2022 STAR SCHOLARS SUMMER SHOWCASE

DREXEL UNIVERSITY
Undergraduate Research
& Enrichment Programs
Pennoni Honors College

DREXEL UNIVERSITY

Undergraduate Research & Enrichment Programs

Pennoni Honors College

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

Table of Contents

Table of Contents

Table of Contents

A Message From the Dean and the Director

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

We hope our 2022 STAR Scholars will take advantage of other opportunities in the Pennoni Honors College as they continue in their Drexel careers. Bentley Hall is always open, and our staff is eager to listen and give advice.

Dr. Paula Marantz Cohen
Dean, Pennoni Honors College

The STAR Scholars Program engages highly motivated first-year students in faculty-mentored research, scholarship, or creative work during the summer between their first and second years as Drexel undergraduate students. This momentous year marks the 20th anniversary of the STAR Scholars Program. We were proud to commemorate this landmark milestone.

The 125 students in our 2022 STAR Scholars cohort participated in projects guided by mentors in 10 out of Drexel's 14 colleges and schools. These students, our 20th cohort, lived in Bentley Hall, the home of the Pennoni Honors College, and participated in in-person social and co-curricular programming to solidify their connections to one another and further develop their research-related skills. In addition, 2 students from our 2020 STAR Scholars Cohort finally had the chance to participate in the program and conducted their research part-time over the Spring & Summer terms in 2022. Their experiences have culminated in presenting their work during the 2022 STAR Scholars Summer Showcase.

All of these students have grown immensely as they chose to engage in deep and immersive learning. We are incredibly proud of our STAR Scholars and are excited to celebrate all that they have accomplished this summer. 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 futher 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 – Spring /Summer 2021
Outstanding Mentor of the Year

We are pleased to honor Dr. Jerome Ricard (COAS) for Spring/Summer 2021 of the 2020 STAR Cohort and Dr. Melinda Lewis (PHC) for the 2021 Cohort as our Outstanding Mentors of the Years! Thank you, mentors!

Dr. Jerome Ricard

Jerome Ricard, PhD, is an assistant research professor of biology in the College of Arts and Sciences. Dr. Ricard mentored Spring/Summer 2021 STAR Scholar Gokul Karthikeyan.

Gokul Karthikeyan said: "Dr. Ricard is an outstanding mentor and teacher who cultivated endless, enthralling, and enjoying research conversations as well as new avenues of work and understanding. The quality that makes a mentor outstanding comes down to how he is able to uplift the person he is mentoring, and Dr. Ricard embodies this trait with natural ease and professionalism; he fits the definition of "Outstanding Mentor" in all aspects of the term."

"Throughout the entirety of the 2020 year as well as this academic year, Dr. Ricard set up the project and assisted me virtually to be ready to jump into in-person work right away. With a combination of virtual preparation and streamlined, patient, and hands-on teaching and research expertise in the lab, I was able to hit the ground running with the project despite not having any previous knowledge of the subject. Thanks to my mentor going above and beyond [...] and actually taking the time to teach me, troubleshoot with me, and work step-by-step throughout the unforeseen errors that cropped up throughout the project not only contributed to my own learning of the specific project, but also gave me a greater understanding of biology research process as a whole."

2021 STAR Scholars – Outstanding Mentor of the Year

Dr. Melinda Lewis

Melinda Lewis, PhD, is the Associate Director of Marketing & Media in the Pennoni Honors College. She is editor of *The Smart Set*, a journal of arts, culture and science, and hosts the podcast *Pop, the Question.* Dr. Lewis mentored STAR Scholar Kathleen Heller in Summer 2021.

Kathleen Heller said: "Dr. Melinda Lewis went above and beyond the requirements of a mentor before she even had that title. With nothing but enthusiasm, she introduced me to an academic world I had no idea existed, and I consider it a privilege and an honor to have worked with her this summer. Her dedication to her work and determination that I leave STAR with a knowledge base I can build upon is more than admirable, it's downright inspiring. That noted, it is because of Melinda that I will continue my own fan studies work after STAR concludes."

"My discussions with Dr. Lewis have never failed to be both enjoyable and informative, and every week I found myself excited to tell her about the research rabbit holes into which I had fallen. She welcomed my questions and found connections I had missed, always understanding what I was trying to accomplish when I couldn't quite put it into words. She once explained how she visualized her thought process and how it seemed to mirror mine, and I felt incredibly understood. No wonder why she just got it! Melinda kept my inbox well stocked with academic texts covering various branches of fan studies, spanning decades and media types to give me the most dynamic view possible during these ten short weeks."

Celebrating 20 Years of STAR

The STAR Scholars Program began in 2002-03 with a cohort of 30 students. Since that first year, we have been able to engage over 2,000 Drexel undergraduates in faculty-mentored research, scholarship, or creative work under the guidance of over 550 Drexel faculty members. This year, in our 20th cohort of STAR Scholars, we have 125 students participating in research, scholarship, or creative work working with faculty mentors in 10 out of our 14 colleges and schools.

To take stock of the impact of this program, we invited STAR faculty mentors and alumni from the program to share their stories during a weekly lecture series. We heard from nearly 20 faculty and alumni over the course of five sessions, during which our speakers shared not only what they've achieved within the scope of the STAR Scholars Program but also how it led them to where they are today.

In addition, we hosted the 20 Years of STAR Logo Competition, where we invited current Drexel students who have participated in the STAR Scholars Program to submit potential logos for 20 Years of STAR.

First Place: Rhythm Osan
Architectural Engineering, '26
STAR 2022

Second Place: Krisha Shah
Biological Sciences, '24
STAR 2021

Third Place: Rahul Inaganti
Environmental Sciences &
Sustainability, '25
STAR 2022

2022 Spring/Summer of the 2020 STAR Cohort Abstracts

Lakshmi Parvathinathan

College of Arts & Sciences
Biological Sciences

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

Co-Mentors: Tiffany Roach, Beth Kern

Investigating the effects of mating on stem cell coordination in the Drosophila testis niche

Many adult tissues require continual replenishment by stem cells. However, the mechanisms by which stem cells are regulated within their endogenous niche remains widely unexplored. The Drosophila testis niche contains two stem cell populations, germline stem cells (GSCs) and somatic cyst stem cells (CySCs), whose daughter cells are coordinated in a 2:1 soma:germline ratio. Failure to produce this 2:1 ratio leads to failed germ cell differentiation and overall sperm production. Our lab has identified a modified cytokinesis program in GSCs that allows for coordinated release of the proper 2:1 ratio. Interestingly, environmental stresses like aging, heat stress, and prolonged mating can disrupt the balance of self renewal and differentiating daughter cells. By using extended live imaging combined with powerful genetic tools, I will investigate the effects of mating on stem cell coordination in the testis niche.

Mihir Rao

College of Computing and Informatics
Computer Science

Faculty Mentor: **Dr. Vasilis Gkatzelis**
Computer Science

Viability of the sponsored search model for real-time online auctions

Whenever you utilize a search engine like Google to scour the web for relevant pages, the search engine presents you with two sets of pertinent results: a set of organic search results, determined entirely through an algorithm like PageRank, and a set of sponsored search results, purchased by advertisers through real-time auctions that are run every time any query is searched. The frequency of this revenue generation methodology far exceeds its financial triviality as pointed to by the fact that these auctions accounted for nearly 98% of Google's revenue in 2006. We explored the sponsored search auction model from the lens of Mechanism Design. Given multiple slots (real estate on the web page) and bidders (advertisers), we looked at a formal specification of sponsored search format that differentiates the slots based on CTRs (Click through rates) and Bidder Quality and how this format satisfies three keys properties that make it a viable option: Dominant-Strategy Incentive-Compatibility (Truthful bidding is a dominant strategy which never leads to negative utility for the bidder), Social Surplus Maximization (The bidder with the highest valuation gets the best slot), and Polynomial running time (the auctions run instantaneously).

2022 STAR Scholars Abstracts

Antoinette Westphal College of Media Arts and Design

Hanako Chen

Antoinette Westphal College of Media Arts and Design
Entertainment and Arts Management

Faculty Mentor: **Professor Linda Kim**
Art & Art History

Indian Arts and Crafts Act

The United States established the Indian Arts and Crafts Act (IACA) in 1935 to protect the indigenous arts market. Congress established penalties for misrepresenting native products and set up the Indian Arts and Board to assist Indian artists and sellers. In 1990, because the cases of fraud and exploitation persisted, amendments were added to the 1935 legislation. Congress expanded the criminal penalties by increasing the fines and prison terms, adding civil penalties, clarifying the definition of the term Indian, authorizing Indian tribes to certify individuals as Indigenous artisans, and assigning the FBI to investigate violations of the act.

My project studies the economic impact the IACA has had on the market for native-made works as well as the law's implications for Indigenous cultural survival. I am further developing this STAR project as part of a Winter exhibition of the works by native bead artist Joy Tonepahhote that will be held at Drexel. My research on the IACA–its relevant case law, the debate over its strengths and weaknesses–and the interviews I conduct with indigenous artists and scholars will provide contextual information on this important federal legislation to exhibition visitors.

Antoinette Westphal College of Media Arts and Design

Kaylin Nicole Trembula

Bennett S. LeBow College of Business
Marketing

Faculty Mentor: **Professor Chris Baeza**
Design & Merchandising

Change in Fashion Is No Longer an Option, It Is an Obligation

In an interview with Jacqueline Canterbury, she said, "Lots of people think that they're not interested in fashion, so they're not part of the problem. Nobody really understands that everybody who gets dressed is part of the problem." Global greenhouse gas and carbon dioxide emissions from the fashion industry are destroying the world's resources. Waters are polluted with textile waste and toxic dyes. Consumers are not mindful as they buy and dispose of clothing at such an alarming rate that the amount results in towering landfills throughout developing countries. Agents of change, individuals with the capacity to drive change in the industry, inspire action to invoke a transformation in the world. How do we combat this pattern of consumerism and disposal?

For this research, interviews were conducted with six agents of change who work or own companies in the fashion industry, and a survey was sent out to 100 individuals to discern consumption patterns. The results are that access to information in fashion could reframe the public's perception to hold consumers and brands responsible for executing change. Younger generations must insist on a better standard of production and consumption to be part of the solution, not the problem.

Antoinette Westphal College of Media Arts and Design

Eli Jordan Goldberg

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

Faculty Mentor: **Dr. Frank J. Lee**
Digital Media

Principles of Accessible Video Game Design for Players on the Autism Spectrum

Exploring accessible video game design has become more popular in recent years among game developers. From small indie companies to larger companies like Naughty Dog, accessible game options are starting to appear more frequently and on a larger scale in comparison to previous decades of game development. While many of these accessibility options aid those with visual, auditory, and mobility impairments, game options supporting players with autism spectrum disorder (ASD) are limited. By reviewing existing research literature on autism and the experiences of gamers on the spectrum, I created a guide for game developers interested in including accessibility features for ASD players. The guide explores four of the main symptoms of ASD and offers four corresponding principles of inclusive game design for designers and developers to implement. This guide encourages the application of accessible game features as well as encourages the expansion of inclusivity to players on the spectrum in the video game industry and community.

Antoinette Westphal College of Media Arts and Design

Annie Dao

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

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

The Black Bottom: Commemorating a Historic Community in a Digital Space

The Black Bottom neighborhood was inhabited predominantly by an African American community that lived within West Philadelphia during the early 20th century until the Philadelphia Redevelopment Authority and educational institutions planned to expand their campuses to create a technology hub. The demolition of the Black Bottom displaced more than 4,000 residents to create what is now University City. The project plan is to produce an augmented reality (AR) tour to commemorate the Black Bottom neighborhood and to promote social justice. I met with U. C. Science Center representatives to seek support. I researched cultural landmarks, read through interviews conducted with former residents and held conversations with civil rights activist, former resident and educator Dr. Walter Palmer and with "Black Bottom Tribe" member Sid Bolling. A neighborhood landmark, Fan's theatre, operated at 40th and Market from 1944 to 1963. I collected photos and building permits of iterations of Fan's theatre from the Philadelphia City Archives and UPenn Digital Archives to prepare a 3D model of the building and a model of the "Fan's Automobile" used to advertise the theater, the models will be used in the AR tour.

Antoinette Westphal College of Media Arts and Design

Kayseigh McCaleb

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

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

Digitally Recreating Bird Exhibits from Peale's Philadelphia Museum

The American artist Charles Willson Peale operated his Philadelphia Museum in Independence Hall, 1802-1827. Peale's museum focused on art, technology, and natural science, using the Linnaeus classification system to demonstrate the world in miniature. The ornithological exhibit had over 700 birds in 140 cases, which Peale and his children painted to portray the environment of the specimen. These displays were used to tell a story and illustrate the importance of art, science, and technology in the early American Republic. My research this summer has been part of a larger project to create an interactive augmented reality of Peale's museum for Independence Hall visitors and interactive learning environments for K-12 STEAM education. My focus has been producing historically accurate 3D models to populate the bird exhibit. Through reading primary sources on the birds in Peale's collection, studying Alexander Wilson's drawings from his 9-volume *American Ornithology*, and researching birds and their environments, I have created a series of bird display cases to be used in the digital museum. I have also created a 3D model of a duck, which can be used in the future to make various breeds of ducks to fill the display cases further.

Antoinette Westphal College of Media Arts and Design

Jillian Wright

Antoinette Westphal College of Media Arts and Design
Digital Media & Virtual Production

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

Digital Cultural Heritage: A Commemoration of Philadelphia's Black Bottom In Augmented Reality

With the destruction of the Black Bottom Community significant cultural history was lost. The main objective of this project is to commemorate the Black Bottom community through an augmented reality (AR) self-guided walking tour of the neighborhood. To accomplish our objective we are working with two Black Bottom community advocates, and conducting research at archives in the Philadelphia area and using historic photographs to produce 3D models of Black Bottom landmarks that will be used in the AR tour. I am producing a 3D model of the 33rd St. Armory based on a blueprint obtained from Drexel's Real Estate and Facilities Office.
The project is important because Urban Renewal, is usually thought of as brightening up an area to make it look better. However, too often it displaces residents, and that is what happened in Philly's Black Bottom; displacing thousands of mid 20th century African Americans. This project will keep the memory of the Black Bottom Community alive and help to serve as a reminder that a practice on this scale should not be repeated.

Antoinette Westphal College of Media Arts and Design

Marial Moreno Gómez

Antoinette Westphal College of Media Arts and Design
Film & Television

Faculty Mentor: **Professor Karin Kelly**
Film & Television

"Awakening", an exploration of the symbolism of dreams through film

"Awakening" is an experimental short film about the symbolism in dreams and the frustration that can manifest in them after a breakup. This was inspired by the very vivid dreams that I have every night. The project was divided into 3 parts: pre-production, production, and post-production.

During the pre-production process, I researched the psychology of dreams and wrote a script that represented their symbolism, taking into consideration the use of color, wardrobe, lighting, etc. This process also included securing locations, recruiting the crew, casting actors, scheduling the dates, and preparing for the production. The production consisted of two days of shooting with the crew (fellow Drexel students) and cast, where I had the opportunity to work collaboratively as we learned from each other. For post-production, I organized and assembled the footage which I then edited. I also developed the sound design for the film.

I have always been interested in dreams and researching this project allowed me to better understand their impact and symbolism. I incorporate my new knowledge into a script and was able to hone my filmmaking skills by producing, directing, and editing a short film.

Antoinette Westphal College of Media Arts and Design

Ellie Wellington

Antoinette Westphal College of Media Arts and Design
Screenwriting and Playwriting

Faculty Mentor: **Professor Neal Dhand**
Film & Television, Screenwriting & Playwriting

"The Ghosts Who Guide Me Home": On Money, Family, and Spirituality

The Ghosts Who Guide Me Home is the pilot episode of a larger series surrounding the Connors, a family in emotional and financial ruin who devise an elaborate money-making scheme involving the creation of a cult. The pilot introduces us to three siblings, Will, Scott, and June. Will hears from June that their mother has passed, bringing him and his family back to the hometown he moved away from years ago. He reconnects with his brother, an addict, who reveals he is running out of money and has come up with a business called Elysian Fields, a wellness company powered by experimental therapy. Scott wants to work with Will. Though Will is disgusted by the idea at first, his crumbling financial situation pushes him to hear Scott out. Through a series of events, the brothers involve June in the business, who is behind on rent and desperate for money. As the siblings work through their issues, the rest of the family fights their own battles, dealing with divorce, drug use, and mental health crises. The broader explorations of this project are the relationships between estranged family members, the consequences of the New Age spirituality movement, mental illness and addiction, and business ethics.

Antoinette Westphal College of Media Arts and Design

Tina Yang

Antoinette Westphal College of Media Arts and Design
Graphic Design

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

Tackling Public Health with Design

With the most recent health crisis that resulted in the pandemic, Covid-19 has had people heavily relying on technology for information and often misinformation to try to comprehend a public health emergency. Through the chaos, individuals have turned to social media for knowledge, direction, and comfort. So how can graphic design be used in the public health industry? The discipline has assisted with health messaging that helped the public navigate vast amounts of data and reassure them they are not alone.

Graphic design, the art of words and images, is literally everywhere. The public acknowledges it as pretty posters or media posts but design serves multiple purposes: communication, information, and persuasion. As a versatile tool, it utilizes visual concepts on any topic in mind to captivate an audience.

To show the versatility of graphic design, posters, public service messaging, and infographics from historical health crises were analyzed. Similarities found showed that the design elements have been embedded in history and differences portrayed the evolving styles developed throughout time. Ultimately, these cases were connected together to emphasize the significance of design, particularly in the healthcare industry.

Antoinette Westphal College of Media Arts and Design

Kylie Mika

Antoinette Westphal College of Media Arts and Design
Music Industry

Faculty Mentor: **Professor Ryan Moys**
Music Industry

Impact of Design and Acoustic Treatment in Workspaces on Creativity, Culture, and Productivity

COVID-19 had a detrimental impact on many industries, with workplaces consisting of various living rooms, and school projects created without ever speaking to partners. With most people returning to school or work this past year, work culture built over the past years seems virtually nonexistent. However, if rebuilt, improved morale, increased productivity, and greater collaboration will result.

