-controlled transactivator, rtTA, to induce the expression of neuronal genes. Primary astrocyte cultures from rat spinal cords were exposed to one of three conditions: rtTA, rtTa+Ascl1 (neurogenic transcription factor), or rtTA+miRs (microRNAs). Induction by doxycycline and addition of neuronal growth factors facilitated neuronal maturation. Data collected to assess the success of reprogramming included electrophysiology, imaging to assess morphology, and immunocytochemistry for neuronal and astrocytic markers. The results support the successful reprogramming into neurons, which may subsequently form novel neuronal pathways to facilitate spinal cord repair.

Drexel University College of Medicine

Shyam Saravanan

College of Arts & Sciences
Biology

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

Co-Mentor: Dr. Peter Baas

The Correlation between Excitotoxic Damage to Neural Cells and Changes in the Structure and Function in Cytoskeletal Proteins

Traumatic brain injury (TBI) is an abnormality in the brain from an outside force. At the impact, neurons begin to die from excitotoxicity resulting in high levels of glutamate. Glutamate binds to N-Methyl-D-aspartic acid (NMDA) receptors that increase intracellular concentration of calcium, which activates enzymes that change the structure and function of cytoskeletal proteins: microtubules (Mts) and microtubule associated proteins (MAPs). The focus of this project is to determine if mechanical damage to neurons is linked to the changes in these proteins. The first phase of the project is to perform control experiments to answer preliminary questions. We exposed primary cultures of hippocampal neurons in vitro to varying amounts of NMDA to simulate excitotoxic damage and fixed them at 4 and 24h after the exposure. Cultures were stained for different makers. Ongoing analyses are examining the effect of NMDA on the immunoreactivity of these proteins. The results will set the next step where neural cultures grown in media from astrocytes will be exposed to NMDA to reflect the in vivo situation where neurons and astrocytes interact. This will see if molecules astrocytes release alters the impact of excitotoxic damage to neurons.

Drexel University College of Medicine



Manali Shah

College of Arts & Sciences
Biology

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

Progesterone Treatment for Pediatric Traumatic Brain Injury

Pediatric traumatic brain injury (TBI) is one of the leading causes of morbidity and mortality in children, inducing life-long deficits in behavior and function. Negative consequences include difficulty in cognitive and social skills and alternations in brain structure. Progesterone, a steroid hormone that reduces edema, inflammation, and cell death, was studied for its function as a TBI treatment method. Previously, male and female rats treated with progesterone in the acute post-injury period (days 1-7 after injury) showed improved cognitive function and excitability of neurons, five weeks after injury. This project tested whether progesterone treatment reduced inflammation, glial reactivity, and neurodegeneration through a histologic analysis of brain tissue from control and brain-injured rats injected with either vehicle or progesterone. Brains were evaluated at both an early period post-injury (1 week) or a late post-injury time point (5 weeks). 40-micron sections of extracted rat brain tissue were stained for indicators of neurodegeneration and inflammation, through processes for GFAP (astrocytes), IBA-1 (microglia), Fluro-Jade B (neurodegeneration), and Nissl-Myelin (cell structure). With progesterone treatment, the expected result is less activation of astrocytes and microglia and reduction of neurodegeneration. Future directions include evaluation of the effects of progesterone on more complex animal behaviors.

Drexel University College of Medicine

Lozen Robinson

Pennoni Honors College
Custom-Designed Major

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

Co-Mentor: Sarah “Sadie” Bennison

Activity-dependent neuroprotective protein impacts polarity in early stages of neuronal morphogenesis

Despite being implicated in a variety of neurological disorders, the physiological functions of activity-dependent neuroprotective protein (ADNP) are not well understood. The Toyooka lab found that loss of ADNP in mouse embryonic development affects late stages of neuronal morphogenesis and subsequent cortical connectivity and neuronal function in adult mice. This study aims to fill a gap in the current literature by examining how ADNP affects neuronal polarity, an early stage in brain development in which neurons specify axons and dendrites. To observe predicted changes due to loss of ADNP, I performed immunofluorescence staining to visualize different molecules related to neuronal polarity. Neurons were nucleofected or chemically transfected with ADNP shRNA or scramble shRNA to knockdown expression or act as a negative control. I observed and quantified neuronal shape and the localization of different molecules at various time points as neurons developed, and found ADNP-deficient neurons had faster polarization than the control group. Further examining how loss of ADNP affects neuronal polarity can help guide subsequent research exploring possible pharmacological treatments for many disorders in which neuronal shape is affected.

