DREXEL UNIVERSITY
Office of
Undergraduate Research
Pennoni Honors College

2019

STAR SCHOLARS

SUMMER SHOWCASE

THURSDAY, AUGUST 29, 2019

Edmund D. Bossone Research Center

9:00am - 5:00pm

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

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First Floor Lobby

12:30pm - 2:00pm
Luncheon for STAR Scholars & Mentors
Bossone Research Center
Third Floor Atrium

12:45pm - 1:45pm
Quick Pitch Competition Finalists' Presentations
Bossone 302

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Poster Session C
Bossone Research Center
First Floor Lobby

4:00pm-5:00pm
Recognition Ceremony
Bossone Research Center
Mitchell Auditorium

A MESSAGE FROM THE DIRECTOR & DEAN

Welcome to the 2019 STAR Scholars Summer Showcase. Over the past eighteen years of the STAR Scholars Program, we have seen the impact, both immediate and long-term, of undergraduate research on our students and their faculty mentors, our Drexel community, and our wider world. Since 2002, more than 1,800 Drexel students have participated in the STAR & iSTAR Programs.

This summer, 173 STAR Scholars have completed faculty- and professionally mentored projects, working in 11 colleges and schools. Under the direction of their outstanding mentors, our rising sophomores have worked on cutting-age projects that contribute to the knowledge bases of their academic disciplines. Ten students worked with faculty in international settings: at Ben Gurion University, in Israel; SSN College of Engineering, in India; with World Vision, in India; and with faculty doing field work in Vietnam and in Costa Rica. One student worked with an alumnus faculty researcher at the University of Alabama – Birmingham, College of Medicine. Several of our campus-based engineering STARs were able to join Vertically Integrated Projects (VIP) teams in the College of Engineering where they will be able to nurture their research skills on real-life problems over several years.

In 2018, 15 former STAR Scholars earned prestigious graduate fellowships including Gates Cambridge, Goldwater, Fulbright, Truman and NSF-GRFP. Over 50 former STAR Scholars have presented their work this year at national and international discipline-specific and undergraduate research conferences. Because of their participation in early undergraduate research, STAR Scholars are retained at a high level within the University, go on to graduate school in higher numbers than their peers, secure premier co-ops and prestigious fellowships, and graduate to outstanding careers. We are confident that our 2018-19 class of STARs and iSTARs will shine as brightly.

Each summer, as we meet with our STAR Scholars, we see them grow in competence, confidence, & maturity as they begin to reimagine their lives because of this extraordinary experience. It is our hope that, as you see the result of their work, you are inspired, as well.

Dr. Suzanne Rocheleau, Director
Office of Undergraduate Research

Dr. Paula Marantz Cohen, Dean
Pennoni Honors College

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, the Office of Undergraduate Research 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.

Each nominated mentor receives a letter signed by Provost Blake 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.

2018 OUTSTANDING MENTOR OF THE YEAR
PROF. HANDE BENSON & PROF. MIKE GLASER

The 2018 Outstanding STAR Mentor of the Year Award was presented to two faculty: Dr. Hande Benson (LeBow College of Business, Decision Science and MIS) and Professor Michael Glaser (Westphal College of Media Arts and Design, Product Design). Both Dr. Benson and Prof. Glaser received a plaque engraved with their names, as well as a $1,000 grant to support their further work with undergraduate researchers.

DR. HANDE BENSON

PROF. MICHAEL GLASER

It is for Dr. Hande Benson and Prof. Michael Glaser's commitment to educating and mentoring students, both in the STAR program and in the research setting, that we honor them as our 2018 Outstanding Mentors of the Year.

2018 OUTSTANDING MENTOR OF THE YEAR
DR. HANDE BENSON

Hande Benson is a Professor in the Department of Decision Sciences and MIS at Drexel's University's LeBow College of Business. She serves as director of the College's Business and Engineering program and teaches in the undergraduate and graduate programs in Business Analytics and Operations and Supply Chain Management. Dr. Benson received her Ph.D. in Operations Research and Financial Engineering from Princeton University and continued as a postdoctoral fellow for the Princeton Environmental Institute. She joined Drexel after faculty positions at Rutgers University and the United States Naval Academy. Throughout her career, she has consulted for numerous financial firms, the production industry, and local governments, and she is a core faculty member for LeBow's Corporate and Executive Education programs.

"Her mentorship has transcended the 10-week STAR Scholars Program, because she is genuinely interested in our future and takes every opportunity she can to provide us with counsel that is always in our best interest."

- Nathan Runk

"What makes Professor Benson an outstanding mentor is not just the fact that she was an amazing, supportive adviser, but that we both felt like we could talk to her about anything. Her involvement with our research has facilitated our academic and professional development, and she has done an exceptional job in confirming the reason why we chose Business and Engineering as our major."

- Ardita Koka

2018 OUTSTANDING MENTOR OF THE YEAR
PROF. MICHAEL GLASER

Mike Glaser is the Program Director of Product Design at Drexel University's Westphal College of Media Arts & Design. Mike brings over 30 years of combined experience in product development and design education. His passion is to explore and quantify a designer's way of being. He's driven by his love for all things design and has a passion to educate the next generation of thinker-makers. Mike holds an MFA from The Ohio State University and a bachelor's in Industrial Design from University of Cincinnati. Mike has teaching experience at The Ohio State University, Savannah College of Art and Design, and the Georgia Institute of Technology. In addition to Mike's pedagogical pursuits, he has a long career of developing products and design strategies for Hewlett-Packard, Ciba Corning, Data General, Telxon, Texas Instruments, and Whal Clippers, among others. Mike was previously Director of the Design at Ignition in Plano, TX, and has spearheaded the launch of two independent design firms.

"Mike's goal is for students to have the critical thinking skills to go into any vocation and thrive by bringing new insights to the field."

-Chloe Tolderlund

"Rather than helping us tackle the problems we chose, Mike gave us examples, metaphors and wisdoms to break down larger problems into something more manageable."

-Lauren Beich

"By placing project conception and implementation in our hands, Mike has forgone his role of teacher and leader, and has become a mentor in earnest. He does not direct or assign, but rather oversees and advises the work."

-BreAnna Bechtold

QUICK PITCH COMPETITION

The Quick Pitch competition invites students to give concise presentations on their STAR projects that are accessible and entertaining to a general audience. Throu gh this competition, we hope that students will cult ivate effective communication skills and gain a gre ater understanding of different styles by which they can communicate their research or creative work. Students are expected to give a one-slide, 180-second presentation of their project, including the problem they are exploring, the greater significance of that problem, and the methods by which they are exploring that problem. The students presenting are from a range of disciplines, but all presentations are geared towards a general audience. Judges, comprising staff from the Pennoni Honors College, have selected two finalists from each of our four preliminary sessions throughout the summer to compete in our final round of competitions during the STAR Scholars Summer Showcase. Good luck to our eight finalists!

2019 STAR SCHOLARS ABSTRACTS

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

KATHERINE COMISAC

College of Engineering
Architectural Engineering

Faculty Mentor: **PROFESSOR DANIEL CHUNG**
Architecture, Design & Urbanism

Co-Mentor: Kyung Yoon

WATER VAPOR TRANSFER MEASUREMENT USING A TDR SENSOR

In a world where there is an increasing focus on energy efficiency and building health, it is evident that buildings must become smarter. One of the ways in which this can occur is with the measurement of water vapor transfer. The condensation of water vapor in the building envelope has the potential to cause unnecessary energy expenditure and mold growth. This project aimed to find an effective method of measuring the moisture content of different building materials under different temperature and relative humidity settings. To do this, a chamber was set up with the capability to control and monitor temperature and relative humidity, as well as, monitor the weight and volumetric moisture content of the tested materials. This set up proved effective at maintaining the desired testing environment and accurately monitoring the moisture content of insulation. Through experimentation, the chamber allows for determination of the correlations between air moisture levels and moisture content within building materials. In the future, the intent is to translate this smaller scale set up to a larger scale chamber. The hope is to create an imbeddable system to provide real-time monitoring of building envelopes.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

MENIYAH MILLER

Antoinette Westphal College of Media Arts & Design
Architecture

Faculty Mentor: **PROFESSOR RACHEL SCHADE**
Architecture, Design & Urbanism

UNDERSTANDING THE PHILADELPHIA ROWHOUSE

The rowhouse has quite literally kept communities close together and shaped Philadelphia's identity and history. However, the Department of Licenses and Inspections listed over 25,000 abandoned properties on the Vacant Property List in 2011 and this daunting number surpassed 32,000 at the end of 2015, according to the NYTimes. This leaves communities fragmented, causes the uprooting of families, and a decrease in community value. Out of the many reasons for abandoned homes, homeowners are often unable to stay ahead of the cost of repairing or renovating. One way to minimize these issues would be to provide homeowners with useful information so they can better maintain and preserve their rowhouses.