The Music Industry Program here at Drexel possesses a necessity to restore student culture. Alongside my mentor, we brainstormed logistical changes to the program, and I assisted in improving existing studios and midi labs. As well, the department recently acquired a space to be renovated and used as a creative workspace for students, which became the focus of my individual research. I analyzed workspaces of successful businesses, acoustic treatment processes, and productivity data. I surveyed current students for their input on design and decor. After reviewing the responses of my peers, I created a rendering of what the new space could look like. The hope is that over the years, this will contribute to the growth of mentorship, collaboration, experiential learning opportunities, and enjoyable productivity within the MIP's culture.

Diana Than

Bennett S. LeBow College of Business
Accounting, Finance and Business Analytics

Faculty Mentor: **Professor Jonathan Liss**
Accounting

Cryptocurrency Investment in Young Adults

In recent years, cryptocurrency – the new financial phenomenon of digital and decentralized currencies - has skyrocketed in value and gained mainstream popularity. In the U.S., investors between the ages of 18 and 34 are most likely to invest in cryptocurrency. Research has shown that both investment experience and financial literary are positively associated with cryptocurrency investment. With the limited investment experience that the youngest investor cohort has compared to more elderly investors, the question remains whether young adults choose to invest because they are knowledgeable about cryptocurrency, or if they are motivated by societal factors around the popularity of this new phenomenon.

With little research on investors' knowledge levels of cryptocurrency, the study aims to collect data from college students through a targeted survey about the basics of cryptocurrency. Questions were posed on basic concepts, current regulations, reaction to future scenarios and interests in formal education on the topic. Respondents were encouraged to indicate their uncertainty where appropriate. Results from this research will be used to make recommendations for course offerings to benefit and protect young adult investors.

Alexander Le

Bennett S. LeBow College of Business
Finance, Business Analytics

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

Activist Investors: What's Their Impact?

Historically, activist investors have targeted underperforming firms and created change through corporate governance, and their ability to do so has been astounding. For instance, in 2021, a small activist investor, Engine No. 1, challenged Exxon Mobil, one of the most visible energy firms in the world. Their goal was to disrupt Exxon's strategy, shift the firm towards cleaner energy, and upgrade the industry experience of the board. By doing this, Engine No. 1 was able to replace three directors on the board while holding only 0.02% of Exxon shares.

Despite the attention on activist investors, there is still a debate about whether they are motivated by short-term gains or long-term value creation. To examine how activists impact companies, we analyze firms' financial performance and director skills both during and post-activist attack. We hypothesize that activists influence firms' long-term strategies by promoting skills that are aligned with a company and industry's needs. Although each industry values different skills, what remains constant is that activist attacks occur more frequently for small, poor-performing firms that have fewer skills required to navigate volatile markets.

Sharon Shi

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

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

Is Sustainability as Good as We Think It Is?

Businesses are under increasing pressure to adopt environmental, social, and governance (ESG) policies. These policies work to enforce sustainability awareness, promote diversity and inclusion, and motivate effective decisions. Therefore, it is crucial to understand the role that ESG plays in the corporate world.

Despite the increased focus on ESG and many executives' claim of its importance, only about 25% of companies incorporate ESG into their business models (International Institute for Management Development). Given this dichotomy, we seek to understand which companies implement ESG, and whether this increased ESG-focus in the boardroom is tied to better performance.

To analyze the impact of ESG, we focus on the skills reported for a firm's corporate leaders, the board of directors. We document that ESG skills increase dramatically on boards over time, driven by larger and poor performing firms. This increased focus on ESG skills may be due to larger firms having more public pressure, and poorer performing firms implementing ESG to improve future performance. Overall, our results suggest that firms that integrate and highlight ESG perform better in the following years and even outperform firms that do not promote ESG.

Alexander I Zavalny

College of Computing and Informatics
Computer Science

Faculty Mentor: **Dr. Naveen Daniel**
Finance

Deep Learning Tools for Finding Bias in Shark Tank Venture Capital Decision Making

The effectiveness of a pitch for any new idea can be measured by looking at the reactions of those listening to it. In the case of start-ups, it's important to detect any bias among venture capitalists listening to a pitch that impacts their ability to make fair offers in funding potentially industry-disrupting companies. Using deep learning algorithms like Google's FaceNet and convolutional neural networks, we analyze video footage from the television show, Shark Tank, to capture the reactions of the Sharks listening to pitches on the show. This allows us to quantify their levels of interest by analyzing body language, facial expression, vocal emotion, and verbal positivity. We then compare the Sharks' reactions to pitches across seasons and look for current events that negatively affected whether a Shark gave an offer or not and at what asking price and equity. Our research has application in helping entrepreneurs recognize potential biases during their own pitch which they can use to improve the chances of getting a fair deal. Our research also helps venture capitalists make more equitable decisions and not forfeit deals that can provide game-changing products to society while simultaneously increasing their profits.

Nawshin Ahmed

Bennett S. LeBow College of Business
Finance

Faculty Mentor: **Dr. Daniel Dorn**
Finance

Statement of Additional Information's Secrets on Securities Lending in Exchange Traded Funds

Securities lending is when asset management funds transfer ownership of stocks temporarily to a borrower which allows firms to earn additional income through the fee charged to the borrower to borrow the security. Although securities lending contains high risks, a few firms still decide to partake because the securities lending income can offset the "sticker price" an ETF investor pays. Using hand collected data from the Statement of Additional Information (SAI) of the top 20 firms that participate in securities lending, I find funds with more aggressive lending with a lower likelihood of recalling will generate higher securities lending income as a fraction of AUM. In addition, the fund will generate more lending income if the securities lending agent is affiliated with the issuer.

Khizar Kashif

College of Computing and Informatics
Data Science

Faculty Mentor: **Dr. George Tsetsekos**
Finance

Data Analysis on EdTech Investments in Private Equity via Pitchbook

Affordability, accessibility, and relevancy are currently significant problems facing higher education. Technology that offers new products and services for the learning process can be a potential solution to some of these problems. The decision by a Venture Capital firm to fund an educational technology (EdTech) company can indicate future trends and possible transformations in higher education. Researching these investments provides convincing signs of upcoming solutions to problems in the education landscape.

By examining the variety of Private Equity Funds that invest in Education Technology using a directory called Pitchbook, we create a database highlighting various metrics such as IRR (Internal Rate of Return), Dry Powder (Liquid Cash), Fund Size, Percentage of EdTech Investments compared to non-EdTech, as well as the names of investees and amount invested in each. We explore the average amount of investment an EdTech Company receives and the capital differences between funds that invest in EdTech purely and those who invest partially. This directory has potential use for pairing prospective EdTech entrepreneurs with PE firms that are more likely to invest in them while enhancing our understanding of the EdTech space.

Christopher Lam

Bennett S. LeBow College of Business
Finance, Business Analytics

Faculty Mentor: **Professor Daniel Dorn**
Finance

Co-Mentor: Melissa Jenkins

An Analysis of Actively Managed U.S. Exchange-Traded Funds

Exchange-traded funds (ETFs) have become a rapidly growing asset class within the portfolios of investors across all levels. Among these securities are two distinct styles of management: passive and active management. In order to determine whether or not an active management style is worth the extra fees and volatility for investors when compared to their passive counterparts, I collected total net asset value (NAV) returns for a sample of 214 actively managed, U.S. based ETFs since their first trading day through the FactSet database (currently extinct funds are included in this sample to avoid survivorship bias). This data was then used to construct regression models containing figures for four factors: market rate, size, value, and momentum betas. The conclusion from the generated data is that actively managed funds do not in fact provide investors with higher returns than what is expected, with an overwhelming majority seeing negative or insignificantly positive alpha. With these findings, investors looking to enter the sphere of ETFs now have further information with which to base their choice of passive or active management funds.

Miley Nguyen

Bennett S. LeBow College of Business
Marketing and Business Analytics

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

Co-Mentor: Wenyan Yin

The Impact of Human vs. Robotic Chefs on Calorie Estimation

Robots and artificially intelligent machines have been widely integrated into customer services. These robots come in humanoid and non-humanoid forms and automate many of the most basic tasks in customer service. Since their value lies in labor savings, efficiency, and 24-hour availability, the replacement of human manual jobs with these robots is plausible in the incoming future. In 2021, the application of service robots has grown 68% worldwide (Newman 2022). However, little is known about how these humanoid robots, compared with human employees, influence consumers' perspective on food quality and alter their decision-making.

In this research, we conducted three studies with a total of 450 subjects to see how human chefs versus robotic chefs affected consumers' calorie estimation, and further determine whether healthy versus unhealthy food played a role in this process. In conclusion, we find that people perceive unhealthy food cooked by humans as having more calories than that cooked by robots, while the effect is reversed for healthy food. Our research sheds light on the psychological process of people's judgments and highlights the potential effects of production mode on individual's consumption for public policy.

Dilnoza Kurbonova

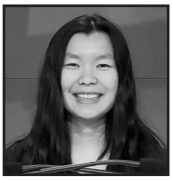
Bennett S. LeBow College of Business
Marketing and Business Analytics

Faculty Mentor: **Dr. Rajneesh Suri**
Marketing

Co-Mentor: Jintao Zhang

Impact of influencers in advertisements in social media and the metaverse on evaluation of fashion apparel

This research was designed to analyze impact of influencers in advertisements in social media and the metaverse on evaluation of fashion apparel. Past research has shown the impact of influencers in advertisements in social media. However, to my knowledge no research has compared the effectiveness of influencer advertisements communicated via social media vs. the metaverse. Qualitative research interviews were used as Stage1 of this research to attain better understanding of the impact of influencers in two media. Six female participants (age range:18-25 years) participated in this stage. Three participants each watched an advertisement in social media or in the metaverse. The results show that overall, influencer advertisements an effective tool for promoting products and building brand awareness. "I got to know about some brands due to my favorite influencer" said one participant. Metaverse is however a new space for participants, and they commented that "I cannot trust computer generated character that can be controlled by anyone, I need to see and hear a real person," said another interviewee. People's perception of avatars and their credibility was main reason for advertisements in virtual reality to be not trustworthy.



Amanda Cao

Bennett S. LeBow College of Business
Economics and Data Science

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

Co-Mentor: Lien Ta

Implications of Remote Work Arrangements Within High-Tech Clusters on Aggregate Inventor Productivity

In the United States, high-tech R&D activities tend to cluster by research fields within a few metropolitan cities, resulting in local economic growth and more patent output associated with positive spillover effects. The recent rise in hybrid and fully-virtual work environments adopted by many firms brings into question the impact of remote work conditions on human capital externalities within high-tech metropolitan cities. The present study aims to evaluate the economic significance of work-from-home arrangements on inventor productivity by considering the spatial agglomeration effect of high-tech clusters. Moretti's (2021) change in the aggregate patent production model and the coefficient of productivity spillover effect were extrapolated to encapsulate shifts in work environments. Collapsing longitudinal data from the ATUS, the percentage of in-office, remote, and hybrid workers in high-tech industries within the top metropolitan cities were computed and interpolated in Moretti's patent production model. The aggregate innovation output is then compared between pre- and post-pandemic periods to establish implications of the most influential work environment to maximize productivity and innovation rate within the country.

Zhiyu Wu

Bennett S. LeBow College of Business
Marketing

Faculty Mentor: **Professor Tristan Potter**
School of Economics

Examining the Differential Effects of Covid-19 on the Labor Market

We use data from the Current Population Survey (CPS) to document a set of facts about the differential impact of Covid-19 on labor market outcomes across demographic groups. First, we document that Covid-19 substantially reduced the black-white unemployment gap. Second, we document that this decline was temporary, lasting for slightly over a year. Third, we document that this decline was driven primarily by young and prime-age workers with less than a college degree, and was present among both male and female workers. Finally, we document that the black-white unemployment gap is also present in labor force participation rates, the ratio of which also declined substantially during Covid-19. We suggest an explanation that could help to account for these facts: The Covid-19 recession had a relatively small negative effect on employment in the healthcare industry, which is disproportionately non-white, thus potentially contributing to a muted rise in non-white unemployment during Covid-19 and a reduction in the racial unemployment gap.

Natalie Richards

College of Arts and Sciences
Biological Sciences

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

Co-Mentor: Karmi Oxman

Neuroethology of a desert isopod (Hemilepistus reaumuri): Navigational brain regions increase in parental females

Bi-parental care, where both parents contribute their energy to raising offspring, is relatively rare in the animal kingdom. A species of desert isopods, Hemilepistus reaumuri, that lives in Israel's Negev Desert is bi-parental. Some behaviors that correspond to parental care include foraging and guarding. The central body, within the brain, controls these behaviors along with navigation. This study aims to quantify the central body's volume and compare that data to the behavior of the isopods. Animal brains can change over time and show differences in response to behaviors such as foraging. It is hypothesized that there will be a correlation between the volume of the central body and the behavior of the isopods.

The isopods were dissected to remove their brains which were then embedded into resin. Brains were sliced, stained, and photographed to look for the central body. Digital images of brain sections were quantified using Fiji ImageJ. Our results suggest that female isopods have a higher volume of neuropil (projections) per soma (neurons) in the central body compared to males. We attribute this difference in volume to the increase in foraging and other navigational behaviors that female parents perform.

Christina Liu

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Geoscience

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Co-Mentor: Jacob Brauner

Diffuse Carbon Dioxide Degassing and Ground Temperature on the Volcanic Island of Nisyros, Greece

Nisyros Island is a Quaternary stratovolcano located in the Aegean Sea. Although regarded as a dormant volcano today, the caldera floor continues to be altered by the underlying hydrothermal activity (Di Paola, 1974). My hypothesis aims to determine whether the surface temperature is controlled by hydrothermal fluids on Nisyros by analyzing the correlation between carbon dioxide flux and ground temperature. Drone imagery, ground temperature and diffuse CO2 emission data was collected from Nisyros craters Stephanos, Polyvotis, and Kaminakia. A 3D model of the craters was then generated as a base map to plot the collected temperature and CO2 points, then spatially compared to previously published Nisyros data. The R-value of the correlation trends between the temperature and CO2 flux data was also computed. A high correspondence suggests the presence of hot hydrothermal fluids ascends to the top and is responsible for the release of gases including carbon dioxide as these gases are dissolved within hydrothermal fluids (Brombach et al., 2001). However, the absence of a correspondence may be caused by interactions with groundwater.

Olivia Maddox

College of Arts and Sciences
Environmental Science

Faculty Mentor: **Dr. Dane Ward**
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Does Nature Relatedness impact diet-related emissions among Philadelphians?

One of the most important solutions to climate change is the sustainability of our global food system which contributes ~30% of our total greenhouse gas emissions. If all other emissions were halted immediately, our food system alone would prevent us from limiting global warming to +1.5°C. Because food type is the most important contributing factor to food CO2-eq emissions, understanding people's food choice can be beneficial. Previous research shows that a person's nature relatedness (NR) is positively associated with dietary diversity and higher intake of fruit and vegetables; however, it does not examine the correlation between a person's NR and the emissions of their diet. This research sought to identify a correlation between a person's NR and the emissions of their food intake utilizing a 2017 survey of Philadelphians (N=233). We found no correlation between subjects' NR and food emissions, additionally, no correlation was observed between subjects' income and food emissions. Future studies will need to resolve the proportions of reported food groups in order to better estimate emissions. Increased focus on food sustainability and further research on contributing factors to food choice will be necessary to address this issue.

Kathryn McFarland

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Environmental Science

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

Co-Mentors: Aaron Jeong, Erin Poole

Coastal shoreline stabilization infrastructure's role in marine carbon capture

Climate change negatively affects coastal and marine environments (e.g. ocean acidification, shoreline erosion, coastal flooding). The Lighthouse Center in Waretown NJ recently installed wave attenuation devices (WADs) to alleviate shoreline erosion and flooding. These WADs are hard substrate habitat for biofouling organisms, providing opportunity for organic carbon capture from marine waters potentially playing a role in combating ocean acidification. However, there has been no research on the amount of organic matter (OM) WADs contain. Using scrapers, we collected biofouling samples from four WADs, sorted them, dried, and burned off the OM using a muffle furnace. After calculating the total OM in each sample, we extrapolated how much OM was on each WAD and estimated OM across the shoreline. Sample OM content ranged from 47.7% to 72.0% (mean = 60.5% ± 2.68). This initial investigation elucidated the potential for WADs to capture OM via biofouling organisms. With the need to stabilize and build shorelines in coastal environments to fight climate change, we expect an increase in the utilization of WADs throughout the world. This is the first step in understanding the role these engineered systems play in blue carbon budgets.

Charlotte Meader

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Environmental Studies

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Biodiversity, Earth & Environmental Science

Greenspace Attributes in Home and Work Settings and Health in Philadelphia?

Urban green spaces (UGS) are areas of trees, grass, and other elements in urban settings, while bluespace includes various bodies of water. Views of and engagement in UGS provide restoration of memory and mood, but little is known about what aspects or elements of greenspace are most effective for positive health outcomes. This information would be useful to decide where UGS types are located to maximize health benefits. To study this, a survey administered in 2017 of Philadelphians (N=282) was analyzed in R-Studio, using stepwise selection to determine which explanatory variables had a crucial impact on self-rated health. The best linear model (F-stat=5.708, p=3.55e-6) included; increased income, nature-relatedness, UGS diversity and park view time at work, and field and bluespace views at home which were individually associated with better health. Interestingly, increased time with a view of fields at work was correlated with poorer health. These results indicate that parks, bluespace, and fostering connections to nature are most important to promote health. In the future, a longitudinal study could be done to determine if these factors cause better health or if healthiness leads to living and working in places with more UGS.