2021 STAR Scholar

Drexel University College of Medicine



Samantha M. Ita

College of Arts & Sciences
Chemistry

Faculty Mentor: **Dr. Ole Valente Mortensen**
Pharmacology & Physiology

Co-Mentors: Dr. Shaili Aggarwal, Clara Xu

Effect of KM822 Analogs on Neurotransmitter Transporter Function for Addiction Treatment

Cocaine and amphetamine addiction run rampant across the US with overdoses accounting for over 32,000 deaths in 2019 alone. This class of psychostimulant drugs causes elevated dopamine levels in the brain by blocking dopamine transporter (DAT) function, contributing to the drugs' addictive properties. Previous research on DAT identified a DAT interacting compound denoted KM822 that affects the function of the transporters through allosteric mechanisms. While KM822 has the potential to treat addiction, the compound can be improved by examining analogs of KM822 and their effects. Nine KM822 analogs were evaluated for their selectivity between DAT, NET (norepinephrine transporters), and SERT (serotonin transporters), as well as their potency for inhibition of the transporters. The results of this study will help us characterize the allosteric binding site and develop more efficient allosteric binding compounds that could lead to future novel drug development to alleviate the drug addiction crisis.

Other – Drexel Autism Support Program

Evan Wax

Bennett S. LeBow College of Business
Business and Engineering

Faculty Mentor: **Dr. Amy D. Edwards**
Drexel Autism Support Program
School of Education

Criminal Justice: Reforming the Current Methods of Capital Punishment

Capital punishment has remained at the forefront of justice and security ever since it was first invoked in 1608 when Jamestown resident Captain George Kendall was executed for being a Spanish spy. Current methods of execution that are legal in the U.S. include lethal injection, electrocution, lethal gas, hanging, and firing squad. Practices of capital punishment, although vital to America's criminal justice history, have recently been called into question due to supply issues and ethical concerns. Nitrogen gas, medicinal concoctions, and death by guillotine, have been used as experimental alternatives to address surfacing legal and moral implications. To ensure there is no constitutional violation of the Eighth Amendment and safety officials are left without psychological trauma, a more suitable solution would be a nine thousand-milligram dose of secobarbital. The self-administered drug would provide death row inmates with a quick and painless death without the active participation of safety officials in the execution. The goal is that this new approach will maintain the integrity of the death penalty in a way that is deemed morally acceptable by the public.

Pennoni Honors College



Kathleen "Kat" Springer Heller

Antoinette Westphal College of Media Arts &
Design
Animation & Visual Effects

Faculty Mentor: **Dr. Melinda Maureen Lewis**
Marketing & Media

Raising Fandom: The Evolution of Fan and Participatory Culture

Participatory culture, defined by Henry Jenkins, is a culture wherein consumers also act as contributors or producers. Modern media fandom - the communities formed around books, film, and television - is where it takes its most identifiable form. As a lifelong fan and creator, my research allowed me to connect myself to the theory and history of media fandom and participatory culture. I also sought to provide a window into how these communities operate and contribute to the narrative around a piece of work. The animation accompanying this presentation illustrates how a lifelong fan may experience the culture at different ages. My project seeks to give historical context to common modern fan practices, explore how modern fandom has come to be, and bring to light the community's splendors and glooms as someone existing at the nexus of participant and researcher. Academic literature by Jenkins and his contemporaries was my springboard, though recent studies were also heavily consulted. It is important to understand the patterns of these communities in our increasingly mediatized world, as it is easier to get involved than ever. It is important to acknowledge the various effects that engagement can have on its participants.

School of Biomedical Engineering, Science, & Health Systems

Nathalia Gomez

Antoinette Westphal College of
Media Arts & Design
Virtual Reality and Immersive Media



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

Co-Mentor: Emma Dryden

Mobile Brain-Computer Interface Design for Powered Wheelchair Control

After so long, physical disability is no longer synonymous with an impairment in the quality of life of a person. Although several improvements are available such as electric powered wheelchairs to minimize the physical burden of mobility, the requirement of continuous input control remains and hence solution ineffective for individuals with limited motor functions, as is the case of patients living with ALS. Brain Computer Interface (BCI) can capture intent by measuring the brain activity without using neuromuscular system. With the emergence of mobile and miniaturized neuroimaging, mobile BCI can be built for use in ambulatory settings. This project aims to design a mobile BCI that allows users to control an electric wheelchair. Direct brain controlled assistive devices aim to restore mobility and independence. This neuroengineering design project at the School of Biomedical Engineering, Science and Health Systems is in collaboration with Temple Neurology and ALS Hope Foundation. The project also aims to incorporate smart safety features for automated emergency stop to prevent collisions. Constraints regarding cost, size, weight, and power life were examined to deliver the most effective product based on patient need.