The work this summer has been predominantly preparing technical plans, elevations, and sections of the Philadelphia Workingman's Model House built for the Columbian Exposition in Chicago in 1893. These digital drawings will then be used to produce a 3D model of the house. In the future, this work may be used to create an interactive video which provides information on the history and building materials. Improved living experiences and healthier environments will keep families in their homes longer and promote more cohesive communities.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

FARAH ABDEL-JAWAD

College of Engineering
Architectural Engineering

Faculty Mentor: **DR. D.S. NICHOLAS**
Architecture, Design, & Urbanism

EXPLORING HOME
A DEEP CONSIDERATION OF THE SPACE THAT MAKES US HUMAN

My investigative research explores the experience and notation of "*Home*" to facilitate healthy living and a stronger connection between people and spaces. Research shows that people are constantly looking for ways to belong and feel safe as this is part of what makes us human. Personalizing and adapting urban spaces to become *safe life zones* is a way places can reflect who we are and what we need. This personalization contributes to our sense of *Home*. Through exploratory research including reflective techniques, site observations, concept mapping, and informal interviews; I further explored how important it is to for spaces to speak to the needs and health concerns of their inhabitants, especially that our lives are getting increasingly more stressful. In this process, I built a personal understanding of common traits that people associate with *Home* and experience to reduce stress. This is important as we are digging deeper into comprehending the relationship between architectural engineering and the wellbeing of people to promote healthier and more personalized urban living. Useful for underserved populations, outcomes could include the design and engineering of a dynamic modular system that makes *someone's space, their place*.

VELAY FELLOW

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

DOLMA YANGCHEN SHERPA

Antoinette Westphal College of Media Arts & Design
Interactive Digital Media

Faculty Mentor: **DR. D.S. NICHOLAS**
Architecture, Design & Urbanism

UNDERSTANDING THE "NOW" FOR THE FUTURE : DESIGNING NOVEL TOOLS FOR FINANCIAL LITERACY THROUGH HABIT BUILDING

Many low-income urban families are experiencing constant financial housing stress leading to consequences such as evictions, the severing of housing utility services, and a cycle of debt. This investigative research centers on the economic behavior and financial decision of the low-income families leading to these consequences.

Based on the interviews conducted and articles read, there is currently a lack of effort in helping to develop financial habits that focuses on the "now" to build a better financial future. Secondary research has shown that poor financial literacy and a lack of long-term planning due to the heavily-researched scarcity mindset has led to desperate yet adverse financial decisions such as resorting to predatory payday loans or mismanagement of finances.

Human-Centered Design research methods such as persona profile, stakeholder maps, and journey maps have been vital to understanding the thought process or behavior behind these decisions made. The information gained will aid in how we can design a service that focuses on developing good financial habits at home. The current research question is "What tools can we build to help families make good financial habits at home"

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

ANJELICA ANNEMARRY ZANDRA SOESANTO

Antoinette Westphal College of Media Arts & Design
Architecture

Faculty Mentor: **DR. D.S. NICHOLAS**
Architecture, Design & Urbanism

BRINGING THE INSIDE OUT: CREATIVE SPACE AND WELL-BEING FOR URBAN FAMILIES

The personalized porches along Mantua, Philadelphia has become a vital part of the neighborhood as it strengthens the community and blur the border between the private and public spaces. Neighborhood life is essential to the social life of Mantua and other urban societies. However, 63% of these homes host family households with 18,743 below the poverty line. More so, 75% of them are living with children in homes without complete kitchen facilities which soon leads to fuel poverty; combination of poverty and poor-quality housing resulting in a decrease in the family's well being.

This project was driven by generative and investigative research using a collection of secondary sources, qualitative surveys, and unstructured interviews. I synthesized the findings by engaging with methods like affinity and concept mapping. From there, a possible solution that emerged is a portable kitchen that holds various basic kitchen needs and create a kitchen wherever it is needed. Therefore, by having more people actively communicating and participating in the neighborhood, this will encourage conversations through porches developing a viable strategy to enhance security while cooking, augmenting creativity, and belongingness between everyone.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

MATTHEW WILLIAM BAUMAN

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

Faculty Mentor: **PROFESSOR NICHOLAS JUSHCHYSHYN**
Digital Media

DIGITAL STORYTELLING

Technology and culture exist in a state of co-evolution, when one field makes an advancement the other develops to adapt with it. As AR and VR technology advances people have been exploring its uses in the fields of communication, education, entertainment, medicine and more. Working under my mentor and fellow STAR scholar we are expanding people's interaction in to the digital world and examining the impact immersive technologies, such as AR/VR, have in digital storytelling through the Children's Hospital of Philadelphia (CHOP), and constructing an immersive performance with the dance troupe JUNK. For CHOP by using softwares such as Vuforia, Maya, Unity, and Motionbuilder, we constructed an AR app that showcases patient's animated characters on a project known as Storymedicine. Focusing on Motionbuilder and Maya I worked with the motion capture data and did corrective animation on the character models to send to Unity for the app. For JUNK, using similar softwares as CHOP as well as programs such as, Nuke, Premiere, Photoshop, Agisoft, we are building a VR immersive video experience showcasing JUNK. My focus on Junk has been 3D modeling in the program Maya and working with motion-capture data in the program Blade.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

ELLIOT DICKMAN

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

Faculty Mentor: **PROFESSOR NICHOLAS JUSHCHYSHYN**
Digital Media

IMMERSIVE MEDIA AND DIGITAL STORYTELLING

The rapid expansion and increased affordability of consumer level virtual reality devices means that there's a significant demand for immersive media content, and this demand is what we worked on addressing this Summer.

Along with the desire for mixed reality content comes Drexel's mission for community involvement. Over the summer we worked primarily on two projects that strive to bring together different aspects of the Philadelphia community though technology in the form of virtual reality and augmented reality applications and digital storytelling.

The first project is Optimism, a joint venture between Drexel and CHOP in which we created an augmented reality application that allows CHOP patients to see their own ideas and characters come to life. This app is the culmination of a months-long project and dozens of students' work involving everything from concept art to animation to application development.

The second project is a collaboration with Philadelphia performance group JUNK. In this project we are working on the development of a VR experience which combines performance, film, and virtual reality, using 360° videography and compositing, motion capture, and CGI to create a unique immersive experience.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

ISABELLA HARO-UCHIMURA

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

Faculty Mentor: **DR. FRANK LEE**
Digital Media

Co-Mentor: Corey Arnold

CREATING VISUALLY ENGAGING NARRATIVES WITH TWITTER API

Games are more than just mindless button pressing and score counting, they can be deep interactive narrative experiences. My research revolved around an academic analysis of narratives of gaming past, specifically with reference to branching choices and dialogue format as seen in Mass Effect 3. This research directly informed our decisions when thinking about how to create a system that allows players to interact with a narrative through the use of Twitter. My project seeks to both attract the player through design and keep them enthralled through the interactive gameplay of controlling a narrative through social media.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

ANNA CATHRYN PANCZNER

College of Engineering
Computer Engineering

Faculty Mentor: **DR. FRANK LEE**
Digital Media

Co-Mentor: Corey Arnold

EXPLORING GAME NARRATIVE POTENTIAL THROUGH THE TWITTER STREAMING API

Twitter provides a means of searching and obtaining real-time tweets through its streaming API. Using a lexicon-based sentiment analysis library, VADER for Python, we can mark these tweets as positive or negative in overall tone. In addition, we can calculate the degree to which a tweet is positive or negative. Having a live stream of user input from all over the world coupled with an analysis of this input is a powerful medium for user engagement in game play. In our project, "Tweet Your Own Adventure" (TYOA), we allow users to decide the course of interactive stories by tweeting with the hashtag #TYOA. These stories are relayed by publicly projecting the project, which is animated using the Processing language, onto the side of a building. TYOA is the culmination of research into natural language processing, narrative structure, and Twitter's APIs. Having users engage in a large, public, projected game via social media pushes the boundaries of what a game can be. This kind of interaction strengthens the players' sense of agency because they can see their unique effect on the story line.

VELAY FELLOW

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

KATE S. WAGNER

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

Faculty Mentor: **DR. FRANK LEE**
Digital Media

Co-Mentor: Corey Arnold

USING ILLUSION OF CHOICE AND CIPHER CHARACTERS IN LINEAR GAMES CREATES IMMERSION

Recently, the media has praised video games that supply the player with branching narratives that are controlled by player choice. Contrarily, my research focuses on how linear games can be more immersive than branching games by employing methods such as 1) the illusion of choice and 2) the use of a cipher character. The illusion of choice creates moments in the story that make the player believe their choices influence the narrative plot by using dialogue options. Using a cipher protagonist is another strategy. A cipher is a blank slate, often mute, that the player can project their own personality onto. This projection allows the players to immerse themselves in the inter-character relationships because they feel personally involved. Both of these strategies are used in Pokémon Mystery Dungeon: Explorers of Sky. Using my research, I wrote a paper analyzing the successful and unsuccessful elements of this title's gameplay and narrative. I came to the conclusion that if the above methods are employed, narrative choices are not necessary to create an immersive game.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

SAMANTHA SEITZ

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

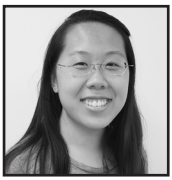
Faculty Mentor: **DR. GLEN MUSCHIO**
Digital Media

EXPERIENCING HISTORY THROUGH PEALE'S PIPE ORGAN

My research team's goal is to create a 3D interactive digital model of C. W. Peale's Philadelphia Museum, housed in Independence Hall from 1801 - 1827. Peale's Museum showcased art, artifacts of natural history, science and technology. Our interactive model will afford visitors to Independence Hall, a UNESCO "World Heritage Site", the opportunity to experience history and learn about cultural heritage. My role was to produce a functional 3D digital model of the pipe organ located in the museum's Long Room Gallery. To determine the appearance and sound of the organ, I utilized primary documents in the archives of the American Philosophical Society and Pennsylvania Historical Society. I read published sources, conducted correspondence with the Organ Historical Society and Associated Pipe Builders of America, toured the Wanamaker organ, visited Independence Hall and interviewed Independence National Historical Park's Chief Curator and other Peale experts. All information collected and analyzed informs the production of my pipe organ model. The 3D digital model of the organ will eventually be made interactive and playable for visitors to Independence Hall.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