Samantha Schultheis

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Biodiversity, Earth & Environmental Science

Co-Mentors: Aaron Jeong, Erin Poole

Living shoreline infrastructure impacts studied through a Barnegat Bay site specific index-of-biological integrity

To combat climate change impacts to local environments, scientists and engineers must develop and install infrastructure to protect existing habitats. However, such infrastructure has the potential to significantly alter biological communities within these habitats. Living shoreline infrastructure has recently been installed to protect and stabilize the shoreline at the Lighthouse Center in Waretown NJ, on Barnegat Bay. To evaluate the effects of such infrastructure on fish communities, scientists require the development of an index-of-biological-integrity (IBI). Here we examine 11 years (ranging from 2008-2021) of fish capture data from the site and propose a site-specific fish IBI. We then test our most recent data collection from the summer of 2022 against this developed IBI to elucidate early impacts to fish community assemblage following the installation of the living shoreline in Spring 2022. The development of this IBI is critical to not only the continued monitoring of this project, but also other similar projects scheduled to occur in Barnegat Bay in the future, including shoreline stabilization efforts and the recent surge in offshore energy production.

Lexi Dooley

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Geoscience

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Co-Mentor: Lena Champlin

Spatial and temporal patterns of salinity in a restored tidal wetland

Coastal wetland decline is a global problem caused by anthropogenic influences including sea level rise (SLR). Recent restoration projects are combating SLR, including one method called thin layer placement (TLP) that increases elevation of the marsh plain using sediment addition. Hester marsh restoration site located in Elkhorn Slough, California used TLP to aid marsh recovery. To better understand restoration success, this study aims to assess hypersaline conditions as it could affect plant regrowth after restoration. Soil conductivity was measured along 10 transects in the field (2019-2022) using electromagnetic induction. Field conductivity was converted to soil salinity estimates using calibration samples. Salinity interpolation maps were constructed using geophysical data, and relationships with distance from tidal channel and elevation. We also examined patterns of soil salinity relative to plant regrowth. Salinity increase was greater closer to the tidal channels with low elevations and lower at high elevations. Salinity was lower at the end of the dry season than at the end of the rainy season. The results can help further understand recolonization of plants in future restoration projects and indicate wetland health.

Velay Fellow

Calvin K. Keeys

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Biodiversity, Earth & Environmental Science

Co-Mentors: Lukas J. Musher, Jon T. Merwin

A Test of Gloger's Rule: An Analysis of Geographic Variation in the White-winged Becard (Pachyramphus polychopterus)

A major driver of Earth's biodiversity is adaptation to climatic conditions. Ecogeographical rules describe variation among populations of a species in form and function across environmental gradients. Gloger's Rule states that organisms will have darker coloration in warmer and more humid environments. Previous research has rarely quantified the covariance in color and climate. The objective of this research is to use White-winged Becard (*Pachyramphus polychopterus*), which exhibits extensive variation in appearance, to test whether its plumage differences track Gloger's Rule. The White-winged Becard has eight subspecies found throughout Latin America; males vary from pale grey to mostly black. I collected both morphometric and color data and placed these data in a geographic context. First, I measured key features of the specimens, such as wings, bills and tails. Then, I took images of the specimens and used an avian visual model to calibrate the pictures and quantify color variation. Finally, I mapped georeferenced specimen localities to determine how morphology and color varies with the environment. This research helps to understand how organisms adapt to climate, and thus how they may adapt to future human-driven changes.

Ashleigh Browne

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Biological Sciences

Faculty Mentor: **Dr. John Bethea**
Biology

Co-Mentor: Sreejita Arnab

Study of TNFR2 on Nex+ neurons by using RNAscope

Hypothesizing that Tumor Necrosis Factor Receptor 2 (TNFR2) signaling in microglia plays an important role for recovery from Chronic Neuropathic Pain, or CNP. During the project RNA Sequencing and Bioinformatic analysis of Fluorescence-activated cell sorter (FACS) - sorted microglia will help in determining the molecular pathways altered at different stages of chronic pain and recovery from CNP. This is the focus of my project and is what I spent ten weeks completing. Microglia have been collected from spinal cord and brain of naïve, injured TNFR2 fl/fl (wild type mice) and conditional deletion of TNFR2 from microglia (CX3CR1- CreERT2/TNFR2fl/fl mice). Microglia are distinguished from infiltrated monocytes and macrophages in FACs. Change in gene and proteins expression which are enriched in microglia and have been shown to participate in neuroinflammation, neuropathology and chronic pain can be a target for novel drug therapies. Results currently are inconclusive.

Rahul Chowdhury

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Biological Sciences

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

Co-Mentors: Jacob Duggan, Breanne Hewitt, Matt Cowan

The Role of the Golgi in the Activation of the Nuclear Piston

Fibroblasts are highly migratory cells and use several modes of migration based on their environment. However, it is unclear how fibroblasts are able to mechanically sense their environment. The Golgi apparatus is a candidate mechanosensor since it responds to mechanical force by decreasing total vesicle trafficking. The present study aims to explore whether disrupting the Golgi's secretory function will affect the cell's migration mode. We hypothesize that the physical environment will change Golgi secretion patterns to dictate the mode of cell migration. HT1080 fibrosarcoma cells were treated with blebbistatin, brefeldin A, or latrunculin A to disrupt polarized secretion and the velocity and directionality of cell migration was measured. Further, siRNA knockdowns were performed for the proteins vimentin and optineurin to decrease vesicular trafficking with western blots used to confirm that the proteins were properly knocked down. The cells were imaged using phase contrast microscopy after treatment. After the cells were imaged, the velocities of the experimental and control group were compared. We expect that these experiments will provide new insight into how secretion by the Golgi apparatus impacts how cells move.

McKayla Q. Procopio

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Determining the localization of absent in melanoma 2 (AIM2) protein in human fibrosarcoma cells in 2D and 3D environments

Human fibrosarcoma cells use varying modes of migration depending on their physical environment. Specifically, cells migrating in a highly crosslinked 3D cell-derived matrix (CDM) use a nuclear piston mode of migration. Piston cells form pressure-driven protrusions known as lobopodia to squeeze the bulky nucleus through narrow pores in the CDM. As piston cells migrate through tight spaces, the nucleus can briefly rupture, allowing DNA to leak into the cytosol. The cytosolic DNA sensor protein absent in melanoma 2 (AIM2) is part of the actomyosin machinery that pulls the nuclear piston forward, but its function in 3D cell migration is unclear. We hypothesize that AIM2 binds to DNA released by the damaged nucleus to regulate the actomyosin contractility in cells migrating in confined 3D environments. Our goal was to compare AIM2 localization in cells migrating in 2D and 3D and we predicted that AIM2 localizes perinuclearly in both 2D and 3D migrating cells. Immunofluorescence labelling of endogenous AIM2 showed that AIM2 is concentrated within the nuclear envelope in cells migrating on both 2D glass and in 3D CDM. We conclude that the localization of AIM2 is not dependent on the dimensionality of the cellular environment.

Rahul Inaganti

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Environmental Studies & Sustainability

Faculty Mentor: **Dr. Jacob Russell**
Biology

Co-Mentors: Dr. Clesson Higashi, Melissa Carpenter

Wolbachia-mediate protection fails against the common fungal pathogen, Beauvaria bassiana

Aphids are destructive pests of many economically important crops. Parasitoid wasps and fungal pathogens are natural enemies of aphids that are often utilized for population control. Aphids have established relationships with symbiotic bacteria that provide life sustaining nutrients or defense. The symbiont, Wolbachia, can protect the banana aphid, Pentalonia nigronervosa, a vector of the BBT virus, against the aphid-specific fungal pathogen, Pandora neoaphidis. However, symbiont protection is often species specific. To evaluate the specificity of Wolbachia's anti-fungal protection, a lab assay was conducted using Beauveria bassiana, a generalist fungus used to control a wide range of insect pests. Cohorts from four Wolbachia-infected (W+) and four uninfected (W-) banana aphid lines were exposed to Beauveria using two different methods: a spray and dunking method. The number of aphids that survived, sporulated, or died from exposure were recorded over ten days. Results show that W- and W+ aphids were equally susceptible to Beauveria, experiencing similar rates of sporulation and survival. This finding highlights the specificity of symbiont-mediated protection and has important implications for biological control strategies.

Sammey Soliman

College of Arts and Sciences
Biological Sciences

Faculty Mentor: **Dr. Nianli Sang**
Biology

Does Cytosolic Histone Deacetylase 5 (HDAC5) Play A Role In Cancer Chemoresistance?

Each year in the United States, more than 1.7 million people are diagnosed with cancer and over 600,000 people pass away from it. As a result, cancer within the United States has consistently been the nation's second leading cause of death (CDC). Previously, we have demonstrated that under metabolic stress HDAC5 shuttles from the nucleus to the cytosol, promoting cell survival by stabilizing HIF-1a. Considering that chemotherapeutics is reported to trigger the activation of AMPK, this indicates an intriguing connection between cell stress triggered activation of HDAC5 and chemoresistance. We hypothesize that the chemotherapeutic trigged activation of cytosolic HDAC5 plays a critical role in mediating cancer chemoresistance. In this study, we established cell lines over-expressing a HDAC5 mutant that is exclusively localized to the cytosol and compared it with the parental cell line. In this comparison, we tested their respective sensitivity to chemotherapy and observed other biological behaviors. Specifically, we compared the cell proliferation rate, morphology, and sensitivity to doxorubicin. Our findings provide the rationale to explore anti-HDAC5 agents as a potential therapy to increase tumor sensitivity to chemotherapy.

Tasneem Sheikh Siddique

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Biological Sciences

Faculty Mentor: **Dr. Aleister Saunders**
Biology

Co-Mentor: Dr. Swathi Swaminathan

The Effect of Synthetic Aβ on Ciliary Membrane and Axonemal Proteins

Alzheimer's disease (AD), a progressive neurodegenerative disorder, is one of the leading causes of death in the United States. Defects in the primary cilia lead to ciliopathies, such being impaired neuronal development and cognitive domains, also compromised in AD. Primary cilia are immotile signaling organelles present in all eukaryotic cells including neurons and astrocytes. Alzheimer's disease is characterized by the accumulation of toxic Aβ plaques and hyperphosphorylated tau tangles; ultimately leading to neuronal death. Previously in Dr. Saunders lab, it was observed that in the presence of both extracellular and synthetic Aβ, primary cilia get disrupted. The purpose of this study is to delineate the localization of major ciliary proteins in the primary cilia in the presence of synthetic Aβ. Specifically, we aim to understand the effect of Aβ on ciliary membrane proteins (Arl13B) and axonemal proteins (Tau; pTau). To achieve this; cells were subjected to synthetic Aβ over time. Immunofluorescence and ImageJ were utilized to visualize and analyze the ciliary proteins respectively. This study will help us understand if Aβ causes differential disruption to ciliary membrane proteins in comparison to cilliary axonemal proteins.

Velay Fellow

Joshua Franco

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Biology

Co-Mentor: Dr. Swathi Swaminathan

Investigating the Role of Primary Cilia in Alzheimer's Disease Pathogenesis

Alzheimer's Disease (AD) is the most common form of dementia that results in memory loss and impaired cognition. One of the major events in AD pathogenesis is the accumulation of Amyloid-Beta (Aβ) plaques. Aβ is a by-product of amyloid precursor protein (APP). Previously, in our lab we have shown that synthetic Aβ disrupts primary cilia structure and APP localizes to the primary cilium, indicating a possible functional role of APP in AD pathogenesis. Primary cilia are non-motile, sensory antennae that are essential in regulating fundamental neurophysiological activities. Defects in the primary cilia lead to impaired neurogenesis which is also compromised in AD. We previously identified 7 putative cilia targeting sequences in the human APP695 isoform; that may influence APP trafficking to the cilia. The main goal of this study is to reproduce the localization of APP to the primary cilia in multiple cell lines. To do this, we utilized two chemical transfection techniques, with our established fluorescent tagged APP695 plasmid and visualized using a Confocal microscope. This will help us establish a robust transfection technique and further pave way to investigate APP trafficking to primary cilia.

Oluwapelumi E. Ojo

College of Arts and Sciences
Biological Sciences

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

Co-Mentor: Joshua T. Okletey

Examining the role of Septin 7 phosphorylation by TAOK2 in neuritogenesis

Neuritogenesis, the formation of neurites—the precursors of axons and dendrites—is crucial for proper signal transmission in the nervous system. Defects in the cytoskeletal mechanisms of neuritogenesis underlie many neurodegenerative disorders. Septin 7 (SEPT7), a GTP-binding protein that associates with the cytoskeleton, has been implicated in neuritogenesis. SEPT7 localization and its phosphorylation are necessary for regulating neurite formation; however, this regulation by SEPT7 is poorly understood. This research examined how SEPT7 and its phosphorylation by TAOK2, a protein kinase that phosphorylates SEPT7, regulate neuritogenesis. Rat hippocampal neurons were observed at early stages of development in vitro (days in vitro 0-3) after being transfected with a control plasmid, SEPT7 shRNA, TAOK2 shRNA, and the TAOK2 K67A mutant. Transfected neurons were immunostained with neurite and cytoskeleton markers, imaged and analyzed. Analyses of these neurons show a defect in overall cell body area and morphology, along with increased neurite number in SEPT7 and TAOK2 depleted cells compared to control cells. Observed phenotypes and analyses suggest a regulatory role of SEPT7 and its phosphorylation by TAOK2 in neuritogenesis.

Abigail Dech

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Biological Sciences

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

Co-Mentor: Emily J. Sterner

Studying the Effects of the Histone Acetyltransferase MOF on Axon Pruning in the Drosophila Mushroom Body

Chromatin readers are proteins containing domains that bind to specific chemical marks on chromatin to regulate gene expression. Histone acetylation is a chromatin mark regulated by histone acetyltransferases (HATs) and histone deacetylases. Kismet (Kis) is a Drosophila chromatin reader that promotes acetylation at the ecdysone receptor (EcR) locus. EcR is a steroid hormone receptor required for proper axon pruning during pupation. Mutations in Kis result in reduced EcR, leading to an axon pruning defect. In humans, the disease CHARGE syndrome is caused by haploinsufficiency of the Kis human homolog CHD7 and is associated with organ defects and intellectual disability. My project focused on identifying the HAT relevant to Kis-regulated axon pruning. I studied the effects of inhibiting the HAT, MOF, on axon pruning in the Drosophila mushroom body. Flies were reared on food containing the MOF inhibitor MG149 dissolved in ethanol. Preliminary results show that ethanol alone leads to pruning defects. Thus, ethanol cannot be used as a solvent and we are now using a different solvent for MG149. Identifying the relevant HAT will increase understanding of this biological pathway and may provide more options for treating CHARGE syndrome.

Alec Shonk

College of Arts and Sciences
Biological Sciences

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

The Inhibition of Rel-A to Combat Biofilm Bacterial Infections

Biofilm bacterial infections cause many deaths in hospital settings. To inhibit bacteria from creating a biofilm the gene Rel-A needs to be inhibited, which will allow standard antibiotics to be effective. By looking at its coding enzyme its binding site can be found, and a drug can be constructed to be a competitive inhibitor. Looking at three ligands with good binding affinity, water solubility, and membrane permeability. The ligands are then broken up into R groups and put through the Swiss Adme database which will replace the R groups with molecular structures that will have a better binding affinity. Once the changes have been identified the new molecule is drawn in Avogadro software and modified to keep bond lengths and angles accurately. Then the new ligand is imported to PyRx. PyRx looks at the binding affinity of the new ligand and if there is an improvement the ligand is imported back to Swiss Adme where the water solubility, membrane permeability, and any health hazards of the ligand are recorded. Lastly, it is imported to the database where the synthesis team takes over to analyze how to create these ligands.

Dorothea West

College of Arts and Sciences
Chemistry

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

Co-Mentor: Jerica Wilson

Drug Design: TIPE2 Protein Inhibitor

Tumor necrosis factor a-induced protein 8 like 2, or TIPE2, is a protein involved in increased tumor cell growth through the facilitation of leukocyte polarization. Leukocyte polarization, the structural change to a white blood cell enabling motility, supports chronic inflammation; providing the necessary angiogenic factors for tumor cells to thrive. The aim of this project is to develop a small molecule inhibitor for TIPE2, which could act as a therapeutic agent to prevent further growth of cancerous tumors.

Target selection begins the process of drug design; a biomolecule involved in the pathway of disease is identified, herein, TIPE2. Virtual screening follows, with libraries of fragments, docked in the protein using AutoDock Vina. The ligands were docked in a moderate grid box, spanning the cavity entrance, four small quadrant grid boxes, and a high grid box, occluding the entrance. The highest binding fragments were determined and linked to another high-binding fragment. These compounds are being modified for the desired absorption, distribution, metabolism, and excretion (ADME) properties. The observed results appear promising and suggest that with manipulation, developing an inhibitor is possible.

Ansh Abbaraju

College of Arts and Sciences
Biological Sciences

Faculty Mentor: **Dr. Daniel King**
Chemistry

Study on the Correlation Between Online-Lecture Usage and Performance on Exams

It is common for students to struggle in general chemistry all over the country. The goal of every instructor is to mitigate some of this struggle through many different study tools such as online lectures. For general chemistry at Drexel, lectures are recorded and posted for students to consume in a way that will allow them to be successful in the course. The benefits of students using these videos are that they can learn at their own pace and rewatch sections of the lecture they need to review. The online lectures also give instructors valuable information on which lectures and sections students are watching the most.

My data analysis consists of separating the students into three groups: students that went to lecture in-person and watched the online lecture, students that did not go to lecture in-person and watched the lecture in the immediate days after it was posted, and students that did not go to lecture and watched the lecture right before the exam. I found that more students stopped attending in-person lectures as the quarter went on, meaning that online lectures were being increasingly utilized. In this presentation, I will compare the number of students in each group who received passing grades on the exams.