2021 STAR Scholar

School of Biomedical Engineering, Science, & Health Systems



Griffin Stein

School of Biomedical Engineering, Science, &
Health Systems
Biomedical Engineering

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

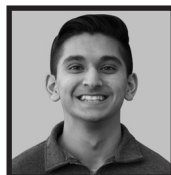
Brain to Brain Synchrony during Social Interaction in Toddlers with Autism Spectrum Disorder

Mobile neuroimaging technologies can be used to monitor brain activity in increasingly natural everyday settings. In particular, functional near-infrared spectroscopy (fNIRS) measures cortical oxygenation changes using wearable optical sensors that can be miniaturized, built battery-operated and wireless for untethered monitoring of active participants. While studies involving fNIRS have been recently increasing, there are very few studies that use fNIRS in multi-brain scenarios to evaluate the similarity in brain-to-brain activity during interactions, or neural synchrony, and none that measure neural synchrony in toddlers with autism spectrum disorder (ASD) in immersive social interaction. This neuroengineering and neuroergonomics research study at the School of Biomedical Engineering, Science and Health Systems is in collaboration with the AJ Drexel Autism Institute and Drexel College of Medicine to examine the brain activity and engagement of children aged 18-42 months with and without ASD while watching social and nonsocial videos and while interacting with an adult caregiver in hopes of better understanding the neural mechanisms of the condition.

School of Biomedical Engineering, Science, & Health Systems

Ansh Asit Gandhi

School of Biomedical Engineering, Science,
& Health Systems
Biomedical Engineering



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

Age-Related Shape Characterization of the Pediatric Pelvis using Generalized Procrustes Analysis

Generalized Procrustes Analysis (GPA) is used to quantitatively characterize the changes in morphology of three-dimensional structures. Through the superimposition of size-variant structures that are scaled and aligned in accordance with homologous landmark points (LMPs), GPA is able to analyze a distribution of size-invariant LMPs for change in shape. This process has been used in previous studies to characterize the change in shape of the human brain, skull, rib cage, spine and lower limbs. Previous studies on the pelvis have used GPA to characterize the sexual dimorphism of the normative adult pelvis, but no study has attempted to use GPA to quantify the shape of the pediatric pelvis. This study utilizes GPA and second order polynomial coefficients to create age- and sex-specific shape models of the normative pediatric pelvis. Through an analysis of three-dimensional pelvic shape, size, and orientation, the generated polynomial coefficients can be used to generate average models of the pediatric pelvis for ages 1—19 years, allowing for increased accuracy in 3D reconstructions of in vivo pelvises. Such models can also be used to assist clinicians in proactive medical and surgical treatments for pelvic deformities.

School of Biomedical Engineering, Science, & Health Systems



Lindsay Hager

School of Biomedical Engineering, Science,
& Health Systems
Biomedical Engineering

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

Co-Mentors: Virginia Orozco, Dr. Anita Singh

Historical Assessment of Neonatal Brachial Plexus Nerves Post Stretch Injury

Currently, only adult human and animal models exist for the understanding of brachial plexus morphology post stretch injury. The brachial plexus is a group of nerves around the shoulder, which when damaged can cause a loss of movement in the arm. The objective of this study was to assess neonatal piglet brachial plexus tissue for blood vessel and fiber disruption post stretch. Fifty-four H&E-stained slides from two piglets (3-5 days old) were imaged using a Leica DMI 4000 B microscope at 5x and 10x along the length of the nerve. Each image was scored by two independent observers using an adaptive scoring system. The observers were unaware of the extent of injury each nerve had previously undergone. By looking at the average scores per slide, it is evident that stretched nerves showed an increase in blood vessel rupture and fiber disruption than non-stretched nerves. This provides results exhibiting the structural changes of the brachial plexus nerves post stretch. Conducting these experiments and analyzing the results can lead to a better understanding of the injury mechanism of neonatal brachial plexus palsy.