EMILY MAH



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

Faculty Mentor: **DR. GLEN MUSCHIO**
Digital Media

DIGITAL RECONSTRUCTION OF THE PEALE MUSEUM

In the early 19th century, American artist Charles Willson Peale established a museum of art, science, and technology. It was one of the first museums in the world to present information using the Linnaeus classification system. While Peale's Philadelphia Museum exhibited a variety of specimens, paintings, and patents, his impressive collection of birds commanded much attention. Lining the walls of the Long Room at Independence Hall were 140 dioramas with over 700 birds Peale had acquired from all over the world. Unfortunately, none are known to have survived. My research contributes to the digital reconstruction of Peale's Museum and focuses on recreating the bird dioramas and backgrounds, hand-painted by Peale and family members. I conducted research at the American Philosophical Society, the Pennsylvania Historical Society, referenced illustrations from Alexander Wilson's American Ornithology and Peale's watercolor studies, to propose a collection of possible diorama background paintings. Using my backgrounds and 3D bird models made by previous STAR Scholars, I've produced several bird dioramas to be used in the interactive digital museum experience.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

LINDSAY ALSHOUSE

Antoinette Westphal College of
Media Arts & Design
Fashion Design

Faculty Mentor: **PROFESSOR GENEVIEVE DION**
Fashion Design

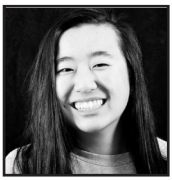
Co-Mentors: Keith Taylor, Sol Schade

STREAMLINING THE DESIGN PROCESS TO SCALE AND ALTER THE KNIT CAPACITIVE TOUCH SENSOR

At Drexel's Center for Functional Fabrics (CFF), interdisciplinary smart textiles researchers are engineering innovative products. One such product from the center is a Textile Capacitive Touch Sensor (CTS), which incorporates carbon yarn into a knit structure to create a conductive touch pad. When connected to a micro-controller it senses touch and becomes an input device. My STAR team worked to design a large-scale CTS game controller to demonstrate the technology and spark interest in the growing functional fabrics field. There are many potential applications for the CTS; however, sophisticated machine programming controls the knit process and complicates the scalability and transformation of the CTS's hardware with each new application. My role in this project was to learn about machine programming to fabricate the CTS in different form factors. I studied the CTS technology so that I could understand the design limitations induced by the technology and create a new CTS fabric within the given parameters. I learned about the knit programming process and used program shortcuts, called packages, to help streamline current and future CTS designs.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

JOYCE DONG



Antoinette Westphal College of Media Arts & Design
Fashion Design

Faculty Mentor: **PROFESSOR GENEVIEVE DION**
Fashion Design

Co-Mentors: Keith Taylor, Sol Schade

DESIGNING A CAPACITIVE TOUCH SENSOR MULTI-CONTROLLER SYSTEM

The Center for Functional Fabrics (CFF) is a transdisciplinary center that advances smart textiles. Our STAR project was to create a maker kit for high schoolers using a textile Capacitive Touch Sensors (CTS) in a multi-controller system. The CTS is a fabric knitted with air-covered spandex and conductive carbon yarn which is then connected to a micro-controller. It is an external input device that can be programmed to interact with a computer when touched. The goal was to make the CTS accessible and marketable to expose younger generations to the technology and grow the smart textile industry. The CTS was designed as a game controller: a single button for Flappy Bird, a slider for Brick Breaker, and a zig zag button pattern for Whack-a-Mole. I used Shima Seiki SDS-ONE APEX computer programs to design various forms factors. There were certain limitations set by the streamlined system of pattern development and the carbon yarn which must be knit continuously. The final pieces are large CTS game controllers for the purposes of understanding if and how the CTS works when scaled up. We explored different applications to demonstrate the flexibility of the CTS and to spur on more research.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

KATARINA GALIC

College of Computing & Informatics
Software Engineering

Faculty Mentor: **PROFESSOR GENEVIEVE DION**
Fashion Design

Co-Mentor: Richard Vallett

CAPACITIVE TOUCH SENSOR: REPLACEMENT FOR TRADITIONAL INPUT DEVICES

Textile devices represent one of the novel and emerging technologies that greatly contribute to the idea of ubiquitous computing. The Center for Functional Fabrics (CFF) has developed a textile Capacitive Touch Sensor (CTS) that enables the use of knitted pads as input devices. The technology, constantly being refined, aims to reach and even exceed the capabilities of current hard technological devices.

To date, textile devices lack public exposure and standards. The STAR team at CFF has focused on repurposing the current CTS to make it suitable for use in high schools. The goal of introducing the technology to a wider audience is to increase the interest in the field of functional textiles. Our approach was to first research fabric construction and smart textiles then, conduct user research on how the CTS technology could be used through interviews and surveys. We were tasked with making a big exhibition maker kit - which will be displayed at the CFF - as the final deliverable. My focus was on improving the previously developed software and fixing issues related to device communication and data transfer, as well as developing games that can be controlled by the fabric to help demonstrate the potential of the CTS.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

LAILA GAUT

College of Engineering
Computer Engineering

Faculty Mentor: **PROFESSOR GENEVIEVE DION**
Fashion Design

Co-Mentor: Richard Vallett

CAPACITIVE TOUCH SENSING SYSTEM: SERIAL DATA

The Center for Functional Fabrics (CFF) works to make new products to advance the smart textile industry. CFF is a transdisciplinary center that fosters collaboration in various disciplines to create textile devices. The goal of my project was to design a maker kit for high school students to learn about smart fabrics using a CTS. It is made with a carbon yarn that is knit into a fabric and then combined with a micro-controller to sense and give a response when programmed and connected to a device. I worked in a team to analyze, debug and refine the code used in a previous CTS project to understand how the fabric operates. We performed user research through surveys with students ranging from sixth to ninth grade. From these surveys, we better understood their programming skills and knowledge of what a capacitive touch sensor is. We learned what functions the user would like their maker kit to have. Based on the data, we designed a fabric CTS maker kit that would be used to educate and interest young students on the world of Smart Fabrics. The maker kit will contain one fabric that will have three different functions when connected to Teensy 2.0s and a laptop, it will come with instructions and examples of what it can be used for.

VELAY FELLOW

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

CURTIS PATEY

College of Engineering
Materials Science & Engineering

Faculty Mentor: **PROFESSOR GENEVIEVE DION**
Fashion Design

Co-Mentors: Keith Taylor, Sol Schade

DEVELOPING A KNIT CAPACITIVE TOUCH SENSOR AS A VIDEO GAME CONTROLLER

Functional Fabrics are textiles that integrate technology to perform a function or interact with their environment. At the Center for Functional Fabrics, a team of STAR Scholars helped develop a Capacitive Touch Sensor (CTS) video game multi-controller, a touch-sensitive textile knitted with carbon yarn. First, the team used books and electronic media sources to acquaint themselves with smart textiles, and then joined one of two groups: a software team and a textile design team. The software team developed games in a Processing IDE. The design team programed machines using Shima Seiki knitting software to produce fabric prototypes; moreover, using a novel programming method, Packages, the team streamlined prototype production. As part of the design team, I focused on optimizing the controller. Using a multimeter, I measured the resistivity of the prototypes, then I determined which forms and structures were the most touch sensitive. The fabric controllers are knitted in one sheet to allow multiple users to interact with the program. The CTS is more durable and flexible than traditional controllers and can be marketed as a maker-kit; allowing the CTS to serve as an impactful educational tool.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

NICHOLAS PAPATERPOU

Antoinette Westphal College of Media Arts & Design
Film & Television

Faculty Mentor: **PROFESSOR KARIN KELLY**
Film & Television

"LIGHTS, CAMERA, HEADACHE!" A CONDENSED EXPERIENCE IN INDEPENDENT FILMMAKING

Many of today's greatest moviemakers have gotten their breakthroughs from independent filmmaking. Intrigued by the "indie lifestyle," I engulfed myself in the process of making my own short film in the spirit of independent filmmaking. I separated my creative process into three distinct categories: pre-production, production, and post-production.

In pre-production, I wrote my script while studying Blake Snyder's screenwriting formula and analyzed numerous successful works of a similar genre. I also used multiple online filmmaking resources to cast actors, find locations, and secure props and wardrobe.

In production, I assembled a team of several crew members to fill various important positions. Indie filmmaker Ed Burns' biography "Independent Ed" served as a reliable resource when seeking tips for directorial leadership.

It is in post-production where, along with the assemblage of footage shot during production, the final touches to the short are made, such as sound design, score composing, and color grading via software Adobe Premiere.

Over the course of ten weeks, I planned and produced a short film, "The Witch Queen." These ten weeks have given me a glimpse of a future lifestyle, and I wouldn't change it for the world.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

SAMIYAH M. WARDLAW

Antoinette Westphal College of
Media Arts & Design
Film & Television

Faculty Mentor: **PROFESSOR JOCELYN TARQUINI**
Film & Television

MY SCI-FI SHOW PILOT

For my STAR Scholars Research Project, I decided to produce a pilot episode of a television show that I wrote. At first, I wrote a mockumentary style story about the dynamics at a small production company. Halfway through the summer I changed my idea and wrote a sci-fi show.