Christian DeBrady

College of Arts and Sciences
Communications

Faculty Mentor: **Dr. Peter Amato**
English & Philosophy

Reframing the Journalist's Role Using Africana Philosophy's Perspective on Objectivity

Western rationality frames journalists as observers recording "objective" truth. This outsider view is designed to foster neutrality, but often reinforces the status quo by ignoring suppression and cultural context. Conversely, Akan philosophy interprets truth through morality, making journalistic objectivity not a "view from nowhere" but acting to fairly convey all subjects' beliefs. This requires journalists to advocate for subjects' rights to share their interpretation of truth. As more journalists do so through protest, it is relevant to examine the meaning of impartial journalism through evolving modern moral stances on objectivity, which includes exploring how the goals of journalists and activists align. By using studies about African-descended journalists and writing on truth in African philosophy to explain current events, this project aims to develop alternative journalism models based on African ideas of truth. Potential models include journalists collaborating with culturally aware citizens and identity-based journalism coalitions mixing advocacy with original reporting. While these options have cons, recognizing flaws in the Western view guides future research on when each model is appropriate.

Lillian Fenzil

Pennoni Honors College
Custom-Designed Major

Faculty Mentors: **Megan McClure, Andrew Snover**
English & Philosophy

Becoming a Writer in 10 Weeks

Creating a novel is painstaking work; a process where you write and write and pray something sticks. With mentors pulling out the red pen to circle any weaknesses, it feels like the story will never reach an ending point. Struggles of plot holes, imagery, and verbs drowned me throughout the past ten weeks, but I learned the hardships that come with constructing a work of fiction. The original loose idea switched from concepts floating in my head to chapters forming a whole new story. Nevertheless, I created the first draft of a novel called "Third Party Call." The work of literary fiction explores the concepts of family, immigration, and assimilation as told by a pair of estranged German siblings in the early 90s.

The plot follows Jonas Bachman, a high school teacher who believed he abandoned all traces of his past when he traveled to the United States twenty years prior. His entire world shifted when the Berlin Wall fell, and Lara, his sister who lived in the East for as long as he can remember, came knocking on his door as if the prior thirty years had not existed. Jonas must figure out a way to balance his all-American life and his history as it comes to light to a family that believed to know him.

Crisia Maria Shibu

College of Arts and Sciences
Political Science

Faculty Mentor: **Dr. Rebecca Clothey**
Global Studies & Modern Languages

Cultural Genocide Against the Uyghurs

In order to accurately identify whether the Chinese Communist Party's crimes against the Uyghur population can be designated as genocide, I examined opinions from scholars in this field of study. One group of scholars advocated that the CCP's actions should be identified as a genocide against the Uyghurs. Some scholars wrote that the evidence from Xinjiang does not constitute genocide under the principles agreed to in the 1948 United Nations Genocide Convention. Other scholars advocated for a different approach to defining genocide altogether, considering other forms of eradication.

I conducted a case study of the CCP's treatment of the Uyghurs and evaluated the evidence under the articles of the 1948 Genocide Convention to consider whether the Uygur peril should be labeled as a genocide or not. I also analyzed prior uses of the genocide convention to consider whether it has a holistic approach to genocide. My findings from this research indicate that the Uyghur plight should be identified as cultural genocide and the definition of genocide should indeed be expanded and provide a framework for crimes against humanity that have the potential to constitute genocide, so more punitive action can be taken against these crimes.

Adam Leghzaouni

Bennett S. LeBow College of Business
Economics & Global Studies

Faculty Mentor: **Dr. Amy Slaton**
History

Mutual aid efforts and their role in combatting rising food insecurity in Philadelphia communities during the COVID-19 Pandemic

Despite numerous federal programs such as the CARE Act, the COVID-19 pandemic has decimated secure access to healthy food in Philadelphia communities. Mutual aid activities, based in cooperative community efforts, have stepped up to take the place of inadequate government stimulus programs by directly providing food security. They have done so by addressing systematic issues, supporting communities that have long experienced inadequate access to healthy food and that during the pandemic have faced rising food prices and unemployment. In Philadelphia, these are often minority communities. Mutual Aid groups have opened food banks or worked with small and local Black-owned business to encourage racial equity in food supply systems. Government responses operate at a greater scale with a significant budget but mutual aid organizations provide communities with direct solutions that contribute to a more equitable and sustainable food system. Different political ideologies about the role of governments and needs for system change are presented in this study. This paper explores the interest of mutual aid groups in achieving food sovereignty for communities, rather than simply food access, highlighting a spectrum of political viewpoints.

Maya Levitt

College of Arts and Sciences
Physics

Faculty Mentor: **Dr. Michael Vogeley**
Physics

Co-Mentor: William Watson

Gas and Galaxies in the Cosmic Web: What are Lyman alpha absorbers?

In this research, we investigate if Lyman alpha absorbers are related to the dark matter halos around galaxies. We use previously collected data from the Sloan Digital Sky Survey and by Keeney et al. to record the positions of AGN, galaxy positions, and Lyman alpha absorber redshifts. This information is then used to create visual maps, data tables, and graphs of the bright and dim galaxies around each absorber via python codes in Jupyter Notebook using the matplotlib and astropy libraries. These figures include information on objects' position, redshift, column density, virial radius (if applicable), and the distance of the closest galaxy to each absorber with respect to its virial radius. We find that while most absorbers have a galaxy closer than 25x its virial radius, very few have a galaxy closer than 8x its virial radius. This supports the conclusion that the majority of Lyman alpha absorbers are not directly related to the dark matter halos around galaxies. Another conclusion we come to is that there is very little correlation between the nearest galaxy distance and the column density of an absorber.

Rex A. Hutchinson

Antoinette Westphal College of Media Arts and Design
Art History

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

Undone Science: a Literature Review

Undone Science refers to areas of research left unfunded, incomplete, or ignored – identified as needing more research, and typically affecting underrepresented constituencies (Frickel et al., 2010). While previous research on undone science has examined the completion of and theory behind undone science, little work has been done to investigate patterns in the topics and arenas identified as areas of undone science. To meet that need, I conducted a systematic literature review of articles about undone science.

We collected 65 articles published between 2009 and 2017. Of those articles, 34 made only gratuitous reference to the term "undone science," while 11 described cases of undone science. These articles covered multiple arenas of research, including environmental justice, pollution issues, public health, and the science behind policy. Articles on undone science have steadily increased since early theorization in 2009 and 2010, rising most substantively in 2019, and maintaining high publication rates over the last four years. We also found interesting overlap between cases of undone science and citizen science, as well as between ignorance studies and undone science, both of which deserve further investigation.

Nicole K. Marie

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Psychology

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College Students' Perception of School-Based Mental Health Services: A Scoping Review

The prevalence and severity of mental health disorders among late adolescents and college students are increasing. One model to address these issues is school-based mental health services (SBMHS) which provide mental health (MH) services and resources on an individual or classroom-wide basis. SBMHS has the advantage of making treatment more accessible compared to community-based external mental health services. Mental health research is starting to examine the short-term outcomes of SBMHS, as well as college students' view of MH overall. To date, undergraduates' satisfaction with previous use of SBMHS remains largely unknown. Thus, a scoping review of the literature was conducted to assess this knowledge gap. Five databases were searched to identify 361 English language papers published between January 2000 and June 2022. After screening titles and abstracts, assessing full texts for eligibility, and examining relevant reference lists, the search yielded zero publications addressing college students' perceptions of high school SBMHS. As MH research advances, further understanding of the long-lasting impacts of SBMHS is needed to guide service improvements and address mental disorders early in their development.

Sajda Adam

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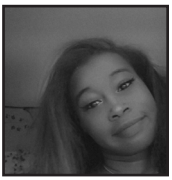

Faculty Mentor: **Dr. Kathryn Devlin**
Psychological & Brain Sciences

Co-Mentor: Dr. Maria T. Schultheis

The Best Tests: Optimizing Detection of Cognitive Decline in People Living with HIV

Approximately half of people living with HIV (PWH) experience HIV-associated neurocognitive disorders (HAND), yet HAND often goes undiagnosed. There is an ongoing need to find efficient ways to screen for HAND and monitor its progression in order to intervene earlier in its course. Prior studies that analyzed brief HAND screening tools have demonstrated that certain cognitive test pairs are sensitive to HAND cross-sectionally, however, few studies have examined optimal tests for longitudinal screening. This study aims to identify the best cognitive test pairs for detecting cognitive decline longitudinally. Receiver operating characteristic analyses examined the sensitivity and specificity of each test pair in detecting significant cognitive decline. Results were compared with the predictive ability of the Modified HIV Dementia Scale (MHDS). Several cognitive test pairs, particularly those that include Grooved Pegboard, are sensitive to HIV-associated cognitive change ($p<.001$), and far more sensitive and specific than the MHDS ($p=.65$). Cognitive test pairs can serve as valid, rapid, cost-effective screening tools for detecting cognitive change in PWH, thereby better enabling early detection and intervention.

Katelyn Phan

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Co-Mentor: Dr. Chavis A. Patterson

Supporting Parents in the NICU Through On-demand, Animated Nurse Training

The Neonatal Intensive Care Unit (NICU) can be a stressful environment for parents and providers. Specifically, bedside nurses tend to witness parents' emotional responses the most. While highly trained to care for ill and fragile infants, many nurses feel unequipped to offer the necessary support to parents. However, nurse simulation training on common psychological responses parents exhibit in the NICU can bolster skills to manage intensely emotional situations (Hall et al., 2015). The CHOP psychosocial team and Drexel Geller Lab developed and evaluated a nurse training detailing parent mental health responses with 151 CHOP nurses. Data showed a 17% increase in confidence when responding to a parent in denial of their infant's health severity and a 14% increase in comfort responding to parents' anger. Due to changing work demands during the COVID-19 pandemic, this in-person training was not feasible. Thus, we translated the nurse training into video modules using Powtoons© (an animation software) that nurses can access on-demand by scanning QR codes. After using this adapted platform, our goal is to test whether nurses feel more prepared, comfortable, and confident communicating with distressed parents in the NICU.

Hunter Cheng

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Mind-Mindedness and Down Syndrome

Theory of mind (ToM) is a precursor to empathy development, and it is known that parental use of mind minded (MM) statements (i.e., comments that use internal state terms to speculate on what a child is thinking, experiencing, feeling) predicts ToM skills. This is crucial, especially for Down syndrome (DS), a developmental disorder (DD) associated with weaknesses in ToM but relative strengths in empathy skills. This study sought to examine differences in parental use of MM statements among 14 children with DS and 14 typically developing (TD) peers of a similar mental ability level. As it has been suggested that individuals with DS may be treated as developmentally younger, it was hypothesized that parents of those with DS may make fewer MM statements than parents of TD youth. To test this, videos of parent-child interactions were transcribed and coded for parental use of MM statements. Contrary to expectations, groups did not differ in the use of MM statements about cognitions and desires, but parents of youth with DS made more emotion-focused MM statements than parents of TD youth. Future research should seek to replicate these findings with a larger sample and also include a sample of children with another DD (e.g., autism).

Toni Marie DeSalvo

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Psychology

Faculty Mentor: **Dr. Michael Lowe**
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Psychological Correlates of Taste Preferences

The "psychological correlates of taste preferences" is a taste study. One side of this study involves examining if preference for foods high in sugar or fat content are more associated with loss of control eating. The second side of this study is examining whether taste preferences for sugar or fat is associated with BMI level. Finally, the possibility that level of loss of control and level of BMI interact to affect taste preferences will be tested. Overall, the main question is which of these two variables are more heavily associated with elevated preference for sweet and fat foods, BMI or loss of control eating? BMI (body mass index) is a measurement found by using one's weight relative to height. Loss of control eating can be described as occurring when one feels they cannot control how much one eats or what they eat, independently of the amount of food that is consumed. Loss of control eating is something that can occur at any BMI. This study will provide insight into the causes of loss of control eating and whether this relationship depends on BMI. These findings could inform the design of future interventions aimed at reducing the level of overweight.

Abigail Hatcher

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Faculty Mentor: **Dr. John Medaglia**
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Co-Mentors: Dr. Brian Erickson, Ryan Rich

Software Development for Closed-Loop Neural Stimulation Research

Transcranial magnetic stimulation (TMS) is a non-invasive technique which stimulates the brain through electromagnetic pulses. Studies have suggested that TMS can improve executive function. However, prior stimulation was delivered without sensitivity to the EEG brain oscillations supporting task performance, which has been shown to be critical in other domains. In three experiments we will identify the optimal EEG phase to stimulate at to further improve executive task performance. Specifically, we will administer "closed-loop" TMS to automatically target EEG phases. We will measure performance using a Navon figure-ground task, in which the participant must switch between identifying a large shape or the smaller shapes that it is constructed from based on the color of the figure. Switching strongly recruits executive functioning, as measured through accuracy and reaction time. The first experiment will determine the optimal ratio of switch trials. The second will determine how EEG phase is related to executive performance, and the third will target this optimal phase with closed-loop TMS to attempt to improve executive functioning. Here, we develop the core task paradigm and counterbalancing strategy to support these experiments.

Sarmistha Madan

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Co-Mentor: Fareshte Erani

The influence of effort–reward interaction on fatigue

Background: Multiple sclerosis (MS) is an autoimmune disease affecting the myelin on neuronal axons. Fatigue is a symptom in persons with multiple sclerosis, negatively impacting quality of life. Even with previous research there is a gap in our understanding of the direct influence of both effort and reward on fatigue.

Objective: Our aim is to examine the influence of effort and reward on cognitive fatigue (CF). We hypothesize that across certain conditions during a cognitive task the effort-reward interaction will lead to CF, additionally, the fronto-striatal regions of the brain will be associated with the reward-effort imbalance and CF.

Method: This study will recruit 20 individuals with MS and 20 healthy controls between the ages of 18 and 60. They will participate in a series of psychosocial and subjective fatigue measures, including a computerized task designed to manipulate the reward and effort levels, while diffusion tensor imaging and functional magnetic resonance imaging will be collected.

Implications: Through evidence and understanding the role of reward-effort imbalance on fatigue, we could better develop assessments and interventions that directly target these mechanisms to predict and treat CF.

Ebubechukwu Donatus Enwerem

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Out Of Distribution Data Detection in Image Classification Neural Networks

Out of Distribution Data Detection refers to methods that enable machine learning models to recognize data that was not included in their training data. The term Out Distribution Data Detection first appeared in 2017, and a few methods for detecting out-of-distribution data have been developed. The goal of this research is to look at some of these methods and see how they can be applied to image processing. The first method investigated was establishing a threshold for a Convoluted Neural Network's SoftMax output layer. TensorFlow and Keras were used to train a Convoluted Neural Network on the Cifar-10 database, and an arbitrary number was chosen as the SoftMax threshold. This method could detect out-of-distribution data, but it had limited capabilities. The next method investigated was the development of a Bayesian Neural Network, which estimates uncertainty by evaluating a probability threshold for output values and determining whether or not that threshold is greater than 20%. Pytorch was used to train a Bayesian Neural Network using this method on the Cifar-10 database. This model performed admirably in terms of recognizing out-of-distribution data.

Asiful M. Islam

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Mitigating Racial and Algorithmic Bias in Autonomous Vehicles

One of the most significant integrations of modern-day Artificial Intelligence into consumers' lives manifests as self-driving autonomous vehicles, such as Teslas. These vehicles attempt to take the burden of driving off humans and into the hands of more reliable drivers. However, as these vehicles become prolific on American roads, researchers seek to understand the harmful repercussions these cars can have on human pedestrians. Researchers at the Georgia Institute of Technology concluded in a study that individuals with darker skin on the Fitzpatrick Scale are more likely to be involved in a pedestrian collision than those with lighter skin. This research seeks to comprehend why this phenomenon occurs in an attempt to mitigate racial bias within self-driving vehicles. This study displayed that racial bias within self-driving vehicles derived from unbalanced datasets used to train these vehicles. Datasets utilized by vehicle manufacturers likely consist largely of white males, which poorly reflects true American demographics and gives Artificial Intelligence difficulty in detecting darker individuals. This project attempts to resolve this racial bias by balancing these datasets using Python scripts and other tools.

Annaliese Blowers

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Preserving History: Reconstructing a Lost Program on the ENIAC

The ENIAC (Electronic Numerical Integrator And Computer) was unveiled in 1946 as the world's first programmable electronic computer. Despite its significance in the field of computer science, its legacy has suffered due to a lack of preservation. Much of the programming done on the ENIAC has not survived, including Derrick Lehmer's program to produce the exponents of 2 modulo p (p being a computed large prime). This was a portion of his larger study of primality in relation to Fermat's little theorem. As one of the first problems solved on the ENIAC, Lehmer's work was able to showcase the computer's ability to process advanced mathematical problems as well as its capacity for parallel programming. Ongoing effort has been conducted to reproduce this work, but prior to our research it had not been implemented or tested in any form. Our primary reference was Maarten Bullynck and Liesbeth De Mol's reconstruction paper. Dr. Stuart's ENIAC simulator was used in our research in order to complete this missing step. By building on this work over the past summer, Lehmer's program has been successfully reproduced for the first time in nearly 80 years.

Velay Fellow

Nicholas Ingravallo

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Demonstrating the Turing Completeness of the Original ENIAC

The ENIAC, being one of the first electronic and programmable computers, had a tremendous impact on the course of modern technology. Beginning in the 1940s, the ENIAC was in development for use in automating difficult and time-consuming calculations to gain an advantage in World War 2. Subsequent computers were designed around the idea of sequentially executing instructions. It was realized that the ENIAC could be used in the same way, and an effort was made to program it accordingly.

Our project is devoted to understanding a preliminary design for instruction processing on the ENIAC. We deployed the original untested implementation on an ENIAC simulator developed by Dr. Stuart. This simulation showed that the instruction set could run on an unmodified ENIAC, and that example programs could be loaded and run successfully. The decoded notes draw parallels to modern computer architecture techniques such as decoding individual instructions, reading, writing, and moving values in memory, and conditional branching. These results give historical context to modern computing, instruction architecture, and how we process programs on a computer today. Furthermore, the results confirm the Turing completeness of the original ENIAC design.