School of Biomedical Engineering, Science, & Health Systems

Soham Patel

School of Biomedical Engineering, Science,
& Health Systems
Biomedical Engineering



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

X-ray Based 2D Coronal Rib Contours of Adolescent Idiopathic Scoliosis Subjects

Children with Adolescent Idiopathic Scoliosis (AIS) are affected by abnormal curvatures of the spine. In scoliosis, rib deformities (such as rib hump) also occur as a result of spine deformity. Treatments such as braces and surgeries are necessary, but without 3D models, clinical diagnosis and treatments are more difficult. Due to the levels of radiation, it is preferred that children with scoliosis do not undergo CT scans for 3D imagery. Instead, frontal and lateral X-rays are completed for clinical diagnosis and treatment. The goal of this project was to create two-dimensional (2D) rib contours from coronal X-rays of AIS subjects. Using these 2D rib contours, a machine learning algorithm will be used to automate the process of creating rib contours from frontal X-rays. Additionally, center lines of the rib contours will be used to create 2D to 3D rib reconstructions. This process will create patient-specific 3D rib models that can be used in clinical diagnosis and treatment of rib deformities associated with AIS. Future research will focus on 2D to 3D rib reconstruction based on lateral X-rays.

School of Biomedical Engineering, Science, & Health Systems



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Co-Mentor: Ausilah Alfraihat

Identification of Three-Dimensional Surface Landmark Points on Normative Pediatric Lungs

Since there is limited data on the three-dimensional morphology and shape of the lungs for pediatric subjects, the aim of this study was to extract 3D lung surface landmark points for the purpose of shape analysis of normative pediatric lungs. 69 STL format lung files, 27 male and 42 female, were compared as left and right lung models. A medical image processing software (3D Slicer) was utilized to visualize the 3D lung surface point clouds, and identify landmark points on the lung surface. The coordinates of the landmark points were used for GPA (General Procrustes Analysis) to determine age-related changes in lung shape for normative pediatric subjects ages 1-19 years.

The right and left lungs exhibit age-related differences in shape throughout the stages of development before and during adolescence for both male and female subjects. The shape variations observed in pediatric lung morphology can be quantified using GPA-based second-order polynomial equations. Understanding the variations in normative pediatric lung shape can also help identify abnormal lung pathology.

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Understanding the Role of Projection Neuron Activation on Locomotor Behaviors

Using smell to navigate is essential to many animals' survival. The fruit fly, *D. melanogaster*, is a great model to study odor-modulated locomotion due to the immense genetic tools available, its readily accessible olfactory system, and rapid life cycles. Earlier studies have characterized the effect of activating input level olfactory receptor neuron (ORN) on a fly's locomotion. Projection neurons (PNs) are neurons that receive information from ORNs and synapse it onto higher processing systems in a fly's brain. However, we do not know the effect of input level PN activation on a fly's locomotion. Here, we investigate this by activating PNs in flies using optogenetics and examining their change in locomotion inside a behavior arena. GH146 and MZ699 are two well-studied PN lines that label the majority of excitatory and inhibitory PNs respectively. From these behavior experiments, we find that activation of these PN populations caused changes in kinematics, but not in attraction. The activation of the PNs labeled by GH146 caused an acute drop in speed while activation of PNs labeled by MZ699 caused a surge in speed. These data give insight into how neurons at different stages of the olfactory pathway regulate locomotor behaviors.

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Investigating the Effects of Knocking Out Sensory Neurons in *Drosophila* Gait

All animals rely on sensory feedback in order to walk, and each species has its own movement and stepping pattern known as its gait. The neural networks and anatomy in most organisms make it too complex to study how sensory feedback affects their walking behavior, but *Drosophila melanogaster* (the fruit fly) have a well understood body structure and the genetic tools to manipulate neural expression, thus making them an ideal model to study. Here, we examine the importance of sensory feedback on *Drosophila* gait by investigating how genetically killing specific areas of sensory neurons in fly legs changes their walking patterns. From our experiments, we've found that knocking out these cells increases the variance in the flies' stepping pattern, but the overarching system of a tripod gait will remain the same. Potentially, future researchers could compare this data with humans and expand on our study to see if flies could model human gait, thus giving us insight into complex walking conditions like multiple sclerosis and leg dysfunction.