When screenwriters write screenplays, they include a logline, which is a one-sentence summary or description of a movie. My logline was, "Mourning the loss of his sister, a boy begins to see people disappear to alternate universes through fog-filled doors and it's up to him to bring them home.''

I was the producer on this project, but I also managed a lot of different roles. While filming, I had to coordinate all of my actors and crew and come up with a schedule that worked for everyone. There were many days that I had cancel or rearrange things at the last minute, or work around locations and unexpected problems. On set I was in charge of directing, lighting and sound as well as leading my crew. After recording everything, I had to edit. I was not able to finish editing the entire project for the showcase because I had a lot of footage to sort through, but I was able to create a short trailer of the project.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

JAE EUN EUGENIE KWON

Antoinette Westphal College of Media Arts & Design
Graphic Design

Faculty Mentor: **PROFESSOR MARK WILLIE**
Graphic Design

BRANDING FUNDAMENTALS AND REBRANDING OF GRUBHUB

Whenever people walk by stores or browse online, they encounter and interact with brands. People can be attracted to certain brands because of the product/service as well as how they are being presented to the public. In this project, I have researched in depth the definition of branding and an application to a specific rebranding project. I have discovered how the visual brand strategy of an organization involves design, marketing, psychology, user experience, and the understanding of historic brand precedent.

Through this research, I have provided a case study on the company Grubhub's major rebranding endeavor in 2016. As general research, I found the basic information about the company itself through articles and interviews about the rebrand. I also reached out to one of the lead designers for the Grubhub's rebrand project at Wolff Olins, a full service international brand strategy agency based in New York, and was able to schedule an interview in person at their offices. The designer provided insightful information on the brainstorming, process, and outcome of the rebrand project which I was able to incorporate into my research project.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

KELLY (MYEONGEUN) LIM

Antoinette Westphal College of Media Arts & Design
Design & Merchandising

Faculty Mentor: **PROFESSOR CLARE SAURO**
Penny Fox Historic Costume Collection (FHCC)

CORRELATION BETWEEN SOCIAL ISSUES AND TRENDING COLOUR, WITH A FOCUS ON WOMEN'S FASHION

Fashion is inevitably influenced by social issues that people follow as trend is prompted from ideas that catches people's attention. Color especially reflects the mood, atmosphere, and people's perspective on society. This has been greatly evident in women's fashion from the 1940's when rationing during World War II regulated the amount and type of chemicals used for color. When rationing was eliminated in 1950's, society regained its lively colors and began to reflect the people's ideology. From then on, the color trend speaks about issues of people's main focus at the time period. The current news are associated with discrimination and intolerance. As a result, vivid colors like neon are popular as people want to convey their presence and self-identity through these very distinguishable colors. We also see vintage and tie-dye colors from the 1960's and 1980's as it is a trend to refer back to the past. According to the Pew Research Center's study in January 2019, 60% of Americans are concerned with America's relationship with foreign countries and 56% are aware of our environmental problems. If these issues continue to rise to surface, then we can expect to see colors that represent these topics in the near future.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

MARCUS BERNSTEIN

Antoinette Westphal College of Media Arts & Design
Product Design

Faculty Mentor: **PROFESSOR MICHAEL GLASER**
Product Design

EXPERIENTIAL DESIGN IN SPORTS; RETOOLING THE FAN EXPERIENCE

Each of us has a formative memory in the world of sports. Whether it's watching a football game with your dad on Sunday or taking your daughter to her first basketball game, sports is an essential component of American culture and plays a role in the lives of every single American. Using a formal research methodology, this project aims to understand the psychology behind what makes sports experiences memorable. Using stadium visits, interviews, and activities, we gathered insights on people's memories and experiences. Those insights were validated in communication with members of the Eagles, Phillies, Dodgers, and employees who have worked for countless other sports organizations and contractors.

This project used design thinking strategies to curate solutions that evoke empathetic reactions. Organizations can design family-friendly nostalgic experiences that build joyful reactions in adults and inspire kids to come back. As experiential designers, we cater to engage each of our consumers rather than all of our consumers.

Using design thinking in the world of sports, we improve the experience for fans that range from die-hard to disinterested, pushing the next generation of formative and impactful sports fan experiences.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

SHARA SAKETKHOU

Antoinette Westphal College of
Media Arts & Design
Product Design

Faculty Mentor: **PROFESSOR MICHAEL GLASER**
Product Design

FINANCIAL EMPOWERMENT

99% of women who experience domestic violence experience financial abuse. Financial abuse, yet another way for an abuser to gain control over their victim, includes not allowing the victim to work, withholding funds, running huge amounts of debt/ruining their credit score and stealing or destroying their property. Financial abuse leaves the victim without any financial stability and they are therefore likely to return to the abusive relationship 7 times before they leave for good. Despite this problem, financial abuse is the least researched abuse tactic. Using design methods and thinking, financial empowerment can be used to enable victims of abuse to leave and not return to abusive relationships.

To better understand how people think and feel about money, I created a board game where players receive a certain amount of money each month and must budget that money accordingly while adding money to their savings to reach their savings goal. I gained insights on how people manage their money, and I learned about how their financial backgrounds affect the way they feel about money. This kinesthetic experience with the participants allowed us to discuss their financial goals, and helped them realize various ways to reach those goals.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

MAXWELL GALLAGHER

Antoinette Westphal College of
Media Arts & Design
Screenwriting & Playwriting

Faculty Mentor: **PROFESSOR MATTHEW KAUFHOLD**
Screenwriting & Playwriting

A DAY AT HOME

A Day at Home is a full-length stage play, written. The play was initially envisioned as an absurdist take on a single, mundane day in an average American family's life, but it became a piece about identity formation, trauma, and past demons. As the project was a full length play — with the first draft 80 pages in length — the challenges largely came from understanding and developing my own creative process as an individual. A journal was kept while the play was drafted to document any struggles that arose during the writing process, including difficulty settling on an idea to develop, challenges in creating a logical and satisfying narrative arc, etc. After a first draft was completed, the draft was evaluated and critiqued by my mentor and together we discussed a plan for revising and developing the piece further. Deliverables along the way include early brainstorming-exercises, completed drafts, and research to aid in the development in a piece my mentor was beginning to write.

ALEX HWANG

Bennett S. LeBow College of Business
Business & Engineering

Faculty Mentor: **DR. MURUGAN ANANDARAJAN**
Decision Sciences, Management Information Systems

THE LEGS IN THE ART OF PUNCHING

The purpose of this study is first, to determine the effect the placement of the rear leg has on the force of a punch. Next, analysis to identify the kinematic determinants of optimal leg placement when punching. Tang Soo Do practitioners were used to perform a basic punch. Two-dimensional kinematics were recorded using a 60fps\1080p camera for three punches using both dominant and non-dominant hands. Impact forces were measured using a handheld target with an accelerometer attached, positioned about shoulder level with the subject. Kinovea, a video player for sports analysis, was used to analyze each recording. Current results show that on average, subjects are observed to have their rear leg often bent at angles ranging between 138 and 142 degrees. The distance between the front and back foot varies with the height of the person, as it seems the body naturally parts the legs to compensate for back-to-front weight transfer. Additionally, the force of the punch seems to be affected more by its speed rather than the placement of their feet. Further testing and analysis are still needed, however. Future tests expect similar results with the angle of the rear leg.

BENNETT S. LEBOW COLLEGE OF BUSINESS

PRIYANC PASSI

Bennett S. LeBow College of Business
Finance, Business Analytics

Faculty Mentor: **DR. SAMIR SHAH**
Decision Sciences, Management Information Systems

REIMAGINING EDUCATION: MAKING THE CLASSROOM MORE AGILE

Business Agility refers to the ability of an organization (focused primarily on customer value) to respond to change by adapting its initial stable configuration. With the world and technology changing faster than ever, the need for business agility is but obvious. Today, agile methodologies and philosophy seem to be rapidly gaining popularity across a broad range of industries and functions as they focus on a stronger alignment to business outcomes. Keeping this in mind, a brand new MBA-level four day residency course (MIS T680: Agile Methodologies) was designed and offered this summer within LeBow College of Business. MIS T680, an innovative course design, covers not only the core agile principles and frameworks but also the applying of agile methods on a complete life cycle of a real-world project with a customer. Data drawn from the course surveys, course formal evaluations, students' personal reflection papers, customers' feedback, agile coach's feedback, and course instructor's observations manifest how a course of such nature can help students solve real-world classroom problems more effectively and its related impact on their learnings.

KEVIN GAO

Bennett S. LeBow College of Business
Finance, Business Analytics

Faculty Mentor: **DR. DAVID BECHER**
Finance

DO INCENTIVES MATTER? THE BOARD'S RELATION TO MERGERS

With globalization growing at an unprecedented rate, firms are trying to find new ways to compete. Evidence suggests that mergers and acquisitions, M&A, is one of the fastest ways for firms to grow, improve, optimize, and diversify into new sectors. M&A activity has grown considerably, with a record global value of approximately $4 trillion in 2018. A firm's board of directors is charged with guiding these strategic processes to not only grow the firm but to also improve shareholder value. Shareholders can benefit from M&A through rising stock prices, greater voting power, and partake in a stronger corporation.