Audra Stein

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

Boundary-Layer Laminar Flow Application on ENIAC Virtual Simulator

During World War Two, the United States government commissioned the creation of the ENIAC, the world's first electronic, digital, general-purpose computer. Although the initial justification for its funding was to calculate artillery trajectories to aid the war effort, it was used for a variety of mathematics and physics research. This included a boundary-layer laminar flow application, used in calculating angles for the fluid mechanics of ballistics at the time, eventually used for supersonic aircraft and general fluid mechanics teachings. The wiring and calculations were done by Kay McNulty, one of six female programmers on the ENIAC, based on the laminar flow analysis of Douglas Hartee. It is known that Hartree later discovered an error in the analysis. In our work, we reconstructed these calculations from Kay's original set-up tables in an attempt to understand the nature of the error. Due to the dismantling of the ENIAC machine, Dr. Brian L. Stuart created a virtual simulator, allowing for the exact processes to be repeated and expanded upon.

Siddarth Kampalli

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Computer Science

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

Co-Mentor: Dr. Bat-Zion Hose

Identification of Handoff Setting Information for HATRICC-US Study

The handoff process for a patient transitioning from the operating room (OR)-to-intensive care unit (ICU) is a critical time due to the patient's acuity and time pressure. However, hospitals often have no standardized process for the OR and ICU care teams to discuss important patient information. In addition, differences between ICU sites may necessitate site-specific changes to a standardized process. This project focused on characterizing OR and ICU setting information, (e.g., number of beds and different roles staffing the ICU), that may impact the OR-to-ICU handoff. Prior work had identified a set of 5 data elements to be collected. Leveraging previously collected interview data from surgeons, ICU nurses, and other staff at four OR-to-ICU sites, this work identified 6 additional data elements related to roles on shift, nurse-to-patient ratios, and environmental factors such as distance between the OR and ICU. Analysis of the four sites indicated that differences between the sites such as ORs and ICUs on the same floor as opposed to being multiple floors apart and requiring the use of an elevator. This research can inform potential barriers to implementation of a standardized process in team based OR to ICU handoff.

Kaylie Nguyen

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User Experience and Interaction Design

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

Co-Mentor: Dr. Afsaneh Razi

Understanding Informal Peer Mentoring Among Youth on Instagram's Private Conversations

Mental health problems have been a persistent issue among youth with almost 50% of adolescents experiencing at least one mental health problem. However, based on their environment, teenagers may not have consistent access to high quality therapy services or family support. Instead, peer mentoring can be their preferred sources of support due to the high level of sympathy among peers. Research shows peer communication happens significantly over social media, which potentially can be a source of support. However, this area of peer support among teens is under investigated. Recognizing the knowledge gap, we analyzed 525 Instagram conversations among teens to examine the problems they are facing and how they are supporting each other. We adapted an existing codebook on identifying peer support types and created topics based on a sub-sample of the conversations (N=82), resulting in 104 codes. We found that informational and emotional support among six support categories were the most common (79% and 73% of the total conversations respectively). The majority of their problems are mental health issues and negative emotions (61%) and relationships (48%). We are still working on the project to provide a complete report of data results.

Channacy Un

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Computer Science

Faculty Mentor: **Dr. Aleksandra Sarcevic**
Information Science

Design and Development of Decision Support Features on Cognitive Aids for Emergency Medical Care

Our team developed a digital checklist based on the Advanced Trauma Life Support (ATLS) protocol that serves as a decision support tool for physicians during trauma resuscitations. The digital checklist consists of individual sections corresponding to the steps of the ATLS protocol. After five years of implementing this digital checklist in actual trauma resuscitations, we are working to design several new decision support features based on user experiences. One new feature will be issued to physicians when a patient is at risk of receiving a blood transfusion. This feature will be based on an algorithm that uses patient demographics and injury data from the trauma bay to determine the risk of receiving a blood transfusion. We used data from interviews and surveys with physicians to inform the design of several alert types, including banners, pop-up alerts, and insights, pre arrival screens. We then conducted usability evaluations with physicians to ensure that design requirements were met. The results of the usability session(s) provided necessary feedback for the final designs and their implementation.

Velay Fellow

Vidhi Shah

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Co-Mentor: Katie Zellner

Prototyping an Alerting System for Supporting Delay Awareness in Emergency Medical Settings

Delays and errors contribute to nearly 50% of preventable deaths in trauma resuscitation. Our research goal is to develop a decision support system to detect delays in trauma resuscitation and alert the team to those delays. In previous work, we identified the most critical delays during resuscitations by studying actual cases and simulations and interviewing trauma team members about their work experiences. These findings were then used to design icons for delays in obtaining vitals, administering blood transfusion, performing intubation, establishing intravenous (IV) access, and administering medications. In this poster, we analyzed data from these previous studies to improve the design of icons and then implemented those design changes in a new iteration of the system prototype. We then conducted 32 interviews with experienced clinicians to obtain feedback about the new prototype. Through these interviews, we found out more about the clinicians' preferences and learned more about how the designs could be misinterpreted. Based on these findings we made the new icons more intuitive, easy to understand, minimalistic and used color to portray stronger differences in the icons.

Yuki Alana Duncan

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Chemical Engineering

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

Co-Mentor: Gregory Manoukian

Photoluminescence Spectroscopy of Cadmium Telluride

Photovoltaic efficiency is important for making economically viable solar cells which is vital in decreasing carbon emissions into our atmosphere via mainstream sources of energy. Photoluminescence is an indicator of long carrier lifetimes and low front interface recombination rates, which defines a highly efficient photovoltaic cell. Using photoluminescence spectroscopies of various solar cell samples, we can study how manufacturing processes affect photovoltaic efficiency. Steady state photoluminescence (SSPL) is used to understand the band gap of photovoltaic absorbers, while time resolved photoluminescence (TRPL) is widely used to understand carrier dynamics of photovoltaic absorbers and devices. Researchers at the national renewable energy laboratories developed a TRPL simulation application for cadmium selenide telluride (CdSeTe) cells, and it is available for public and research use. We simulated various CdSeTe device stacks at varying lifetimes and front interface recombination velocities to determine how each cell parameter affected the overall TRPL decay dynamics of various cells. We were able to reconfigure a SSPL spectrometer designed for liquid samples to make reliable measurements of thin films on glass substrates.

Cara Capsambelis

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Chemistry

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

Extraction of Recycled Fatty Acids to Build Antimicrobial Polymers

This project seeks to optimize a procedure for extracting free fatty acids (FFA) from wastewater residuals in collaboration with the USDA to build bio-based antimicrobial polymers. The wastewater residuals collected from grease traps, called brown grease, can be purified to produce FFA. Collaborators experiment on the effectiveness and the viability of producing bio-based antimicrobial polymers from recycled materials with possible contaminants. Improving this procedure in a manner that increases sample size while decreasing the amount of waste produced is important for the project. There are three main areas of exploration to decrease the generation of waste: reducing the amount of solvent (hexane) needed, reducing the amount of co-solvent (alcohols) used, and increasing the molarities of acids and bases used. Hexane and water are used during to extraction steps to make it possible to separate the FFAs. Yield decreases without enough solvent. Reducing the amount of alcohols helps to improve separation but can reduce reaction conversion. A new procedure with reduced alcohol content but a high yield of FFAs is important for scaling up this procedure and realistically using recycled materials to make antimicrobial polymers.

Velay Fellow

Emma Sloan

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Extracting Free Fatty Acids from Brown Grease

Brown grease is a waste product collected from restaurant grease traps and wastewater treatment facilities. Until recently, this material has been discarded; however, extracting the free fatty acids (FFA) from brown grease allows the FFA to be tested for suitability in the USDA process of producing antimicrobial polymers. Brown grease is a waste product and contains many different molecules, so a deeper understanding of the composition is needed to understand how changes to the extraction process affect the yield and composition of the FFA. A variety of analytical techniques were used to understand the composition of the brown grease and the extracted FFA. Total Acid Number quantifies the FFA content of a sample using a base titration. Iodine Value measures the double bonds in a sample by reaction with iodine. Differential Scanning Calorimetry (DSC) measures the melting and freezing points of the sample. Fourier Transform Infrared Spectroscopy (FTIR) measures adsorption of infrared light at different wavelengths which is then compared to known FFAs to understand the structure. Using these techniques, changes to the yield and composition of the FFA can be measured to evaluate the effect of extraction process conditions.

Velay Fellow

Jack Warlick

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Chemical & Biological Engineering

Co-Mentor: Theodore Houser

Fluoride Passivation During Fluoropolymer Lamination of Halide Perovskite Solar Cell Materials

Perovskite solar cells have been shown to have a high efficiency and are moving towards commercialization. However, they suffer from environmental instability, which requires them to be encapsulated. We hypothesized that encapsulating the perovskite with fluoropolymers could enhance efficiency through surface fluoride passivation. Using three fluoropolymers, Dyneon, CS Hyde, Solef (PVDF-HFP co-polymers), we optimized the photoluminescence performance with respect to two lamination variables: temperature and time. Photoluminescence performance serves as a proxy for solar cell device performance and is judged by steady state and time resolved photoluminescence. To make samples, we used a glass substrate with a layer of perovskite, a fluoropolymer to encapsulate the perovskite, and a glass superstrate to seal the sample. After the stack is made and heated to a specific temperature, it is put under 1450 PSI. This is when the fluoropolymer encapsulates and reacts with the perovskite layer. We found that fluoride passivation improves the photoluminescence performance of perovskite, but that too much or too little passivation is detrimental. In future research, these optimized conditions will be applied to the creation of solar cells.

Christopher Bahr

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Faculty Mentor: **Dr. Aaron Fafarman**
Chemical & Biological Engineering

Co-Mentor: Arkita Chakrabarti

Perovskite Crystallization in Nanoporous Scaffolds

Perovskites, a class of material, have shown promise as an absorber material for solar cells. In particular, CsPbI3 has emerged as an excellent choice due to its optimal electronic properties. CsPbI3 can adopt a non-perovskite yellow phase or a perovskite black phase. Unfortunately, its perovskite phase degrades at room temperature and transitions to a stable phase at 330°C. Porous metal oxides can confine the perovskite in nanosized pores that stabilize the desired phase. Hence, it is important to study how perovskite solutions crystallize in their pores. In this research, we study the crystallization dynamics of CsPbI3 within the pores of anodic aluminum oxide (AAO) membranes. We hypothesize in the presence of a reservoir of precursor solution, capillary forces and surface tension draw solution to the membrane surface. We observed that in the presence of a reservoir, surface crystallization is favored over pore crystallization, causing bulk CsPbI3 crystals that remain in the yellow phase. Contrarily, when the precursor-filled AAO is rid of a reservoir the CsPbI3 solution crystallizes inside the pores only, resulting in a phase transition temperature depression to 90°C and the stable black phase in the pores of the AAO membranes.

Evelyn Carpenter

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Environmental Engineering

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

Co-Mentor: Karla Negrete

Using thianthrene as a fluorescent molecule for evaluating electrode heterogeneity during optical microscopy

The use of fluorescent microscopy as a screening technique for assessing commercial electrodes has the potential to accelerate battery technology. However, there has been minimal research on the thianthrene (TH) molecule as an electroactive fluorophore. This project uses cyclic voltammetry (CV) and chronopotentiometry (CP) to develop a battery cell using TH as the fluorophore in a solution of acetonitrile with conductive salt, tetraethylammonium tetrafluoroborate. Experimental plans initially included ultraviolet visible spectroscopy, fluorometry, and fluorescent microscopy, but reactions between the TH electrolyte solution and oxygen (O2) in air skewed CV and CP results. Hence, the project shifted to study the interaction of oxidized TH in the presence of molecular O2 as a precursor to understanding TH fluorescent behavior. We find that solutions purged with O2 yield current peaks about 30% smaller when compared to those tested in an anaerobic glove-box environment. This preliminary data would be used in future studies as a baseline for more extensive electrochemical measurements. Ideally, if well-behaved, TH could be used to visualize redox reactions at battery electrode surfaces to evaluate electrode quality and efficiency.

Velay Fellow

Brandon Paul

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Faculty Mentor: **Dr. Maureen Tang**
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Co-Mentor: Tana Siboonruang

Electrochemical Oxidation of Cyclohexanol and Cyclohexanone into Adipic Acid

Based on its use in the production of nylon, adipic acid plays an important part in the production of many everyday products. However, adipic acid is mainly produced with thermochemical methods which release harmful gases into the atmosphere which is why we chose to research electrochemical methods to produce adipic acid. To achieve this, we used electrochemical methods like cyclic voltammetry (CV), and electrolysis to determine the ideal conditions for adipic acid production. By performing CVs using a copper working electrode, platinum counter electrode, and silver/silver chloride reference electrode, we were able to determine an ideal voltage for electrolysis. After a voltage was decided, we moved on to performing electrolysis in a divided H-Cell using the same electrode as our CVs. In doing this, we found that using copper created many complications. To help this, we switched to an electrode using nickel oxyhydroxide deposited onto FTO which was significantly more successful in oxidizing our reactants. We then used multiple analytical chemistry methods like NMR, FTIR, and GCMS which allowed us to determine that we had produced adipic acid. Our results provide a framework for the use of electrochemistry to produce adipic acid.

Gladys Priscilla Kirabo

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Civil Engineering

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

Co-Mentor: Robin Deb

Use of Phase Change Materials (PCM) in Concrete Pavement to Melt Ice and Snow

The rapid development of infrastructure needs innovative materials for pavement construction. The main objective of the research is to understand various complex damage mechanisms that occur during the freezing and thawing of concrete and how they can be curtailed by using self-heating concrete. This research is necessary because the damage caused to concrete by freezing and thawing due to exposure to temperature extremes significantly reduces the service life of concrete infrastructures such as bridges and pavements. As a result, repairs and replacements happen more frequently than predicted or intended, which is economically and environmentally unsustainable. By finding a way to mitigate the damage caused by freezing and thawing, there will be a decrease in overall cement production, which lightens the stress on naturally occurring minerals and decreases the emissions from cement manufacture.

Rhythm Osan

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Civil, Architectural, & Environmental Engineering

Thermal Vascular Self Responsive Composites for Civil Infrastructures

Vascular systems in nature autonomously respond to different environmental stimuli such as moisture and temperature thus creating equilibrium for organisms. Civil infrastructure similarly combats external stimuli such as weather but is incapable of autonomously responding and faces issues such as cracking or collapsing over time. Vascular concepts can be incorporated in engineering construction materials to increase the durability of civil infrastructure, thermoregulate buildings, reduce cracking & melt snow. This idea has proven successful in polymers using an active circulating fluid and is now attempting replication in concrete using a passive thermal self-responsive phase change material (PCM). This project aims to find an efficient way to create a vascular network mold and optimize the production of a PCM injected vascular network in concrete ensuring minimal cracking and absorption as well as increased tensile strength.

Velay Fellow

Jessica Abu

College of Engineering
Enviromental Engineering

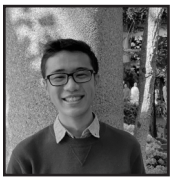
Faculty Mentor: **Dr. Christopher M. Sales**
Civil, Architectural, & Environmental Engineering

Co-Mentor: Peerzada Madany

Establishing Controls in a UV Light and Air Disinfection Experiment

COVID-19 infection rates and restrictions in public transit have prompted research on how air disinfection technologies inactivate airborne pathogens, like SARS-CoV-2. Previous studies have found germicidal UV (ultraviolet) lamps at 254 nm can inactivate pathogens in air. Others found far-UVC, UV lamps set to 200-230 nm, can do the same with reduced human harm. This study aims to deduce the extent of MS2 viral inactivation due to far-UVC through air chamber tests. In these tests, deposition, a process where some viral particles stay on chamber walls, can occur. This project phase tried finding MS2 loss due to deposition in the chamber without any treatment. The final and initial viral concentrations varying could mean deposition is present in the experimental setup. Establishing loss from deposition would produce accurate results, helping ensure UV light's efficiency. MS2 samples were dispersed into a 1 m^3 chamber, mixed, and collected for quantification. In test 1, 99.98% of the MS2 dispersed was collected; in test 1, 99.99% of the MS2 dispersed was collected. High retention indicates minimal deposition. This data should provide insight into later air chamber tests which will examine the efficiency of disinfection by UVC light.

Velay Fellow



Matthew R. Soesanto

College of Arts and Sciences
Biological Sciences

Faculty Mentor: **Dr. Christopher M. Sales**
Civil, Architectural, & Environmental Engineering

Co-Mentor: Jinjie He

Plasma vs Bacteria: The Fight for Salmon Fillet

Plasma is a rising technology in the field of food sanitization. The reactive species created by plasma, when mixed with a medium like mist, can be used to disrupt the cell structures of microbes, eventually inactivating them. The technology has the potential to be an alternative to current methods of food sanitization which sometimes involves adding potentially toxic chemicals, such as BHT and BHA.

Past research has shown plasma being tested on vegetables and fruits, displaying promising results as they reduce the bacterial presence on these specimens. However, plasma has not been tested on other food materials, such as meat.

The current research aimed to prove that plasma can reduce bacterial concentration in salmon tissue, a type of meat. A plasma chamber, OxyFog, was used to test three samples: Escherichia coli O157:H7 1) plated on agar, 2) on salmon, and 3) homogenized with salmon and plated on agar. When compared to untreated samples, the treated samples showed a decrease in E.coli concentration over increasing times of treatment. By diving deeper in this novel technology, methods in food sanitization may not only be safer, but also more efficient.

Marc A. DeCarlo

College of Engineering
Computer Engineering

Faculty Mentor: **Dr. Andrew Cohen**
Electrical & Computer Engineering

Co-Mentor: Layton Aho

GPU Blob Detector for a Mitosis/Apoptosis Classifier

Live cell microscopy for biological and medical studies requires accurate cell segmentation, tracking, and pattern classification to recognize key cellular events. Two key cellular events are mitosis (cell division) and apoptosis (programmed cell death) which have distinctive visual characteristics. Currently, there is a lack of machine learning algorithms that require no training data for mitotic/apoptotic classifiers. This project presents an application for a GPU based blob detector which returns responses that are recognizable by a simple machine learning model. The GPU detector is an extension of the Laplacian of Gaussian filter that responds highly to mitotic/apoptotic visuals. The GPU responses are represented in a structure function that scores the cell's similarity to the model. Along with spatial and temporal information, the GPU blob detector lays the groundwork for a mitotic/apoptotic classifier that will improve accuracy and minimize false detection. The results presented here use human stem cells and cancer cells datasets. The blob detector response is shown as a 3-D rendering of a 2-D plus time kymograph. This approach is more robust and practically effective compared to previous approaches.