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Recycling of Polylactic Acid Filament Via Hot Melt Extrusion

While additive manufacturing (AM, 3D printing) produces less waste than traditional machining, there are concerns regarding the environmental impact of polylactic acid (PLA) waste from discarded prints. PLA is the most common 3D printing material, and with AM usage expected to rise, so too will the amount of PLA waste. Additionally, purchasing new spools of material represents a notable expense for AM users. The goal of this research was to recycle used PLA into new filament via hot melt extrusion. To determine optimal parameters for filament extrusion, 9 trials were defined using the Taguchi Method. Variables included temperature, extrusion speed, pellet size, and distance between extruder and spooler. The products of each trial were evaluated for surface finish, diameter, and printability. Results showed that melting the smallest pellets (~1mm) at 165°C gave the smoothest finish, and a diameter similar to commercial filament was achieved with medium-high extrusion speed. Spooling distance did not have a significant impact on the resulting filament. Future work includes comparing properties of recycled and virgin PLA filament to and assessing how many remelting cycles the material can withstand before its properties are impacted.

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Retrieval Analysis of Hinge Knee Megaprotheses

Distal Femur Fractures (DFFs) account for between 3-6% of all femoral fractures in adults. DFFs can occur in young patients as a result of high impact accidents, however, in elderly patients DFFs often occur due to degenerative diseases such as osteoporosis and arthritis. While a gold-standard consensus has not been made on how to surgically treat DFFs, custom made prosthetics capable of reconstructing large scale bone defects, also known as megaprotheses are one of the most widely used treatments for them.

300+ explants were collected from several hospitals from the past 20 yrs. From this set, 37 hinge knee megaprotheses from Stryker, Zimmer, Biomet, and Depuy were retrieved and the corresponding patient operative notes, radiographs, and post replacement implant images were examined. Revision reasons, standardized reasons, XRF data, age, sex, material, cement, implantation time, interface scoring and many other parameters were looked at extensively. Explants were all then analyzed in order to determine the common causes for failure and revision experienced by many patients. Our complete findings will better inform implant manufacturers when creating future megaprosthesis.

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Co-Mentor: Aliza Rabinowitz

Tensile Properties of Carbon Fiber Acrylonitrile Butadiene Styrene

Fused Filament Fabrication (FFF) is the process in which thermoplastics are heated and deposited in a layer-by-layer method to create objects. There are many different types of filaments that are used for this manufacturing process, with the leader in strength being carbon fiber reinforced filament. These filaments have strands of carbon fiber oriented parallel within the thermoplastic to increase physical and thermal properties of the material. Our study focused the mechanical properties of these reinforced filaments, with a specific interest in Carbon Fiber Acrylonitrile Butadiene Styrene (CF-ABS).

We tested the mechanical properties of CF-ABS when printed in the XY, XZ, and YZ directions, and when printed at certain parameters. Such parameters include specific nozzle diameters, extrusion multipliers, and layer heights. Tensile strength specimens were constructed according to ASTM standards and were sliced in each of the directions. These specimens were tested, then imaged by an SEM to review fiber orientation after printing, as well as the breaking point of the specimen.

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3D Printing Polyplex-Embedded GelMA Scaffolds for the Healing of Chronic Wounds

In the United States, about \$25 billion is spent on the treatment of chronic wounds which affect roughly 6.5 million individuals. Chronic wounds fail to heal due to the stalled phenotypic switch of macrophages from pro-inflammatory to pro-regenerative. This research focuses on the design of porous scaffolds to initiate this switch via the delivery of DNA polyplexes — a non-viral gene therapy technique. 3D bioprinting was used to create gelatin methacrylate (GelMA) scaffolds with controlled microstructure to ultimately control the delivery of the polyplexes. After investigating several polymer percentages from different animal sources, a 10% porcine gelatin solution and a 27 gauge tapered plastic tip (inner diameter = 0.203 mm) proved ideal for gelatin-based printing. Using the results from the gelatin findings, a scaffold protocol was created for two brands of GelMA. Successful GelMA prints had the following: layer height: 0.3 mm, print speed: 2-4 mm/s, pressure: 4-20 psi, temperature: ~22°C, crosslinking: 15% intensity for 10 seconds every 1 layer. These optimized settings and protocols prove the ability for controlled scaffold properties which can be used to incorporate gene therapies for the healing of chronic wounds.