To examine the board of directors' role in M&A over the past decade, we analyze their incentives, the factor that encourages directors to monitor and ensure that they act in shareholders' best interests. We separate director pay into two categories, cash and equity, to examine whether incentives impact director behavior. In particular, we hypothesize that more equity compensation will lead to a greater probability of a firm undertaking a merger. Further, we juxtapose M&A of all public small firms to those of the largest U.S. firms to understand whether directors' incentives vary when the market is not watching.

FILIP KRÜEGER

Bennett S. LeBow College of Business
Business & Engineering

Faculty Mentor: **DR. DAVID BECHER**
Finance

TECH FIRMS ARE WATCHING YOU: WHO IS WATCHING THEM?

In recent years, credibility in the tech industry has fallen, in part, because consumers say they do not trust tech firms to handle their personal data. Given this increasing lack of confidence, the board of directors plays a vital part in monitoring firms to help regain consumer trust. For the biggest tech firms, media exposure and activists provide additional oversight to help ensure that boards act in shareholders' best interest. However, this is likely not the case with smaller firms that do not have similar exposure. Will they do the right thing when no one is watching?

To better understand director motives when external monitoring is potentially low, we examine director incentives for small tech firms. We hypothesize that how a director is paid, cash versus incentive (equity) compensation, will be tied to firm performance. By developing our own computer program, we extract director compensation for a large sample of non-S&P 1500 firms over the past decade. While greater incentive pay should be tied to better firm performance, we find that small tech firms still predominately pay their directors in cash. Given the shortage of trust in tech firms, the lack of director incentive pay may indicate signs of more problems to come.

MICHAEL R. GARVEY

Bennett S. LeBow College of Business
Finance, Business Analytics

Faculty Mentor: **DR. GREGORY NINI**
Finance

ANALYSIS OF THE EVOLUTION OF BANK LOAN COVENANTS SINCE 1985

When banks lend money to a company, they incur the risk that they might not be repaid. To reduce that risk, banks often include financial benchmarks, called covenants, that a company must meet to avoid defaulting on their loans. Due to limited access to historical SEC filings, there has been little research into bank loans and their covenants prior to 1996, when the SEC's EDGAR database made filings easily accessible. I instead examine SEC filings from 1985-1995 using Mergent Archives, a database available to me through Drexel Libraries that contains historical SEC Filings. For a random sample of 500 firms from 1985-1995, I manually download 10-K filings and search for evidence of a bank loan. If the loan is available, I download the credit agreement governing the loan. I then examine the covenants contained within the loans, and compare them to similar loans from more recent years to understand how bank loan restrictions have evolved since then.

JORDAN NON

Bennett S. LeBow College of Business
Finance, International Business

Faculty Mentor: **DR. GREGORY NINI**
Finance

LOAN RESTRICTIVENESS: ASSET BASED AND TRADITIONAL LOANS

The use of asset-based loans (ABL) by corporate borrowers has skyrocketed since the early 2000s. ABL loans are unique because the amount of borrowing is contractually limited by the assets that serve as collateral. The emphasis on collateral supervision gives lenders a piece of mind, and I hypothesize that lenders relax the alternative methods for monitoring borrowers. I focus on covenants, which are rules and conditions borrowers must abide by. There is little academic evidence examining the usage of ABL's and how contractual restrictions differ from traditional cash-flow financing.

I begin by compiling a set of more than 200 ABL contracts extracted from firm's filings with the SEC over 19 years and then read each contract and compile data on 25 loan features, including covenants and other features specific to ABLs. I compare ABL's to traditional cash-flow financing and find the hypothesis to be true; ABL lenders use fewer and less restrictive covenants. Additionally, covenants in ABLs have become less restrictive.

BENNETT S. LEBOW COLLEGE OF BUSINESS

SOPHIA M. DESKO

Bennett S. LeBow College of Business
Marketing, Business Analytics

Faculty Mentor: **PROFESSOR DANA D'ANGELO**
General Business

Co-Mentor: Professor Jodi Cataline

ANALYZING THE IMPACT OF GLOBAL CLASSROOMS ON STUDENT OUTCOMES

In recent years, Global Classrooms (also known as COIL: Collaborative Online International Learning) have become an added means for students to engage globally besides traditional study abroad. Drexel has a variety of Global Classrooms with different focuses. For our purposes, we examined LeBow's Freshmen Foundations of Business I and II Global Classroom, which is an underrepresented type of global classroom – freshmen-oriented and business-specific. Our research aims at gauging student outcomes in two ways. The first is through analyzing the most recent cohorts' student reflections (17-18 and 18-19) and annotating for KSAs (Knowledge, Skills, and Attitudes). Through this, we've been able to garner insight into what KSAs students have gained through their participation. We've also been able to put the KSAs into smaller subcategories, which aids in our evaluation. The second has a wider focus on everyone that went through this sequence over the past 5 years. We want to assess their global engagement beyond this program (ICAs, traditional study abroad, other experiential courses abroad, international area studies, etc.,). The results show how this experience encourages students to become globally engaged earlier and maintain it.

JANE KARAM

Bennett S. LeBow College of Business
Finance

Faculty Mentor: **DR. CHEN WANG**
Marketing

IMPLICATION OF NIKE'S RECENT POLITICAL STANCE ON CONSUMER BEHAVIOR

To understand how political ideology affects consumer behavior, I conducted an experiment in which I studied consumers' reactions to Nike's recent controversy with their limited-edition Betsy Ross flag sneakers. Before Nike was set to sell the sneakers in July, NFL star, Colin Kaepernick, informed Nike that they should not release the sneakers because many people may find them offensive. After removing all the sneakers from stores, Nike received mix reactions from their consumers. The question I researched was if Nike's controversial political action would help/hurt its brand and consequent consumer behavior compared to a) its status before the political action and b) Adidas, another comparable brand without political standing? 15 surveyors were asked about their opinions on Adidas, Nike, and post-controversy Nike. The surveyors answered questions about their attitude toward the brands, the quality and price of the brands, and whether a brand's political decision would affect their behavior. I found that Nike's political decision caused the surveyors to have more negative feelings toward the brand. Consumers were more willing to purchase their apparel at Adidas, a non-political brand, than Nike after Nike's sneaker controversy.

SYDNEY PAN

Bennett S. LeBow College of Business
Marketing, International Business

Faculty Mentor: **DR. CHEN WANG**
Marketing

SHOULD FAST FASHION BE SUSTAINABLE OR FAST?

In a culture in which fast fashion dominates the clothing market and a need to implement sustainable practices, it raises the question of whether the fast fashion industry should accommodate such sustainable needs with the downside of increasing costs. To answer this question, we examined Reformation – a fast fashion company that puts ethics and sustainability at the forefront of their products and marketing, in comparison to Fashion Nova, a traditional fast fashion company. We conducted a simple experiment by randomly assigning participants to one of the two companies and asked them to provide opinions to the company and its products. We were able to quantify their attitudes and opinions towards either company and created analyses to further help our understanding. Among our results, we discovered that because Reformation places ethics at the forefront of its branding, it positively impacts the attitude of consumers have towards the company, more than a traditional fast fashion brand like Fashion Nova. Unfortunately, when brands are not as transparent about their practices, aspects like ethics do not necessarily come to mind in regards to brand perception, so the attitudes towards a brand like Fashion Nova are more neutral.

CAROLINE PEREIRA

Bennett S. LeBow College of Business
Marketing

Faculty Mentor: **DR. CHEN WANG**
Marketing

THE REAL MYSTERY BEHIND NETFLIX'S STRANGER THINGS: MUSIC AS A MARKETING TOOL AND CONSUMER CURIOSITY TRIGGER

Have you ever watched a movie or TV trailer and immediately wanted to learn more? This instant response may be due to consumer curiosity that aims to gain consumer attention and inspire them to search more. While it often goes unnoticed, music can play a huge role in triggering this, and can be used to promote buying behaviors and connect with viewers on deeper levels. This research focuses on links between musical choices in trailers and post-viewing behavior. To examine this, we studied two trailers, which use vastly different music, from Netflix's Stranger Things. Specifically, we conducted an experiment to find how the music difference in the two trailers would affect the viewers' emotions, trailer preference, and watch likelihood. Upon receiving the data, we found that familiarity of music leads to trailer preference. This may be due to many viewers knowing the music used and having emotional connections to it. This can incite reactions in the brain that make viewers happier, more motivated and overall open to the trailer and show when they're already connected to the the musical aspect. This research is important to media marketers because it shows how important of a role music can play in marketing and consumer curiosity.

CASEY REINKNECHT

Bennett S. LeBow College of Business
Marketing

Faculty Mentor: **DR. CHEN WANG**
Marketing

ONE FOR ONE VS. ONE OF FIVE: HOW TOMS' NEW CHARITABLE BUSINESS MODEL IMPACTS CONSUMERS' CERTAIN ATTITUDES AND BEHAVIORS

Founded in 2006, TOMS established a business model called One for One, namely, for every pair of shoes purchased, a pair of shoes would be donated to a child in need. In 2019, TOMS announced its decision to update its business model – with every purchase, customers have the option to choose one of the five campaigns to fund: gun violence, equal rights, safe water, homelessness, and mental health. In order to determine the impacts the change in business models has on consumers' attitudes and behaviors, I conducted an experiment in which participants were randomly selected to answer questions based on TOMS' old business model or new business model. The results showed that a majority of participants were satisfied with TOMS' new business model and were likely to recommend the brand based on the new model. Based on these findings, consumers were likely to recommend TOMS because of the feel-good impact it leaves.