Thomas O'Keeffe

College of Engineering
Computer Engineering

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

Co-Mentor: Dr. Malvin Nkomo

Wearable Deep Vein Thrombosis Monitoring System

According to the Centers for Disease Control, about 900,000 people are affected by Deep Vein Thrombosis (DVT) every year. Deep Vein Thrombosis is a condition that occurs when blood clots form in the veins. DVT is fatal in about 25% of cases. The way to mitigate DVT is to maintain healthy circulation through physical exercise. However, for many patients, this is simply not possible for numerous reasons. Solutions exist such as compression devices in the case of prolonged inactivity to stimulate blood flow, but this causes discomfort and immobilizes the patient. We propose the use of micro-electromechanical sensors that measure small movements as a means of assessing the activity of the patient. We developed a sensor system with a temperature sensor, 9-Axis accelerometer, heart rate monitor, and pulse oximeter. This sensor data is fused together to enable mobility detection in patients to ascertain stimulation. Sensor data is transmitted to a backend processing engine via Bluetooth for storage and visualization. The goal of the research was to leverage an existing custom design for smart health applications. Low-level driver logic was developed using C programming for the microcontroller and interface to the IoT backend.

Istiak Rahman

College of Engineering
Computer Engineering

Faculty Mentor: **Dr. Anup Kumar Das**
Electrical & Computer Engineering

Effect of BERT-based Transformer Model on Deep Learning Algorithm for Sleep Classification

For this term-long project, my research is based on a pre-developed machine learning algorithm provided by a Github repository coded in Python using the outdated TensorFlow 1 code. The algorithm works as a system that automates the process of organizing and plotting data collected from EEG signals during different sleep cycle stages. Large EDF datasets are processed and then a supervised classification algorithm provided by the repository is expected to classify the different parts of the data with a 'W', 'N1', 'N2', 'N3', or 'REM', i.e. the stages of the human sleep state. However, for this algorithm to successfully classify sleep state datasets, it must be trained and its levels of accuracy must be tested. The problem that arises from this process is the lack of speed and efficiency in the pre-training and training phases of the deep sleep algorithm, taking multiple hours to process data and determine accuracy levels for each pass of the training dataset through the code, i.e. an epoch. Through this project, I will study the effect of not only updating the provided algorithm to TensorFlow 2 but also the impact of utilizing a BERT-based transformer, a deep learning model that supports natural language processing.

Santiago Sosa

College of Engineering
Electrical Engineering

Faculty Mentor: **Dr. Adam K. Fontecchio**
Electrical & Computer Engineering

Co-Mentor: Marquise Pullen

Hyperspectral Imaging System Through Holographic Polymer Dispersed Liquid Crystals (H-PDLC) Switchable Filters

The ability to capture visual data at a high-fidelity rate along the electromagnetic spectrum, and interpret it, is an emerging technology known as Hyperspectral imaging; this technology allows us to understand our world at a deeper level. Using Holographic Polymer-Dispersed Liquid Crystals (H-PDLC) filters mounted onto a camera, an enhanced vision system can be created to analyze data in a broader range than just the visible spectrum, reaching into both the infrared and ultraviolet light. The use of expanded vision can be integrated into industries such as environmental monitoring, biotechnology, machine vision, and much more. For example, forest fires have managed to cause irreversible damage in many parts of the world. Through an advanced hyperspectral image system, specialists can capture images in the infrared to detect the heart of these fires to best attack them, and due to the physical properties of liquid crystals, the filters can be switched off instantly to capture images in the visible spectrum at the same instance. The capability to create an advanced imaging system allows for more data to be collected to help make more effective decisions in fields such as vision systems, autonomous vehicles, and crop production.

Rohan G. Chandraghatgi

College of Arts and Sciences
Biology

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

Co-Mentor: Dr. Bahrad Sokhansanj

Developing a Pipeline for Computational Fragment-Based Drug Design

In-silico methods of evaluating potential drugs can greatly reduce the cost of pre-clinical phases of drug development. Previously, the EESI lab developed an experimental pipeline to fragment drug candidate ligands that had been previously evaluated using Autodock VINA, a computational docker that predicts ligand binding affinity. The pipeline splits ligands into constituent fragments using the BRICS protocol, generating a library of fragments to be reassembled into new ligands. To improve usability and reproducibility, I built a production ready pipeline that generates results including additional information on residue binding sites. After developing the list of fragments, we developed an exhaustive search algorithm to recombine fragments to intelligently design new drug candidates. Priority is given to fragments from ligands with lower predicted binding affinities. The results from this search included new ligands with significantly lower binding affinities than the original ligands used for the fragment library. Some of these ligands have good drug-likeness and ADME properties, making them potential candidates for new drugs. I am currently developing genetic algorithms for recombining fragments for future implementation.

Brandon Christopher Gorski

College of Computing and Informatics
Computer Science + Computer Engineering

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

Co-Mentor: Dr. Bahrad Sohkansanj

Predicting Emerging Variants of Covid-19 from Wastewater Sequencing

Covid-19 is one of the most widespread viruses to plague the entire human race within the 21st century, having an irreversible impact on our lives and the way we perceive illness. As such, being able to classify Covid-19 variants within populations is crucial for protecting people by creating resilient vaccines for our population. However, due to Covid-19's tendency to mutate rapidly, it is crucial to be able to differentiate between variants of Covid-19, detecting them in populations early to construct more specific vaccines and treatments. Modern techniques for wastewater sequencing show data about Covid-19 variant abundances 2 weeks before they appear within clinical data. I will compare the Anderson Lab's convex optimization demixing (Ivar->Freya) to reference-based assembly (TenSQR->BLAST & VirGenA->BLAST) to classify the percentage abundances of variants within these wastewater samples. I will test these methods with artificial Covid-19 sequencings that I have implemented to compare these methods' metrics (e.g. accuracy) in classification and abundance estimation. Classifying the variants within these samples over time can be used to determine the percentage abundances of emerging variants in sampled populations.

Marcelino Smith

College of Engineering
Materials Science and Engineering

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

Co-Mentor: Kiana Montazeri

Synthesis and Characterization of 1D Titanium Dioxide Filaments using Bottom-Up Methods

With promising electrical and optical characteristics, titanium dioxide, TiO2 has many applications such as in solar cells, electrochemical water splitting, and others.

Titanium based anatase is a material that is used extensively in pigment creation. This involves the synthesis of bulk low dimensional material. The traditional method is expensive and emits substantial amounts of CO2. However new methods of synthesis offer reduction in both emissions and cost. Additionally these methods are very straight forward in procedure.

We developed a new method of bottom-up synthesis, to create one dimensional TiO2 nanostructures. This involved immersing Ti-precursors, viz., titanium carbide, diboride, and nitride, in NaOH and KOH basic solutions, then mixing the solutions for 4-14 days at temperatures ranging from room to 100 °C, followed by a washing process. X-ray diffraction suggests our material is 1D anatase. Scanning electron microscope images shows both individual filaments and bundles. Given their characteristics and simplicity of synthesis these nanofilaments are quite desirable. Offering major reduction in environmental impact as well as new properties these TiO2 nanostructures are a promising material for several applications.

Hans Alexander Geiser

College of Engineering
Materials Science & Engineering

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

Co-Mentor: Shichen Yu

Controlling Poly(L-lactide)-based Crystalsome Formation for Biomedical Use

Crystalsomes are nanoparticles that form by controlled crystallization of polymers on an emulsion's liquid-liquid interface. They are mechanically robust and show high particle retention time in blood. They have exciting potential for use in drug delivery; however, the challenges faced in the application of these particles are their generous size distribution and lack of a consistent shape. The three aims of this project were to control the shape-definition of, control the size of, and test drug loading on the crystalsomes. The shape-definition (sphericality and surface features) of the crystalsomes was controlled by altering the molecular weight of the PLLA or PEG chain. Modifying the emulsification method, as well as filtration, helped control the size of the crystalsomes; however, changing emulsification methods yielded better results. The project focused on analyzing how emulsions form and can change over time or over temperature changes, using the DLS. Continuation of this project will see exploration into loading the crystalsomes with medicine through a post-loading process.

Juan F. Cruz

College of Arts and Sciences
Environmental Science

Faculty Mentor: **Dr. Ekaterina Pomerantseva**
Materials Science & Engineering

Co-Mentor: Ryan Andris

Phase Transformation and Battery Performance of Bilayered Vanadium Oxide Integrated with Carbonized Small Organic Molecules

This work integrated small organic molecules with bilayered vanadium oxide (BVO) to improve the electronic conductivity and electrochemical performance of the BVO phase. The synthesized materials were hydrothermally treated to carbonize the organic molecules of dopamine hydrochloride (DOPA) and o-phenylenediamine (oPH) and to study how DOPA and oPH affected the final structure and properties of each DOPA:BVO and DOPA:oPH sample. X-ray diffraction showed that increasing the initial amount of organic molecules resulted in further reduction of the vanadium in the BVO precursor. Samples made with a 1:20 oPH:BVO ratio maintained the BVO phase and a vanadium oxidation state of 5, while the oPH:BVO 1:5 sample was reduced to a VO2 phase with a vanadium oxidation state of 4. A four point probe measured the electronic conductivity of the pure BVO and oPH:BVO 1:20 samples at 1.0 x 10-5 and 1.2 x 10-3 S·cm-1, respectively. Therefore, the oPH:BVO 1:20 sample was chosen for electrochemical testing due to its improved electrochemical conductivity and its high vanadium oxidation state. This sample achieved a high discharge capacity of 190 mAh g-1, indicating that our approach can be successfully applied for a broad range of organic molecules.

Alessandra Cabrera

College of Engineering
Materials Science and Engineering

Faculty Mentor: **Dr. Caroline Schauer**
Materials Science & Engineering

Co-Mentor: Emily Herbert

The Materials Behind Active Packaging

Aluminum cans serve as food containers for several types of semi-liquid to fully liquid ingredients, ranging from canned vegetables to alcoholic beverages, and fizzy sodas. Food ingredients degrade and spoil more quickly when exposed to oxygen, so there is a strong need for antioxidant-infused can linings to help keep food on grocery shelves for longer. Most can linings utilize fossil fuel-derived plastics, but in recent years, the product life cycle and recyclability of these synthetic materials have been put into question. Natural food waste components such as cranberry pomace and spent coffee grounds have been incorporated into active packaging films, serving as biodegradable alternatives to existing industry plastics. The liquid extract from these food waste products is high in phenolic compounds and antioxidants.

Employing the method of solution casting, polymer films of varying weight percentages were dried and analyzed for efficacy using tensile testing data, water absorption tests, and the Folin-Ciocalteu assay, which qualitatively measures antioxidant release. The development of active films for this project serves as critical groundwork for a canned beverage which will be created in conjunction with the Drexel Food Lab.

Velay Fellow

Eli Werbach

College of Engineering
Materials Science and Engineering

Faculty Mentor: **Dr. Caroline Schauer**
Materials Science & Engineering

Co-Mentor: Dr. Reva Street

Drawing Polymer Nanofibers via Trackspinning

Nanofibers are ultralight strands of material with fiber diameters ranging between one nanometer and one micrometer that have many applications in the biomedical industry such as wound dressing and drug delivery. However, nanofibers potential appears untapped due to difficulties in traditional processing methods. This research focuses on a novel method of drawing nanofibers called trackspinning. Trackspinning involves dripping solution at the top junction of two rotating tracks at an angle. As the tracks rotate, the drop of solution is elongated into fibers. The trackspinner can easily regulate the length and diameter of drawn fibers by raising and lowering the collector as such a collector was designed that moves in the z-direction. Additionally, various components of the trackspinner set-up were modeled and 3-D printed to improve its functionality.

Conway Zheng

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Materials Science and Engineering

Faculty Mentor: **Dr. Caroline Schauer**
Materials Science & Engineering

Co-Mentors: Dr. Reva Street, Divya Kamireddi

Characterization of Nanofiber Deposition by Touchspinning

Nanofibers are fibers possessing diameters of only one micrometer to several nanometers with many applications in filtration, tissue engineering and drug delivery. They have attractive properties of high surface area-to-volume ratio and porosity in their non-woven state. Electrospinning, the predominant technique to create nanofibers, uses electrical charges to propel a continuous stream of polymer solutions onto a grounded collector. However, this technique requires applying high voltages to the polymer solution, which can be difficult to produce fibers from specific biopolymers and damage the biomolecules within them due to the toxic solvents needed. Touchspinning, a recently developed method, mechanically draws polymer droplets into thin fibers and then deposits them onto a collector. This technique and its parameters are not as well-studied as the more established electrospinning technique. This project focused on whether touchspinning forms continuous fibers on 3D-printed cylinders of different sizes at various speeds. By covering the cylinders with aluminum foil, resulting fibers are easily removed to obtain geometric data on yielded fibrous mats. Parameters such as collector size and needle rotation speed were investigated.

Andrew Dolaway

College of Engineering
Electrical Engineering

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

Co-Mentor: Luke Simeone

Transforming Quadcopter Design For Controlled CubeSat Landing

First developed by California Polytechnic State University and Stanford University in 1999, CubeSats are a type of nanosatellite commonly used by universities to provide students with inexpensive access to space. CubeSats are measured in "U," where "1U" represents a 10cm cube. Presently, there are no CubeSats capable of controlled flight within a planet's atmosphere. The purpose of this research is to develop a novel method of controllably flying and landing CubeSats on the surfaces of planets. The system my group and I developed uses a compact folding quadcopter design. Before deployment, the quadcopter fits within a 1U CubeSat by folding the arms of the quadcopter down with spring-loaded hinges. While folded down, all four arms are held in place by a single pin that can be remotely pulled by putting current through a push-pull solenoid. As the electrical engineer on this project, my roles included design, construction, and testing of the electrical systems needed for the release and flight mechanisms. This system will expand the current capabilities of CubeSats by allowing them to be dropped in free-fall and transform into a controllable quadcopter that can act as a probe.

Evan Gallagher

College of Engineering
Mechanical Engineering

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

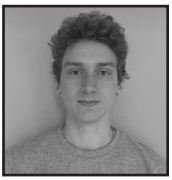
Co-Mentor: Luke Simeone

CubeSat Innovation: The Quadcopter Effect

In today's world, satellites are one of the most important tools in the field of astronomy. However, some missions require the use of a probe rather than a satellite. These probes generally cost much less due to their short life since they can only be used once with no return. However, with recent innovation of CubeSats, the satellite and probe have started to merge. Based on the above ideas, a team of four, Drew, Rachel, Dan and myself, set out to create a CubeSat that could control its landing with the use of a quadcopter design. This would allow the CubeSat to maintain similar characteristics of a satellite as well as a probe while being reusable. With many design choices to sort through, the use of computational fluid dynamics software proved a four-motor, battery powered design would be more effective rather than a passive design. Knowing that the design would need to enclose many components, a model began to be created via fusion 360 to establish how each part would fit as well as its shape and size. These parts were re-design many times to ensure that flight was effective and efficient. Simulations were also conducted to plot stresses and contact forces while the CubeSat is in motion to ensure its structural integrity.

Daniel Goulding

College of Engineering
Computer Engineering



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

Co-Mentor: Luke Simeone

Flight Control for Expandable Quadcopter Within a CubeSat Module

CubeSats are small-style satellites used by everyone from students to NASA for various purposes and functions. These CubeSats are launched on a carrier vessel that ejects the satellites into the exosphere (the outermost layer of the atmosphere) for orbit and is currently the most accessible method of launching a satellite to space. One area in which research lacks is a method of retrieval. The current life cycle of the satellite ends when they burn up in the atmosphere upon re-entry. We look to expand the use case by creating a capability for the CubeSats to land unharmed on a planetary surface via a deployable quadcopter-type system. The work was done in collaboration with Rachel Hanes, Andrew Dolaway, and Evan Gallagher. The primary focus of my research was flight control and deployment systems. Our model is dependent upon a semi-automated flight system in which control is abstracted to a landing pilot allowing for machine precision and ease of use. This allows for the capability of landing and maneuverability about any specified location on almost any planet with an atmosphere and gravity of up to 3.9 G's.

Rachel Hanes

College of Engineering
Mechanical Engineering and Mechanics

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

Co-Mentor: Luke Simeone

Physics and Design for Expandable Quadcopter

CubeSats are 10 cm cube, 2 kg satellites. They are cheap to produce and launch, and are used for a myriad of purposes, including taking data on the climate and atmospheric conditions. Their use is important to predict natural disasters, as climate change makes them more frequent and deadlier. CubeSats, however, typically fall out of orbit and burn up through the atmosphere within a few months to several years after being launched, which reduces their ability for use. If they could be retrieved, they could be reused, and they could collect physical data. I worked in a four-person group with Andrew Dolaway, Daniel Goulding, and Evan Gallagher to create a landing method. Our design is a folding quadcopter. When folded, it fits within a 10 cm cube, which would allow it to be deployed along with other CubeSats. We assume that its cargo already has a heat shield, and our quadcopter would carry it safely down to the ground after getting through the atmosphere. My role was to work on the physics that allow us to land it as well as finding lift and drag given by different methods to determine the best overall design. I then worked on the design elements for our final version and was responsible for much of the unlatching method.