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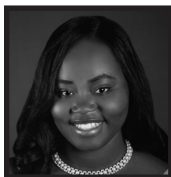
Co-Mentor: Shreya Soni

The Effect of Cyclodextrin Nanoparticle Size on Macrophage Uptake

Macrophages (MF) are crucial to the tissue injury response, guiding processes of damaged tissue clearance and later remodeling. MF accomplish this by transitioning from initial pro-inflammatory (M1-like) to later reparatory (M2-like) behaviors. To assist in desirable M1→M2 transition, the delivery of immunomodulatory drugs is of interest. However, delivery is hampered by poor pharmacokinetics and rapid drug clearance, motivating the development of nanoparticulate drug carriers. We previously developed cyclodextrin nanoparticles (CDNPs) that readily encapsulate small-molecule drugs and afford MF-targeted delivery. Here, we examined the effect of CDPN size on MF uptake *in vitro*. CDNPs were prepared through crosslinking of succinylated- β -cyclodextrin by L-lysine. Altering concentrations of crosslinking catalysts yielded CDNPs of varying diameters (small: 46.34 ± 0.81 nm, large: 82.22 ± 1.09 nm). RAW264.7 cells were treated with fluorescently labeled CDNPs and uptake is being assessed via quantitative analysis in ImageJ to determine if CDPN size can be tuned to improve MF-targeted drug delivery at the injury site.

2021 STAR Scholar

School of Biomedical Engineering, Science, & Health Systems



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Uncovering motor circuits involved in sensorimotor transformations using novel electron microscopy analysis tools

Sensorimotor transformation is the process by which sensory stimulus is converted to motor response. This is essential for survival as they lead to behaviors. We know less about how motor codes are relayed to motor circuits that drive a behavior because we do not know the connectivity of circuits within the spinal cord. We overcome this limitation by investigating sensorimotor connections within the fruit fly *D. melanogaster*, using a complete electron microscopy (EM) dataset of the ventral nerve cord (VNC, fly “spinal cord”). The VNC is accessible in insects because there is no vertebra, and their small size allows them to be a great model for human behavior. We first examine and compare new toolkits including FlyWire, NeuPrint, and CATMAID that can be used to analyze EM data. We apply these tools to map out key neural connections within sensorimotor circuits that drive well-defined behaviors. We identify interneurons and motoneurons postsynaptic to descending neurons that are hypothesized to drive escape behaviors, like the Giant Fiber. Tracing the connectivity of these descending neurons gives insight into the specifics of fly behaviors and provides a better understanding of how sensorimotor circuits control motor output.

School of Education

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Co-Mentor: Kimberly Sterin

Education Adequacy, Funding, and the Pursuit of Equity for Pennsylvania Traditional Public Schools

This study applies an equity-lens to Pennsylvania's current traditional public school (TPS) funding system and reviews alternative school structures and equity efforts at both the state and local level. The findings explain how shifting toward a resource-based funding formula at the state level would bring about educational equity and how district leaders can reallocate funds to develop an impactful action plan, today, at the local level to better the education quality of all PA children. These findings are supported by the input of interviewees from PA school boards and legislature in Harrisburg. The study includes recommendations for reform at the federal, state, and local levels. For the state, developing a new funding formula that is based on resources, students, and sound evidence is an essential step in shifting PA from a regressive to progressive funding distribution wherein more funds are going to high-poverty areas than low-poverty areas, bridging the inequitable resource gap. On the local level, increasing accountability for local school districts to develop practical action plans consisting of methods that are appropriate to their needs will push PA schools to regain momentum and clarity in the pursuit of equity.

School of Education



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Public Diplomacy and Partisanship: The Utilization of the Fulbright Program to Further US-Foreign Policy Goals

Created by Senator J. William Fulbright after World War II, The US State Department's Fulbright Program has become known as one of the most prestigious exchanges. The program, which is managed by the Bureau of Educational and Cultural Affairs, provides research and teaching opportunities for American students to go abroad and for foreign students to come to the United States. This research focused on the Obama and Trump Administrations and whether or not the Fulbright Program was used in a partisan manner to further their respective political goals. During the course of research, I examined fiscal year budget requests from the State Department, as well as speeches, press releases, and other publicly available articles and documents. After an analysis, I can conclude that each administration used Fulbright to reflect their vision of what America is. President Obama, along with his Assistant Secretaries, placed an emphasis on democracy and inclusion. The Trump Administration, through rhetorical and funding choices, used the program to align with his "America First" agenda.