BRANDON SAFIE

Bennett S. LeBow College of Business
Finance, Marketing

Faculty Mentor: **DR. CHEN WANG**
Marketing

THE DIRECT EFFECTIVITY OF APPLE'S MARKETING ON BRAND LOYALTY

Ever since the release of the first iPhone, Apple has grown to amass billions of consumers making them one of the best-rated companies for brand loyalty. Though Apple has plenty of competition, they are able to distinguish themselves to their customers through their unique brand image created by their marketing strategy. To determine the effectiveness of Apple's marketing over recent years towards the growth of their outstanding brand loyalty, I collected primary data from a survey to identify key traits within smartphone consumers that drive them to buy from their respective brands. The purpose of this data was to identify a direct comparison between the effectivity of Apple's unique marketing with the key traits of brand loyalty for smartphone consumers. Participants were diversely selected, with smartphone consumers of varying backgrounds and brand choices. Using this survey data, a marketing analysis, and Apple's sales reports, we examined the actual influence of Apple's marketing in recent years in terms of creating and growing their brand loyalty. We found that Apple's unique focus on quality in their marketing has given their users an experience that keeps them coming back.

NICHOLAS COSTANTINO

Bennett S. LeBow College of Business
International Business, Legal Studies

Faculty Mentor: **DR. BANG NAM JEON**
School of Economics

DO FOREIGN BANKS HELP HOSTING ECONOMIES GROW?

Foreign banks entering host countries affect the overall well-being of all parties involved—consumers, investors, firms, domestic banks and governments. This research examines the impact of foreign banks entrance on economic growth for several Central Eastern European (CEE) countries where the foreign bank penetration rate has been very high. We use both qualitative and quantitative approaches to investigate the foreign bank-economic growth relationship in the CEE region. We collect data on foreign bank entry and real GDP growth for the major CEE countries from the Federal Reserve Economic Data (FRED) and the Bank for International Settlements (BIS). Applying statistical analyses including regression estimations to the banking and macroeconomic data will help us better understand the role and relationship of foreign banks on economic growth in the host country, as well as derive useful implications for policy makers.

BENNETT S. LEBOW COLLEGE OF BUSINESS

MEDHAVI JAIN

Bennett S. LeBow College of Business
Economics

Faculty Mentor: **DR. BANG NAM JEON**
School of Economics

WILL BANKING INTEGRATION ADVANCE ECONOMIC DEVELOPMENT? A CASE STUDY OF ASEAN

After the Global Financial Crisis, regional banking integration in the Association of Southeast Asian Nations (ASEAN) region is on the rise. The ASEAN Bank Integration Framework (ABIF) has implemented the 6th Package of Commitments to provision Qualified ASEAN Banks (QABs) and to improve regional economic integration. The ABIF policymakers seek to accelerate the process of regional banking integration and contribute to both financial integration and economic growth in the ASEAN region.

This research examines what are the main impacts of banking integration on the economic growth and economic development in the ASEAN economies through the expansion of their cross-border banking transactions in the region. By applying both qualitative and quantitative approaches to the data collected from Bank for International Settlements (BIS), Asian Development Bank (ADB), and World Bank, this research aims (1) to identify factors enhancing banking integration, (2) to analyze its impact on economic growth and development, and (3) to derive useful policy implications.

DIOTIMA ROY

Bennett S. LeBow College of Business
Economics

Faculty Mentor: **DR. CHRISTOPHER LAINCZ**
School of Economics

LEGALIZING PERU'S INFORMAL TRADE SECTOR THROUGH EFFECTIVE ALLOCATION OF PROPERTY RIGHTS

Like most other developing countries, Peru has a sizeable informal sector. Street vendors constitute a considerable part of this sector. According to a survey conducted by the Instituto Libertad y Democracia, there were 91,455 street vendors in Lima in January 1986 with yearly gross sales of $322.2 million. By 2015, the number of street vendors in Lima increased drastically to reach 325,758 with yearly gross sales estimated at over $1.1 billion. In the same time period, Peru's real GDP grew from $70.7 billion to $198.6 billion. By reducing the hurdles to register a business and issuing temporary licenses to these informal workers in the meantime to guarantee them short-term property rights, Peru successfully harnessed the potential of the informal sector. Through a comprehensive literature review of the history of the informal sector in Peru, examining time-series graphs of macroeconomic indicators, and looking at how other countries addressed similar issues, this research analyzes what changes mattered and what could have been done better. Peru set a precedent for struggling economies throughout the world and the lessons learned from its transformation will be beneficial to other countries looking to reduce poverty.

CHARLES D. CLOSE SCHOOL OF ENTREPRENEURSHIP

HENRY NGUYEN

Charles D. Close School of Entrepreneurship
Entrepreneurship & Innovation

Faculty Mentor: **PROFESSOR SCOTT QUITEL**
Charles D. Close School of Entrepreneurship

DOCUMENTING PHILADELPHIA'S STARTUPS

In my Star Scholar Research, mentored by Mr. Scott Quitel, I have investigated the various startups from Philadelphia. I have interviewed and researched companies that range from environmentalism to healthcare and even tech. My research hopes to expose the complete stories of various startups. In my research of startups such as *Musa's World, Outland Analytics and Bsafe*; I have documented topics that make a startup a startup, from the origin story, team building, product/service creation, financing and marketing. First I research as much as possible about these Philadelphia startups before I schedule an interview, however some of these new startups have little online information. The interview with the Ceos is where a vast majority of my information comes from. From this I ask specific questions about the origin, why they choose their team, what inspired the company, funding and sales. Due to the nature of companies, some startups choose not to disclose specific information regarding finance and/or product development. Through my research interviews, I have documented a more complete version of a startup's story rather than a facade online.

CLAYTON FOSTERWEBER

College of Arts & Sciences
Environmental Science

Faculty Mentor: **DR. STEFANIE A. KROLL**
Biodiversity, Earth, & Environmental Science (BEES)

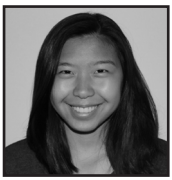
Co-Mentor: Danielle Odom

DIFFERENCES IN ASSESSMENTS OF BIOLOGICAL INTEGRITY AND BIODIVERSITY OF MACROINVERTEBRATE COMMUNITIES BASED ON LENTIC VERSUS LOTIC AQUATIC HABITATS.

Benthic macroinvertebrates are a major component of nutrient cycles and food webs of aquatic ecosystems. Macroinvertebrates are useful indicators of stream integrity based on their varying tolerances and sensitivities to environmental changes, limited mobility, and year-long lifespans. Bioindicators such as macroinvertebrates are used to understand the effects that human activities have had on aquatic ecosystems. Often studies on stream integrity only use data from lotic habitats. Lentic habitats may provide crucial information about functional groups missing from traditional lotic data. Our study uses data from samples collected in 2014 from lentic aquatic habitats and compares them to lotic data from the same stream systems. These samples were preserved and identified to the lowest level of the taxonomy. A biodiversity value was determined by quantifying the number of genera found in each sample. Tolerance values were recorded at the family or genus level. We will discuss the implications of using only lotic or a combination of lentic and lotic assessments in monitoring stream health.

EMILY X. JOHNS

College of Arts & Sciences
Environmental Science



Faculty Mentor: **DR. SEAN O'DONNELL**
Biodiversity, Earth, & Environmental Science (BEES)

Co-Mentor: Katie Fiocca

UNDERSTANDING THE RELATIONSHIP BETWEEN OVARY DEVELOPMENT AND DOMINANCE IN A EUSOCIAL TROPICAL PAPER WASP *(Mischocyttarus pallidipectus)*

In primitively eusocial *Mischocyttarus pallidipectus* paper wasp colonies, separation of members into reproductive castes is characteristic. Unlike many insects which are divided into morphologically and functionally distinct castes, *M. pallidipectus* castes are monomorphic: females on the nest are identical at emergence but will differentiate into castes by social dominance. The July 2019 field season in Monteverde, Costa Rica was devoted to testing the hypothesis that ovary size is correlated positively with dominance and connecting this to differences in individual chemical cues. In the field, we located wasp nests and observed individual behavior for four hours each day over two days to identify dominance interactions and determine the social hierarchy of females. Following observations, the wasps were collected, and females were dissected. Female ovaries were photographed and measured in order to examine the behavioral data against the size and development of their ovaries. The gasters of each wasp were swabbed for their cuticular hydrocarbons which will then be run on chromatography columns, allowing us to evaluate whether or not there is a difference in the chemical identity of females with and without developed ovaries.

CATHERINE QUINN

College of Arts & Sciences
Environmental Science

Faculty Mentor: **DR. MARINA POTAPOVA**
Biodiversity, Earth, & Environmental Science (BEES)

STUDYING THE DIETS OF STREAM MACROINVERTEBRATES WITH DNA METABARCODING

Pollution negatively affects stream ecosystems, especially in altering their food webs. Due to the sizes of primary consumers, it is difficult to determine who's eating what. A method that has not been widely used in diet studies is DNA metabarcoding, a newer technique for molecular characterization of environmental samples. To explore this approach, we had to determine if we could extract enough DNA from the guts of benthic macroinvertebrates. At two streams in the Philadelphia area, we collected several rocks and water samples. For each rock, every macroinvertebrate was identified and incubated. After incubating, we fixed them with ethanol for measuring and imaging, saving the incubation water for DNA extraction. The rock biofilms were saved for DNA and microscopy study. After filtering water samples, the filters were frozen for DNA. I then extracted and quantified DNA from every sample. The ones that yielded a sufficient amount of DNA (at least 2.6 ng) were sent for sequencing. A positive correlation was found between the size of the invertebrates and the amount of DNA extracted from their gut material. Our extraction of enough DNA for sequencing proves DNA metabarcoding to be effective in studying benthic trophic structures.