Christina Ing

College of Arts and Sciences
Criminology and Justice Studies

Faculty Mentor: **Dr. Stephanie Krauthamer Ewing**
Counseling and Family Therapy

Mentalizing on Emotion Regulation and Depression Severity

Depression affects over 4 million teens in the US alone. Alongside interfering with one's life mentally and physically it can also put teens at risk for suicide. An important risk factor linked to depression is mentalization, or the ability to understand mental states (one's own and others). While multiple studies have found this link in adults, only one study has examined links between mentalization and depression severity in teens. Further studies are needed to examine this link in teens. The current study will add to the literature by examining: 1) correlations between teen mentalizing scores from the Adult Attachment Interview (AAI) and depression scores (Beck Depression Inventory); and 2) correlations between teen mentalizing scores and self-reported difficulties with emotion regulation. It will use secondary baseline data from depressed teens in a NIMH R01 clinical trial. The following hypotheses will be tested: 1) lower mentalizing will relate to higher depression severity; 2) lower mentalizing will relate to higher emotion regulation difficulty; 3) emotion regulation difficulties will partially mediate the relationship between mentalizing and teen depression.

Ned Elshafi

College of Engineering
Chemical Engineering

Faculty Mentor: **Professor Jennifer Quinlan**
Department of Nutrition Sciences

Food Nutrition and Availability: The Ethnic Angle

There has been much discussion about food deserts and availability of grocery stores in low-income neighborhoods. Not as much has been assessed regarding the quality and type of items available from ethnic markets in these urban communities. This research involved assessing 18 ethnic grocery stores and markets in the city of Philadelphia. Commonly available produce and meat items in these markets were identified and their packaged form, either frozen, canned, or fresh, was recorded. Prices between frozen, canned and fresh products were analyzed and compared. Unique items including, but not limited to, cactus, eel, cassava, and abalone were commonly available in multiple forms in these ethnic markets. In general, the fresh form of products was the least expensive, though it varied on the neighborhood. In Little Saigon, of 19 products, 42% of fresh products were cheaper than their alternatives. These types of unique products are often not included in discussions of food deserts and food availability. The research presented here indicates that unique products in ethnic markets should be part of the conversation when addressing food access and food insecurity.

Madelyn Farland

College of Nursing and Health Professions
Nursing

Faculty Mentor: **Dr. Rose Ann DiMaria-Ghalili**
Doctoral Nursing

Co-Mentors: Dr. Jina Huh-Yoo, Zachary Hathaway, Lee Scott

Development of a Web App Interface for Fluid Intake Monitoring in Older Adults

In the United States, 45% of older adults have two or more chronic conditions. Fluid intake management plays a significant role in the self-management of certain chronic conditions (i.e., heart failure, kidney disease, etc.). When monitoring fluid intake, the recorded values are usually consumption estimates. Due to these constraints, recorded fluid intake values by adults, patients, and clinicians are inaccurate and unreliable. The Smart Cup is a Bluetooth-enabled device that captures the fluid consumed by an older adult unobtrusively and automatically. The data retrieved from the device will be made accessible through a Web app. This project aims to design and evaluate the Web app interface through scenario-based user testing. A series of semi-structured interviews with nurses will be conducted to evaluate the design features of the interface. The findings will inform the future development of the Smart Cup's mobile-friendly Web app interface.

Clara Hartlaub

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

Faculty Mentor: **Dr. Arun Ramakrishnan**
Office of Research, Discovery and Innovation
School of Biomedical Engineering, Science, and Health Systems

Co-Mentor: Dr. Noel Goodstadt

Portable Adaptable Strength Testing Device: Product design for clinical and commercial applications

Accurate measurement of muscle force output is used by physical therapists and sports coaches to evaluate athletic performance as well as monitor rehabilitation progress after injury. Such measurements were previously only possible with a bulky isokinetic dynamometer that costs over $50k. Researchers at Drexel University have developed a portable isometric muscle strength testing device that functions equally as well at a fraction of the cost. Since securing the patent in 2021, the research team has received numerous requests for use of this device in clinics and research labs. A previous clinical trial using this device revealed some structural weakness in the enclosure causing electronics failure and leading to long delays in the study. This STAR project involved working with clinicians and engineers to improve repairability and structural rigidity of the enclosure and incorporate design elements to make the device more ergonomic and marketable. Using an iterative design process facilitated by CAD and 3D printing, a new enclosure was developed that holds all the electronics components and can be unplugged from the physical load-bearing elements for easy repair, while also providing physical support for the outer enclosure.

Isha Singh

College of Arts and Sciences
Biological Sciences

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

Co-Mentor: Cody McUmber

HBx and Mitochondrial Co-localization in HepG2 Cell Line

Globally, close to 300 million people are chronically infected with Hepatitis B virus (HBV)which is one of the leading causes of Hepatocellular Carcinoma (HCC), a type of primary liver cancer. The HBV genome codes for 7 proteins, one of which is HBx. During infection, HBx is shown to interact with different cellular pathways and components, including mitochondria. Mitochondria are the main energy source for any cell, and impaired mitochondrial function can quickly lead to cell death. Our project focuses on HBx's localization to, and potential impact on, mitochondria. To start, I first transfected HepG2 cells, an HCC cell line, with a plasmid coding for Green Fluorescent Protein (GFP) to find which ratio of plasmid to transfection reagent yields the best transfection efficiency. Next, I will transfect cells with an HBx-GFP fusion and treat them with Mitotracker Red CMXRos, a dye that stains mitochondria red. When imaging, we expect co-localization of green and red fluorescence indicating HBx localization to the mitochondria. Uncovering the potential roles of HBx in mitochondrial function during infection can aid in development of treatments for HBV infection.

Medha Raman

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Biological Sciences

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Biochemistry & Molecular Biology

Co-Mentor: Kendall Torres

Investigating HBXIP Mediated Inhibition of HBV Replication

Hepatocellular carcinoma (HCC) is the most common type of primary liver cancer, which is the third leading cause of cancer-related deaths worldwide. Globally, the primary cause of HCC is a chronic Hepatitis B virus (HBV) infection. Approximately 296 million people are living with a chronic HBV infection. The HBV X protein (HBx) is a regulatory protein encoded by the HBV genome and is crucial for HBV replication. HBx interacting protein (HBXIP) is a cellular protein that binds to HBx and inhibits HBx activities. Recently, HBXIP was identified as one factor in a complex that regulates the mechanistic target of rapamycin complex 1 (mTORC1). mTORC1 is a central regulator of protein synthesis. Previous studies have shown that HBXIP expression inhibits HBV replication and activates mTORC1. Interestingly, activation of mTORC1 inhibits HBV replication. We therefore hypothesize that HBXIP inhibits HBV replication by activating mTORC1. We expect to show that HBXIP activation of mTORC1 is linked to the HBXIP-mediated inhibition of HBV replication. By understanding factors that regulate HBV replication, we may identify novel therapeutic strategies for treating a chronic HBV infection and the associated development of HCC.

William S Stanley

College of Arts and Sciences
Biological Sciences

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

Co-Mentor: Nima Sarfaraz

Investigating the Interplay Between LncRNA SNHG15 and HBV Infection

The WHO estimates that 296 million people globally live with a chronic Hepatitis B Virus (HBV) infection and that there are 884,000 HBV-related deaths annually. HBV can dysregulate host cell gene expression, a contributing factor to hepatocellular carcinoma (HCC), a form of liver cancer. Through bioinformatics analyses, we found that HBV-positive HCC patients had higher expression of the long non-coding RNA Small Nucleolar RNA Host Gene 15 (SNHG15) relative to HBV-negative HCC patients. Additionally, HBV-positive HCC patients with high SNHG15 expression had significantly worse prognoses than those with low SNHG15 expression. Studies have shown that SNHG15 can promote HCC, thus, it is important to determine whether HBV infection can directly regulate SNHG15 expression. Using real time quantitative polymerase chain reaction analysis, we demonstrated that HBV can upregulate SNHG15 expression in HepG2 cells. Studies have indicated that SNHG15 may regulate HBV replication via sponging of microRNA 141, an effect we aim to investigate via knockdown of SNHG15 and HBV replication assays. The characterization of the relationship between SNHG15 levels, HBV, and HCC could lead to novel therapies for treating chronic HBV infection.

Nina Haracz

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

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

Co-Mentor: Emily Esquea

Role of ACSS2 in Regulating Cell Death in Breast Cancer Brain Metastatic (BCBM) Cells

Breast cancer kills approximately 40,000 U.S. women yearly, with the primary cause of death being cancer spread to major organs, in particular metastasis to the brain. While most tumors are heavily dependent on glucose utilization, tumors in the brain differ from primary tumors as they are highly dependent on acetate conversion to acetyl-CoA by the enzyme acetyl CoA synthetase 2 (ACSS2). This pathway is used by cells to drive metabolism including lipid metabolism, which facilitates tumor growth in breast cancer brain metastases. Our lab has previously shown that targeting ACSS2 genetically or pharmacologically blocks growth of BCBM cells. Here, we show that targeting ACSS2 in BCBM cells induces apoptosis as measured by annexin-PI assay. Preliminary data indicates that a knockdown of ACSS2 in BCBM cells increased levels of the pro-apoptotic protein Bim. Our results suggests that ACSS2 could be regulating a critical pathway in BCBM cell survival and thus provide a novel therapeutic target to kill BCBM cells.

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Co-Mentor: Aakansha Nangarlia

GRFT-HIS inactivation of SARS-CoV-2 via engagement with the glycan residues of the spike protein

A class of envelope inactivators, namely lectins and in particular cyanovirin (CV-N), has previously been reported to cause inhibition of SARS-CoV-2 infection by engaging with conserved glycan residues present on the virion's surface spike and irreversibly inactivating the virions. However, the breadth and potency of lectin inactivation of SARS-CoV-2 viruses and an ideal lectin delivery system are yet to be evaluated. This research investigated the inhibition of SARS-CoV-2 infection by lectins GRFT and GRFT-HIS as compared to CV-N. Of the two, GRFT-His exhibited inhibition of infection with an IC_{50} of 0.631uM with some evidence of an irreversibility effect. Furthermore, mutational assays highlighted a set of glycan residues, N61, N165, N343, N616, and N657, as essential for GRFT-HIS-based inhibition. These results suggest that GRFT-HIS inactivates SARS-CoV-2 via a different mode of action than previously reported with CV-N. The mechanism by which the CV-N and GRFT-HIS modes of action differ needs to be further investigated. These results strengthen the feasibility of lectin–based therapeutics for COVID-19 treatment and highlight potential use of polysaccharide nanoparticles to target areas of high SARS-CoV-2 presence.

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Sex-Related Differences in PACAP Expression in the PVT of Rats

Both the paraventricular nucleus of the thalamus (PVT) and the neuropeptide, pituitary adenylate cyclase- activating polypeptide (PACAP), are associated with motivated and affective behaviors, including alcohol drinking and binge eating, and sex-related differences in neuronal activity have been identified in the PVT. While PACAP has been found to be densely expressed in the PVT of male rodents, with the isoform PACAP-27 more prevalent than PACAP-38, this remains to be characterized in females. The purpose of this research was to examine PACAP in the PVT of female rats and to determine if there are sex-related differences in this expression. Thus, we performed fluorescent immunohistochemistry for PACAP-27 and PACAP-38 on tissue containing the PVT from adult, male and female Sprague-Dawley rats (n = 5/sex). Using confocal microscopy and ImageJ, we determined that female rats had a higher percentage of cells that co-labeled with PACAP-27 and PACAP-38 in the PVT, across the anterior, middle, and posterior subregions. These findings highlight sex-related differences in PACAP in the PVT, and they suggest that PACAP may underlie some established sex-related differences in motivated and affective behavior.

Maggie Williams

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Transplanted Human Stem Cell–Derived Interneurons Functionally Integrate to Promote Recovery after Spinal Cord Injury

The effects of spinal cord injury (SCI) are devastating, as the normal adult central nervous system does not spontaneously regenerate. There is evidence for plasticity and partial recovery, but the extent remains limited. Thus, the goal of our research is to repair the underlying damaged anatomy with cell transplants. One type of neuron important for plasticity and respiratory function after SCI is the V2a spinal interneuron (SpIN), known for its excitatory characteristics and ipsilateral projections. We hypothesized that we could harness the potential of these cells and transplant SpINs to promote repair of damaged respiratory networks. We used a cervical (C3-4) contusion SCI model to test the therapeutic potential of transplantable V2a SpINs, differentiated from human induced pluripotent stem cells. Neuroanatomical (transneuronal tracing) and electrophysiological (diaphragm electromyography with optogenetics) outcome measures tested the functional integration of human V2a SpINs in the injured rat spinal cord. These experiments confirmed anatomical and functional integration with ongoing quantification. This is the first demonstration of transplanted human V2a SpINs synaptically integrating with the injured rodent spinal cord.

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Microglia Activation in Developing Brains After Traumatic Injury

Traumatic brain injury (TBI) is one of the highest contributors of death and disability in children below the age of 4. The underlying cause is speculated to be neurodegeneration and white matter damage. Survivors of TBI develop deficits in memory, learning, and psychosocial behaviors as they age into adolescence. The Raghupathi Lab has developed a model of pediatric TBI using neonatal rats which has demonstrated clinical and translational relevance. In the present study, 11-day-old male and female rat pups received head injuries. Brains were extracted for histologic analyses at 3, 7, and 14 days after injury. Brain sections were stained for reactive microglia (evidence of inflammation) and with silver (evidence of neurodegeneration). Staining has been completed and quantitative analyses are ongoing. Results presented will demonstrate evidence of reactive microglia in multiple areas of the injured brain which will likely lead to further studies focused on treatment of the injured pediatric brain.

Katherine Quintero

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The role of long noncoding RNA XIST in inflammation

Disparities in severity of inflammatory diseases with regards to biological sex raise questions about the differences in inflammatory signaling pathways between males and females. While women tend to have better prognoses than men for acute inflammatory diseases, they tend to be disproportionately afflicted with chronic inflammatory diseases. A potential variance may lie in the sex chromosomes. Females possess two X-chromosomes while males have one X- and one Y-chromosome, creating a genetic imbalance. Dosage compensation occurs when one of the X-chromosomes in the female cell is inactivated by XIST, a lncRNA. Our previous studies showed upregulation of cytoplasmic XIST in female cells under lipopolysaccharide induced acute inflammation. Our goal is to elucidate the role of XIST in inflammatory pathways by utilizing male and female macrophage cells. We hypothesize that XIST has other functions outside of the nucleus, and in concert with protein partners, regulate inflammatory pathways after translocating to the cytoplasm. Future studies will explore the function of cytoplasmic XIST aimed at identifying its role in mediating inflammation. These studies can lead to sex specific treatment strategies for chronic inflammatory diseases.

Kirsten Benes

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Cloning of the Ccl5 Mouse Gene in an Inducible Lentiviral Expression Plasmid

The CCL5/CCR5 immunological axis has been proposed to recruit MDSCs, cells with immunosuppressive tendencies, to tumor sites. Unfortunately, this often results in aggressive tumor relapse within previously treated melanoma (skin cancer) patients. We hypothesize that Ccl5 over-expression in immunocompetent models of melanoma will drive drug resistance of standard-of-care cancer treatments. This study used Stbl3 strain E. Coli to produce, harvest, and extract plasmids expressing Ccl5. Gateway cloning was utilized to transfer the gene into destination vector, pDG2i-eGFP. The successful execution of gateway cloning was verified using restriction enzyme digests, gel electrophoresis, and Sanger sequencing. Overall, we produced a novel lentiviral vector for Ccl5 over-expression which we will test in mouse models in vivo and in vitro. Future studies will utilize Ccl5 knock-out in mouse cell lines to verify the complementary hypothesis that Ccl5 downregulation will increase immune response against melanoma. CRISPR technology will be used for the knockouts. In this direction, we have started preparing and characterizing the pLenti CRISPR v2 vector containing the mouse Ccl5 guide RNA (gRNA) and the corresponding non-targeting control vector.

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Gateway Cloning of the Firefly Luciferase Gene into Lentiviral Expression Vectors for the Production of Bioluminescent Melanoma Cells

Drug-resistant cancer cells may remain dormant even after apparent treatment success in patients. The small number of cancer cells that linger after treatment constitute the tumor "residual disease". Our lab uses mouse models to develop novel treatment approaches to eliminate residual disease, one of the main causes of tumor relapse. Our project aims to produce bioluminescent melanoma cells to be used in vivo and enable residual disease tracking. Bioluminescent imaging has been shown to be more sensitive than fluorescent imaging, allowing even small amounts of tumor cells (<1000) to be detected. We used the gateway cloning system to transfer the Firefly Luc2 gene (ffLuc2) from a donor vector to two lentiviral destination vectors (pLENTI-CMV-puro/blast). Gateway cloning involves DNA recombination facilitated by the enzyme Clonase II that occurs between the attL and attR sites of the donor and destination plasmids, respectively. This project successfully created expression clones (pLENTI-CMV-puro/blast-ffLuc2) that contained the open reading frame of interest and were verified through digestions and Sanger sequencing. The expression clones will be used for lentiviral production and the eventual transduction of mouse melanoma cells.

Velay Fellow

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You Can Turn the Camera Off Now: Performance and Exploitation in Family Vlogging

92% of children worldwide have an internet presence by the time they are two years old. But, what happens when this internet presence is exploited? Family vlogging, while being a platform for parents to navigate the highs and lows of having children, suggests concerns of ethicality, privacy, and security. By using a Foucaultian framework of surveillance, this research analyzes the ways in which family vloggers will utilize their children in conjunction with specific verbiage to create an environment of performance. To do this, quantitative data analysis software was used to examine three family vloggers: the 8 Passengers Family, the Labrant Family, and Wren Eleanor. It was found that children being present in these videos correlates to increased views and subscriber rates, as well as the vernacular of two vloggers sharing 66% similarity. Overall, this research concluded that family vloggers display performative actions that rely on the presence of their children on social media in order to maximize views, supporters, and, in turn, profit. This information could be used to encourage the creation of policies that ensure the privacy and safety of the children present in these incredibly influential and successful vlogs.