FRANCIS VELAY FELLOWS

The 2021 STAR Scholars cohort includes our sixth cohort of Frances Velay Fellows, thanks to the generous support of the Panaphil and Uphill Foundations. This year's cohort of 13 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 virtual weekly meetings throughout the summer. These meetings have included meetings with women in STEM mentors, as well as the presence of a peer mentor, Samantha Seiden (STAR & Velay 2020). 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 and Uphill Foundations 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.



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INDEX

by STAR Scholar's last name

A

Agrawal, S., 55
Al Hashim, M., 94
Amin, R., 111
Angiulo, D., 14
Armentani, J., 31
Azhar, A., 113

B

Bahl, A., 13
Baruzzini, S., 11
Bass, N., 49
Ben-Whyte, J., 66
Bhamidipati, A., 40
Binder, E., 16
Bravman, N., 26
Bui, D., 104

C

Callaway, M., 56
Carton, O., 114
Chaudhury, A., 72
Chauhan, H., 135
Cho, S., 141
Cilleruelo Fernandez
del Moral, L., 74
Collins, M., 54
Cooper, J., 143

D

Daly, E., 27
DiMitri, L., 92
Do, H., 67
Do, N., 105
Doran, L., 39
Drew, A., 51
D'Souza, J., 61
Dulon, S., 29

E

Eben, S., 38
Ehlers, S., 45

F

Fedon, E., 77
Fetherston, D., 17

G

Gallen, C., 37
Gandhi, A., 131
Garcia, C., 95
Garcia
Sanchez, P., 108
Gavasheli, A., 32
Gedeon, S., 20
Gleit-Weinstein, S., 15
Goel, D., 65
Gomez, N., 129
Gonzalez
Baerga, D., 112
Graff, A., 53
Graubart, R., 58
Greco, G., 41
Gupta, Monisha, 115
Gupta, Medha, 118

H

Hager, L., 132
Harper, S., 52
Hiterer, A., 79
Hochstetler, C., 18
Huynh, D., 70

I

Ita, S., 126

J

Jackson, A., 87
Jomy, A., 60
Jones, O., 137
Jones, K., 142
Judd, N., 84

K

Karthikeyan, G., 48
Kavathekar, A., 81
Kemp, A., 82
Khan, S., 138
Kothari, K., 64
Kraus, E., 140
Kujawski, S., 35

L

Luca, A., 90

M

Madala, V., 43
Matlis, J., 96
McNally, L., 78
Mehta, A., 42
Miller, R., 36
Mitchell, J., 24
Moran, K., 109
Moreland, Z., 44
Moroz, R., 86

N

Nakai, L., 103
Ng, N., 120
Ngo, A., 93
Nguyen, B., 68
Nguyen, D., 89
Niv, J., 34

O

Oak, S., 62
Offutt, C., 85
Olstad, M., 46
Ozvural, Z., 25

INDEX

by STAR Scholar's last name

P

Palmer, N., 28
Panwar, S., 21
Parento, B., 97
Park, W., 22
Patel, D., 121
Patel, K., 98
Patel, M., 76
Patel, N., 50
Patel, S., 133

R

Rao, S., 102
Rheineck, M., 144
Robinson, L., 125
Rogers, G., 117
Rudolph, K., 59

S

Saravanan, S., 123
Saunders, L., 69
Scheuer, A., 57
Schneider, Z., 110
Scorese, J., 30
Semykina, A., 23
Sengupta, A., 47
Shah, K., 119
Shah, M., 124
Shah, Y., 122
Sharma, P., 106
Sigey-Ronoh, J., 88
Simkovich, E., 80
Singh, K., 83
Smith, L., 33
Springer Heller, K., 128
Stein, G., 130
Stowe, A., 139
Suresh, S., 71

T

Takizala, M., 99
Thakur, H., 73
Timme, J., 134

V

Vavilala, S., 116
Virtucio, J., 136

W

Walat, J., 100
Wax, E., 127
Weingarten, S., 107
Wilson, K., 63
Wilson, H., 101
Wohlbowne, B., 12

Z

Zheng, D., 91

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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.



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