VICTORIA ALLEN

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Faculty Mentor: **DR. DAVID VELINSKY**
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Co-Mentor: Michelle Gannon

THE SECRET LIFE OF PLANTS: STABLE ISOTOPE (CNS) SPATIAL VARIABILITY IN FLORA THROUGHOUT BARNEGAT BAY, NJ

Barnegat Bay (BB), New Jersey has long faced extensive nutrient pollution leading to eutrophic conditions and a degradation of water quality. This directly effects both the health and function of the surrounding ecosystems. In this study, I assessed the spatial variability and flow of nutrients through analysis of stable isotope ($\delta^{15}N$, $\delta^{13}C$, $\delta^{34}S$) values of marsh and aquatic plants, such as *Spartina alterniflora*, *Spartina patens*, *Phragmites*, and *Ruppia*; soil; macroalgae, particularly *Ulva*; and suspended particulate matter collected from 9 sites ranging from north to south in BB. Stable nitrogen (N), carbon (C), and sulfur (S) isotopes act as tracers of nutrient sources and movement as well as microbial activity. For example, stable N isotopes reflect the sources of N from which they originate such as fertilizer runoff, atmospheric deposition, N fixation, and upwelling. As land use differs from north to south over BB the isotopic signatures are expected to vary due to a potential difference in sources. This data is useful in that the identification of spatial patterns of these stable isotopes is indicative of spatial patterns in nutrient sources that can be used to aid and guide remediation efforts throughout BB.

BRONWYN SAYRE

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Mathematics

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POOR WATER QUALITY CONTRIBUTES TO COASTAL ACIDIFICATION AT ELKHORN SLOUGH, CALIFORNIA

Increasing levels of atmospheric CO_2 have resulted in ocean acidification which affects coastal waterways worldwide. Since the industrial revolution, ocean acidity has increased more than 30%, negatively affecting marine organisms. While atmospheric CO_2 is certainly to blame for the decreasing oceanic pH levels, it is important to understand how other factors contribute to its exacerbation in coastal areas. This project focused on the Elkhorn Slough in California as a model site that experiences eutrophication and upwelling, factors that can influence coastal pH. To determine if a relationship exists between poor water quality and ocean acidification, pH data from four sites throughout the estuary collected in 15-minute intervals over the last 25 years were screened for association with upwelling indices and dissolved oxygen (DO) as an indication of eutrophication. These sites span from the mouth of the estuary with a marine influence to a tidally restricted pond with more terrestrial influence. No clear correlation was found between upwelling and pH, however there was a clear relationship between pH and DO. This correlation suggests that coastal acidification at Elkhorn Slough is being driven by increased eutrophication.

JENNA SOUTO

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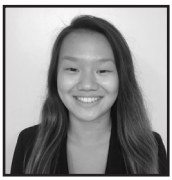

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Co-Mentor: Dr. Spencer Galen

CAUSES OF VARIATION IN AVIAN MALARIA INFECTION INTENSITY IN A COMMON PENNSYLVANIA SONGBIRD

Avian malaria is a common disease of birds that is caused by protozoan parasites in the genera Haemoproteus, Plasmodium, and Leucocytozoon that are spread through dipteran vectors. Although a high proportion of birds in Pennsylvania are infected with malaria parasites, we do not currently understand why some birds develop high infection intensities and others develop weak infections. To address this question, I collected blood samples from Gray Catbirds (Dumetella carolinensis) at Rushton Woods Preserve in eastern Pennsylvania during the summer of 2019. I screened blood smears under the microscope to quantify parasite infection intensity and used a nested PCR protocol to screen and characterize the parasites. I used the DNA sequence analysis program Geneious to identify the species of malaria parasite in each infection. In additon, I used a PCR and gel electrophoresis protocol to molecularly determine the sex of each avian host. I found that male catbirds have higher intensity infections than females, and that birds in the spring had higher infection intensities than birds in the summer or fall. Furthermore, I found that Haemoproteus parasites had higher infection intensities compared to Plasmodium and Leucocytozoon infections.

RUFRANSHELL REYES

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Faculty Mentor: **DR. VALERIE BRACCHI-RICARD**
Biology

Co-Mentor: Dr. Swathi Swaminathan

THE EFFECT OF SPINAL CORD INJURY ON AORTA STIFFNESS

Studies show that patients suffering from spinal cord injuries are more predisposed to cardiovascular diseases such as atherosclerosis and have increased arterial stiffness and thickness. However, it is not well understood how spinal cord injury affects arterial stiffening. Our hypothesis is that chronic inflammation and/or deregulation of the sympathetic nervous system may contribute to the stiffening of the aorta. To test this hypothesis, we isolated the aortas of naïve uninjured mice and mice with spinal cord injury. Some of the spinal cord injured mice were treated with XPro1595, an anti-TNF drug, to reduce inflammation, while the control group received PBS. Collected aortas from these mice were frozen, cut into sections on the cryostat, and stained for CD68, a marker for macrophages and Tyrosine Hydroxylase, a marker for norepinephrine neurons. Fluorescent images were then acquired of the samples with the Olympus FV 1000 confocal microscope and analyzed using plot intensity profile with the FIJI software to indirectly measure the levels of macrophages and norepinephrine present which are believed to affect aorta stiffness. Our data will provide insight into the mechanism of arterial stiffening following spinal cord injury.

NICHOLAS BARBIERI

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Faculty Mentor: **DR. FELICE ELEFANT**
Biology

Co-Mentor: Akanksha Bhatnagar

INVESTIGATING A CROSS REGULATION BETWEEN HISTONE ACETYLTRANSFERASE TIP60 AND HISTONE DEACETYLASE HDAC2

Histone acetylation dysregulation has been implicated in Alzheimer's disease. Acetylation of the histone proteins controls packaging of chromatin, therefore controlling the accessibility of the genes by transcription machinery and eventually their expression. While histone acetyltransferase enzymes, such as Tip60, loosen the chromatin and switch ON the genes, histone deacetylase (HDAC) enzymes tighten the chromatin, switching the genes OFF. Dr. Elefant's lab has previously shown Tip60/ HDAC2 imbalance in an Alzheimer's Drosophila model, which results in repression of critical neuronal genes and cognitive decline. To test whether there is a cross-regulation between Tip60 and HDAC2, we tweaked the levels of either Tip60 or HDAC2 and observed if that affects the other enzyme. Genetic crosses were used to induce either overexpression or RNA-interference (RNAi) mediated knockdown of Tip60 and HDAC2. Larval brains from the progeny were dissected, followed by RNA extraction and cDNA conversion using RT-PCR. Finally, qPCR was used to observe and compare the mRNA levels of Tip60 and HDAC2 in overexpression and knockdown lines. These results will give a better understanding of histone acetylation and its role in Alzheimer's disease.

RESHMA BROWN

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Co-Mentor: Mariah Beaver

THE KNOCKDOWN OF ROK AND PDGFRB AND ITS EFFECT ON EARLY COGNITION IN DROSOPHILA

Traumatic Brain Injuries (TBIs) are caused by violent jolts of the brain within the skull from falling or being struck by objects and can disrupt normal brain function. Recent studies show that TBIs increase the risk of developing early onset Alzheimer's disease (AD) most prevalently in military veterans that experience head trauma. To understand the long-term effects of TBIs, we examined the cognitive abilities of fruit flies that express TBI related genes Rok and PDGFRB. The human homologs of these genes are known to cause cell death and glial scaring after a TBI. In addition, the expression of Rok and a mutation in PDGFRB may be implicated in AD onset. Using genes identified in both RNA sequencing data from a well-characterized AD model fly and RNA sequencing data from human TBI patients, we investigated if the knockdown of these genes played a role in early cognition through behavioral assays. Here, we observed that the knockdown of Rok and PDGFRB are not standalone factors that lead to decline in early cognition.

ILAYDA ERKAN

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Faculty Mentor: **DR. FELICE ELEFANT**
Biology

Co-Mentor: Haolin Zhang

HISTONE ACETYLTRANSFERASE TIP60 RESCUES AMYLOID-B INDUCED ALZHEIMER'S DISEASE PATHOLOGIES

Alzheimer's Disease (AD) is a progressive neurodegenerative disorder that causes cognitive and bodily functional impairments followed by early death. Recent studies in our lab have provided solid proof that Tip60 histone acetyltransferase (HAT) plays a crucial role in neuroprotection against amyloid precursor protein (APP)-induced AD neurodegeneration. Neurotoxic amyloid-β (Aβ) results from abnormal APP processing and contributes to plaque pathologies and neuronal apoptosis, however, whether Tip60 can protect against such Aβ-induced neuropathologies remains unclear. In our current study, we utilized a double transgenic Drosophila model (Aβ42; Tip60) to test the potential neuroprotective function of Tip60 against direct Aβ-induced pathology such as Aβ plaque accumulation as well as indirect Aβ-induced pathology such as neuronal apoptosis. We proved that the restored Tip60 expression under Aβ conditions not only lead to the reduction of Aβ plaques in the mushroom body region of the brain, which is the counterpart of mammalian hippocampus but also reduced apoptotic driven neuronal cell death in the mushroom body region. Taken together, Tip60 can efficiently rescue Aβ pathologies, making it a promising target for AD treatment.