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The Impact of Virtual Reality vs. Reality on Brain Function

Virtual reality (VR) and modern mobile neuroimaging allows researchers to capture brain activity in increasingly realistic environments. However, comparing how the brain interprets VR versus the real world (RW) has not been significantly explored. In this study we contrast the impact of VR vs. the RW on brain function in three perspectives: the effects of an environment on resting state and mindful cognition, the impact of environmental context on learning and recall, and during complex cognition in the form of route-planning and spatial navigation. Participants will be placed in VR and RW environments while cortical function is monitored using functional near-infrared spectroscopy and peripheral physiology from biometric watches. During this project, we designed maps for participants to navigate, developed components for learning, recall, and navigation tasks, and ran test trials to optimize the experimental procedure. In addition, we developed functions to analyze the biometric watch data including heart rate and accelerometry for each trial. This study may provide insight on how individuals experience nature in RW and VR settings, and how interaction with RW and VR differ during spatial navigation and knowledge acquisition.

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Making a Matching the Pair Game Using Python Pygame and UDP Connection for a long-term Human-Robot Interaction Study

My project was to design a task where participants play the game "Matching the Pair" with the robot as a team in a computerized environment. "Matching the Pair" is a game created, using Python Pygame, where players work collaboratively with the humanoid robot Pepper to find all the matching pairs in a set of digital cards. Once the Subject ID, order number, and the Session ID is placed, Pepper and the participant will see a menu with a start button. When clicked, the game will display either easy mode or hard mode. The participant will see ten or twenty blank blocks arranged in chessboard notation. The task encompasses four rounds of easy and hard modes in different orders depending on the experimenter's order number. Pepper and the participant will have 90 seconds each round to make as many matches as they can together. The total number of "matches" they make in all four rounds is recorded in a log file. The game sends markers to a computer recording fNIR data using a UDP connection. This task will be utilized in a research study protocol that aims to investigate brain function during human-robot collaboration.

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Neuroegonomic assessment protocol implementation for wayfinding and path planning in virtual environments

The human ability for navigation is a basic aspect of everyday life, requiring both coordination of higher-order cognition and physical motion. Until recently it has been very difficult to study brain activity of individuals during active navigation due to lack of practical and portable imaging equipment. Due to these limitations, spatial cognition and brain functions are not well understood in real world environments. In addition, the recent rise of virtual reality has introduced a new blending of physical and perceptual spaces, requiring the brain to adapt navigation in unknown ways. Investigating human navigation and associated brain activity can allow for a better understanding of how individuals are affected by virtual environments and a greater understanding of fundamental brain processes. The purpose of this study is to investigate the brain activity of participants naturalistically navigating in real and simulated environments under varying task complexities. In order to determine the validity of the navigational tasks and optimal parameters, a virtual environment was built for testing. Additionally, the experimental procedure was piloted on-site while physiological and neuroimaging data were collected.

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Quantification of Neck Bending Stiffness in Neonatal Piglets

There is limited data on immature cervical spine rotational stiffness, that can help better understand the mechanisms that lead to birthing related neck injuries. This study aims to quantify the cervical spine stiffness in lateral bending (LB) and flexion extension (FE) in a three-week-old piglet. Cervical LB and FE tests were performed on a three-week-old cadaveric piglet. A force sensor was held under the piglet's head while it was moved through the range of motions in LB and FE, respectively. Head and neck angular displacements were measured by video tracking the movements of key anatomical landmark points on the piglet's head, neck, and shoulder. For LB and FE, applied moment (Nm) and head and neck angular displacements (deg) were plotted, and rotational stiffness values were calculated using custom MATLAB code. The left LB stiffness values during loading and unloading were 0.011 Nm/deg and 0.072 Nm/deg, respectively. The stiffness values in neck flexion and extension during loading and unloading were 0.059 Nm/deg and 0.011 Nm/deg, and 0.010 Nm/deg and 0.076 Nm/deg, respectively. These data can be further applied to improve the biofidelity of computational models used to study cervical spinal injuries.

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Development of Finite Element Model for Congenital Early Onset Scoliosis

Early onset scoliosis (EOS) is a progressive spine and ribcage deformity that affects children in the age range of 1 to 9 years old. Current management strategies for EOS rely on clinician preferences, hence there is a lack of consensus among surgeons on age at intervention, instrumentation type and location. There is a need for computational Finite Element (FE) models to predict the outcomes of intervention and gain a better understanding of outcomes of surgery to aid clinicians in selection of type of intervention. The aim of this study is to create a patient-specific 3-dimensional (3D) FE model of an EOS spine consisting of the twelve thoracic and five lumbar vertebrae along with intervertebral discs (IVDs) and spinal ligaments. After IRB approval from CHOP, CT scans from a 4 year-old congenital EOS patient was obtained and reconstructed using 3D Slicer, to extract the thoracic and lumbar vertebrae. These geometries were then meshed with tetrahedral elements using HyperMesh. IVDs and spinal ligaments were then modeled between each adjacent vertebral level. Such a patient-specific FE model can aid in the simulation of novel growth modulation-based and distraction-based instrumentation for scoliosis correction.

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Understanding the Role of Excitatory Projection Neurons Deactivation on Locomotor Behavior

Using smell to navigate is critical for animals' survival. Drosophila melanogaster, or fruit fly, is a great model organism to study odor-modulated locomotion due to the large number of genetic tools available, rapid life cycle, and relatively simple nervous system. Activation of olfactory receptor neurons (ORNs) has been previously shown to modulate fly's locomotion. However, it is unknown how this modulation is implemented by fly's neurons. Here, we study the role of neurons directly downstream of ORNs called projection neurons (PNs) in these sensorimotor transformations. GH146 is a well-studied PN line that labels the majority of excitatory PNs (ePNs). By optogenetically activating ORNs and while simultaneously inactivating ePNs labeled by GH146, we examined the changes in locomotion inside a behavior arena. From these experiments, we confirm that locomotion depends on both the instantaneous firing frequency (f) and its change (df). Furthermore, the mapping between f-df and locomotor parameters is comparable between flies with ePN inactivation and those without, which may result from insufficient optogenetic inactivation of ePNs. In the future, we will optimize the intensity and wavelength of light to inactivate ePNs.

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Effect of Reclined Seat Back Angle and Booster Seat on Small Female Vehicle Occupants During Sled Simulated Evasive Swerving

Introduction. Reclined small occupants are more prone to submarining (i.e. sliding under the lap belt) and preventative counter measures are unknown. The goal of this research is to examine how reclined seatback angles and a BPB could decrease small female vehicle occupant's motion during a pre-crash maneuver.

Methods. The 5th percentile female crash dummy was placed on a low-speed sled mimicking an evasive swerving (2g). Three seatback angles (25°, 45°, 60°) with and without BPB were tested. Head and trunk kinematics were collected with a 3D motion capture system (OptiTrack).

Results. Lateral peak head and trunk excursion decreased as the seatback angle increased. Without BPB, lateral excursion was greater and more variable than with the BPB. Forward excursion was minimal but increased in reclined conditions and without the BPB.

Conclusion. Reclined seating configurations place small occupants in a more advantageous lateral position within the shoulder-belt during evasive swerving. Although no submarining was observed, forward motion increased with reclined seatbacks. The BPB was beneficial in decreasing the dummy motion and its variability.

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Monitoring Effects of Hypercapnia with Functional Near-Infrared Spectroscopy (fNIRS)

Cerebral Vascular Reactivity (CVR) measures are an index of microvasculature's ability to dilate. Traumatic brain injury patients have shown to have cerebrovascular impairments. Despite the sensitivity of CVR, its use in routine clinical settings is still lacking as the current care uses functional magnetic resonance imaging to quantify CVR. Hence, research over the last decade has identified fNIRS as a viable tool for CVR assessment. However, there is variability in fNIRS-derived CVR measures. Thus, this research aims to improve the reliability of fNIRS derived CVR measures. This project focuses on the stimulus (hypercapnia) administration aspect (fixed-inspired CO2 method), which is one of the factors that may cause variability. The project investigates differences in respiration rate and EtCO2 between sessions and hypercapnia and normocapnia states. The participants underwent 2 sessions of a 17.5-minute protocol (5 minutes resting state followed by 5-looped 1-minute hypercapnic and 1.5-minute normocapnic states). Our results showed variability in EtCO2 and respiration rate within and between sessions and states, suggesting that this variability should be accounted to improve reliability of fNIRS-derived CVR measures.

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Microbial Decontamination via Plasma misting

Thoroughly cleansing of produce is necessary for decontamination methods. Washing away surface-associated microbial, pesticides, and other contaminants before consumption, to keep the health of a community. Research into different ways of cleaning produce has been conducted and resulted in multiple different findings. The research currently being conducted for decontaminating blueberries focuses on novel technology of plasma-activated misting of the produce surface. Plasma is adopted to activate misting of water (concurrently generated via nebulization in a closed system). The blueberries were either contaminated with a known log of Escherichia coli or left non-contaminated. Blueberries are then exposed to plasma-activated mists directly. Microbial inactivation was assess using standard colony assay. The purpose of the research is to evaluate the effectiveness of plasma-activated mist in the decontamination of produce without introducing an acid or a base to the products and in turn consumers. The findings suggest that plasma-activated misting substantially inactivates contaminants (E. coli). Further research is required to optimize further the conditions that will prolong the shelf-life of the produce.

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Hinge Knee Retrieval Analysis

Hinge knee prostheses are a specific type of knee implant which is typically reserved for cases of extreme bone loss and total revision arthroplasties (TKAs). The use of hinge knees is restricted due to them having a higher complication and revision rates than alternative joint salvage systems. As implant manufacturers take steps to improve the reliability of their products, it is crucial to examine hinge knee explants (implants that have been removed from the patient) to understand how these devices fail.

Over 140 explants were obtained from the Implant Research Center's collection, which were narrowed down to 13 hinge knee systems (all manufactured by Stryker) for the study. The damage on each explant was rated using a semi-quantitative grading scale which looked at the damage mechanisms on various sections of polyethylene and metallic components. Patient data for each explant was also retrieved and included information about patient age, height, weight, implantation time, revision reason, etc. By studying the damage modes to the explants and identifying trends in the patient data, this retrieval analysis seeks to provide the information necessary to improve hinge knee outcomes.

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Additive Manufacturing of a Patient-Specific Spine Segment

Additive manufacturing (AM) aka 3D printing is vital and applicable to several fields of healthcare, such as orthopedics. In the orthopedic field, the ability to create patient-specific bone models using 3D printing has positively impacted surgical training, preoperative planning, patient communication, and clinical outcomes. The goal of this study is to utilize AM to create a patient-specific 3D anatomical spine model. Finding the best method to create patient-specific models accurately is essential since they are used to represent the anatomy of a patient. Image segmentation was performed with 3D slicer software, which allows computerized tomography (CT) scans of a patient to be uploaded and viewed in 3D. Using the software, certain segments of the vertebrae can be segmented, meshed and exported for printing. In this research, 3 vertebrae from the lumbar section of the spine as well as 2 spinal discs and the spinal cord were printed based on the CT scans from a 63-year-old male patient. To best reflect a realistic look and feel, the vertebrae were printed with a composite material called SimuBone and the discs and cord were printed in thermoplastic polyurethane. This method was successful in creating a patient-specific model.

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Effect of Hydrogel Crosslinking Density on Swelling Ratio

Volumetric muscle loss (VML) describes traumatic damage of skeletal muscle that results in defective structure or function, and estimated life-time disability cost per patient is $340,000-440,000 in addition to medical costs and lost wages. Macrophages are crucial in the immune and regenerative response, and delivering exogenous macrophages to VML deficits could encourage repair. Hydrogels are promising biomaterials that can mimic native tissue and be modified for cell delivery. Hydrogel crosslink density affects cell viability where the ideal stiffness for macrophage delivery is unknown.

Swelling ratios (Q) can provide insight into crosslink density. 5, 10 and 20% modifications of type-A gelatin methacrylate (GelMA) were synthesized, reconstituted in photoinitiator (LAP), and crosslinked using UV light. Samples were measured daily and data was analyzed using PRISM. 10% modified GelMA was found to have the lowest swelling ratio whereas the 5% had the highest. LAP concentration had little effect on crosslinking density, and salinity also affected Q. This work provides insight into how crosslinking density and swelling ratio could affect macrophage viability and delivery.

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Dual Stage Ventricular Assist Device for Infants

Each year, thousands of children suffer from debilitating heart failure due to acquired or congenital heart disease, which impairs the ability of the heart to effectively pump blood. Heart transplantation, when available, becomes the only lifesaving option. Fortunately, children can benefit from mechanical circulatory support in the form of a blood pump. However, blood pumps for children lag well behind those for adults and, while many intended-for-adult devices have been utilized in children, operation of these pumps is at off-design pressures and flows, increasing the risk of harmful hemolysis (blood cell rupture) and dangerous thrombosis (clotting). Thus, there is an unmet need for a blood pump specifically for pediatric patients. The need is compelling because existing devices cannot support the anatomic heterogeneity of childhood heart disease and cannot adapt to the increased cardiovascular demand of growth. To address these limitations, we are advancing the design of a compact versatile dual-blood pump, and this study evaluated a sealing strategy for this new device. This innovative design will overcome current shortcomings of existing devices and fill a significant treatment gap for pediatric patients with heart failure.

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3D Surface Scans for Noninvasive Ventilation Interface Development

Respiratory failure is the leading cause of childhood death, and hospitals employ both invasive and noninvasive ventilation (NIV) strategies. NIV interfaces, such as oxygen masks, can deliver critical respiratory support without the challenges associated with invasive ventilation. The efficacy of this treatment is complicated, however, by the lack of well-fitting NIV interfaces available for children, especially for those having facial abnormalities. The purpose of this study is to build a registry of 3D surface scans of the heads and faces of children with and without facial abnormalities in order to determine facial features for the sizing and development of better fitting NIV interfaces. Following Institutional Review Board (IRB) approval, 3D image surface scans of children at the Children's Hospital of Philadelphia were collected and analyzed using 3-Matic. 28 facial dimensional measurements were extracted from each patient's scan, and descriptive statistics were obtained from the measurements to determine the sizing of NIV interfaces for different age ranges, weights, dimensions, and more. These descriptive measurements will be utilized to develop novel personalized NIV interfaces to markedly improve respiratory therapy.

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Utilizing Genetic and Molecular Tools to Identify Ion Channels Within the Giant Fiber Neuron of Drosophila

Neural computations are the basis for all brain functions. Computations within individual neurons are shaped by the ion channels they express. Ion channel location and density establish how a neuron integrates and transmits electrical signals, and disrupted ion channel function is thought to contribute to multiple disease and disorders. We know little about the location and type of ion channels that are present within neurons that provide them with distinct computations, due to limited anatomical and genetic access to individual neurons. Here we examine the location of ion channels in the anatomically and genetically accessible giant fiber neuron of Drosophila. We use the GAL4/UAS system to target neurons and endogenously tagged ion channel lines to localize ion channels within the neuron. We use immunohistochemistry and high-resolution confocal microscopy to image the giant fiber and ion channels of interest. Finally, we utilize an analysis pipeline that incorporates Fiji to quantify colocalization between the giant fiber and each ion channel. By understanding how ion channel expression enables neurons to perform computations, we can gain a better understanding of how we can manipulate ion channels to restore neuron function.

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Using Genetic Tools to Identify and Locate Ion Channels in DNp03

Sensorimotor transformation is the process by which a sensory stimulus is converted to a motor response. It is poorly understood, primarily due to difficulties identifying and accessing neurons involved in these transformations. In the common fruit fly, Drosophila melanogaster, descending neurons (DNs) are a type of neuron that bridges sensory input and motor function. As DNs are both anatomically and genetically accessible, they are ideal for investigating the mechanism underlying sensorimotor transformations, which we examine within one DN called DNp03. In response to a visual stimulus, DNp03 emits a persistent spiking response we believe is due to its biophysical properties. These properties are established, in part, by ion channels, a type of protein that allows ions into and out of a cell. Using the genetic toolkit of Drosophila, we examine which ion channels are present in DNp03 and where they are localized to understand how they shape DNp03's firing behavior, and in turn, how they impact motor output. Learning what sets DNp03 apart from other DNs will aid in understanding the molecular mechanisms that establish diversity in sensorimotor transformations and ultimately how the brain decides to respond to a certain stimulus.

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Co-Mentors: Quezia Lacerda, Brian Oeffinger

Microencapsulation of Rose Bengal in Microbubbles for use with Sonodynamic Therapy

Rose Bengal (RB) demonstrates toxicity to malignant cells and may induce an immune response. The purpose of this study is to attach RB to a microbubble (MB) to facilitate delivery through sonodynamic therapy (SDT) using MBs and low intensity ultrasound to release drug at a target site. A MB shell is made up of surfactants each with a hydrophilic head and hydrophobic tail. Typically, a hydrophobic drug is incorporated into the bubble shell. Since RB is water soluble, when typical encapsulation was attempted, a series of wash steps resulted in no drug loading. The later attempt focused on RBs negative charge. By adding the surfactant cetyltrimethyl ammonium bromide (CTAB) the MB becomes positively charged, and a RB wash allows the RB to be attached. Drug loading was compared between one batch loaded with CTAB and one without, the same wash steps were followed for each batch. In the CTAB batch, 2.1μ g/mL of RB were loaded compared to no evidence of loading on the batch without CTAB. These results were confirmed using both a plate reader and a fluorescent microscope. Results gave a MB diameter of 2.1 μm at a concentration of 1.35×10^{9} MB/mL The results demonstrate excellent potential of this method to produce RB-MB for use in SDT.

FRANCIS VELAY FELLOWS

The 2022 STAR Scholars cohort includes our seventh cohort of Frances Velay Fellows, thanks to the generous support of the Panaphil and Uphill Foundations. This year's cohort of 12 women in STEM are participating in the full STAR experience, including faculty-mentored research, while also having the opportunity to engage with each other in weekly meetings throughout the summer. These sessions have included meetings with women in STEM mentors as well as the presence of a peer mentor, Alyssa Kemp (STAR & Velay 2021). 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

INDEX

by STAR Scholar's last name

SPECIAL THANKS

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

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

We applaud and thank you.

STAR SCHOLARS

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