RYAN LITZKE

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Faculty Mentor: **DR. FELICE ELEFANT**
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Co-Mentor: Bhanu Chandra Karisetty

VALIDATION OF THE HA-TIP60 FLY LINE

Drosophila melanogaster (Dmel) is a preferred model organism for genetic manipulations and studying neurodegenerative conditions like Alzheimer's. Tip60, a histone acetyltransferase (HAT), unfolds the chromatin and allows binding of the transcription machinery. A UAS-Tip60-HA fly line was used to identify Tip60 binding partners. HA tag, derived from the human influenza virus, allows for detection of specific binding due to its unique antibody. Tip60-HA can be expressed by crossing the UAS-Tip60-HA fly line with the ELAV-GAL4 fly line. Adult heads of the F1 generation were used for the downstream experiments. Due to the abundance of Tip60 in the nucleus, nuclear and cytoplasmic fractions of protein were isolated and an Immunoblot was performed to detect the target proteins. Tip60 (endogenous; anti-Tip60 antibody), positive control (HA-tagged protein) were identified but Tip60-HA (exogenous; anti-HA antibody) was not detected. The phenotype of the F1 generation was different from their parents'. Future research will entail designing primers to amplify Tip60-HA, and conducting a qPCR to identify the presence of genetic material of Tip60-HA.

SHREYA SRINIVASAN

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Co-Mentor: Mariah Beaver

THE ROLE OF MISREGULATED GENES HSC 70-3, CYP1, AND CNX99A IN DROSOPHILA LARVAE BRAINS

Alzheimer's Disease (AD) is a neurodegenerative disorder that destroys a person's cognitive ability. This disease is caused by cell death where the tissue contains fewer neuronal synapses than a healthy brain. When the Amyloid Precursor Protein (APP) in human brain cells are improperly cleaved, AB fragments are generated resulting in AB plaques. These plaques are an established marker for AD in human brains. We hypothesize that genes misregulated in AD human brains may play an early role in AD development causing a decrease in cognition. We explored the role HSC 70-3, Cyp1, and Cnx99a in the drosophila larvae brain. HSC 70-3 has been shown to play a supportive role for the progression of tau phosphorylation (a hallmark of AD) and neurodegeneration. Cyp1 is a gene involved with cell death in neurons. Cnx99a is a gene found in patients diagnosed with AD. We hypothesize the knockdown disease model flies would be unable to successfully identify odor using olfactory and gustatory senses, like early stage AD patients. However, our results produced data which indicated that the HSC 70-3, Cyp1, and Cnx99a genes did not influence early on-set AD suggesting that they play a role in later onset symptoms of AD.

MERRY XIANG

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Biological Sciences

Faculty Mentor: **DR. FELICE ELEFANT**
Biology

Co-Mentor: Ellen Armour

THE MISREGULATION OF TIP60 IN THE TAU DROSOPHILA ALZHEIMER'S DISEASE MODEL

Alzheimer's Disease (AD) is a prevalent neurodegenerative disorder. A common feature of AD in the brain is neurofibrillary tangles, which block axonal transport of neurons due to hyperphosphorylation of the Tau protein. Through the examination of the Tau fly line, a Drosophila AD model, it is possible to see if there are cognitive defects resulting from decreased levels of the histone acetyltransferase Tip60. Histone acetylation is an important epigenetic regulatory mechanism, so the misregulation of Tip60 is thought to play a role in AD. This project investigated whether the Tau fly model exhibits a neurodegenerative phenotype and whether this phenotype is due to misregulation of Tip60 and its target genes. Behavioral assays including learning and memory, gustatory, and olfactory were conducted to test the cognitive defects of the Tau model. qPCR was used to determine expression levels of Tip60 and its target genes. Our results show that the Tau model has decreased cognitive abilities in comparison to the wild type, and this is likely due to misregulation of Tip60. Further work should investigate if overexpression of Tip60 can rescue the disease phenotype in the Tau model.

HIEU JEROMY

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Faculty Mentor: **DR. DENISE GARCIA**
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Co-Mentors: Pooja Sakthivel, Katherine Shepard

ACTIVITY-DEPENDENT CHANGES IN SONIC HEDGEHOG-RESPONDING ASTROCYTES THROUGHOUT THE CORTEX

Synaptic plasticity allows neurons to respond to new experiences by altering how they communicate with each other. Astrocytes found throughout the central nervous system, communicate with neurons and are known to be involved in synaptic plasticity. Neuron-astrocyte communication can provide insight into the molecular mechanisms that regulate neuroplasticity. Sonic Hedgehog (Shh) signaling provides an example of neuron-astrocyte communication: a subpopulation of cortical astrocytes, localized to the deep layers, responds to Shh from a neuronal source. Data from our lab has shown that in an enriched environment (EE), consisting of access to toys and a running wheel, leads to an increase in the number of these astrocytes responding to Shh. We hypothesize that, in EE, the distribution of these astrocytes changes, spreading from deep layers into the superficial layers. In this study, we quantified the number of Shh-responding cells in the deep layers and superficial layers of the cortex after EE compared to standard conditions. Preliminary data suggests that there is no change in layer distribution of Shh-responding cells after EE, suggesting that the increased neuron-astrocyte communication observed after EE occurs in the same layer.

ANJALI PRADHAN

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Co-Mentors: Pooja Sakthivel, Katherine Shepard

NEURAL ACTIVITY INCREASES NEURON–ASTROCYTE COMMUNICATION

Sonic hedgehog (Shh) signaling is well known to be involved in central nervous system (CNS) development, although its role in regulating neuron-astrocyte communication is less well understood. Past work found a subpopulation of cortical astrocytes in the adult cortex that responds to Shh from a neuronal source. Recently, we found that exposing mice to an enriched environment (EE), defined as access to toys and a running wheel, results in an increase in the number of cells responding to Shh signaling. Taken together, this data suggests the possibility of activity-dependent signaling between astrocytes and neurons mediated by Shh. We hypothesize that this is due to increased neural activity following EE, leading to an increased astrocyte response. In this study, we identified the increased number of cells responding to Shh using cell identity markers Sox9, NeuN, and Olig2. Preliminary data suggests that, following EE, a greater number of astrocytes are responding to Shh signaling. The identification and quantification of the cells responding to Shh will strengthen our understanding of the role of Shh and how it regulates neuron-astrocyte communication.

NIDHI PATEL

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Co-Mentor: Mingjie Ying

A NOVEL NEUROPROTECTIVE FUNCTION OF PERK IN GROWTH FACTOR LOCALIZATION IS MEDIATED BY THE CALCINEURIN/CAMKII PATHWAY

Genetic variants in the ER stress sensor protein PERK are risk factors for neurodegenerative diseases tauopathy and Alzheimer's disease(AD). Until recently, it was thought that excessive activation of PERK leads to neurodegeneration. However, new data show that the PERK risk alleles decrease, rather than increase, PERK activity. The mechanism by which decrease in PERK activity contributes to disease is unknown.

Our lab discovered that PERK is required for correct localization of growth factors(GFs) DAF-28(IGF) and DAF-7(TGFβ) in neurons. When PERK is deleted in C. elegans, DAF-28 accumulates in the cell body while DAF-7 mislocalizes to the axons. Because the GFs are neuroprotective, the loss of function of PERK may be contributing to neurodegeneration by altering their trafficking.

I am testing the hypothesis that PERK's role in GF localization is mediated by the calcineurin(CaN)/CamKII pathway. CaN is a known PERK target and this pathway is important in neurons. Indeed, the loss of CamKII reverses the GF mislocalization caused by deletion of PERK. I am using loss and gain of function alleles in CaN and CamKII to genetically test this pathway. Identifying the correct pathway will provide drug targets for treating tauopathy and AD.

ANH QUACH

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Faculty Mentor: **DR. SUSAN GURNEY**
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Co-Mentor: Dr. Svetlana Khakina

ELUCIDATING THE EFFECTS OF BACTERIOPHAGE LYSIN CASSETTE GENES ON MYCOBACTERIUM SMEGMATIS AND MICROBACTERIUM FOLIORUM HOSTS.

Bacteriophages (phages) are viruses infecting and lysing bacteria, forming plaques on a bacterial lawn. Mycobacteriophage Larva, which infects Mycobacterium smegmatis, has a lysin cassette that includes Lysin A, Lysin B, and holin genes, which are involved in host lysis and generate uniform sized plaques. Microbacteriophage Pherbot generates plaques of varying sizes on a Microbacterium foliorum lawn and contains a gene of no known function (PHERBOT_25) in place of Lysin B. We aim to investigate the function of this gene by employing molecular biology techniques and phenotypic assays. Lysin cassette genes of both phages were transformed and individually expressed in bacterial cells, and differential cytotoxicity of these genes was evaluated. None of the Larva genes demonstrated any cytotoxicity for M. smegmatis hosts. Surprisingly, Pherbot Lysin A demonstrated high levels of cytotoxicity when expressed in M. smegmatis. This data suggests that PHERBOT_25 is not required for cell lysis and most likely not expressed. A two-hybrid assay will be performed to verify the hypothesis. The result of this study will facilitate further understanding of phages' lytic and cytotoxic abilities which may aid in combating antibiotic resistance.

ISABELLA MANCINI

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Faculty Mentor: **DR. DANIEL R. MARENDA**
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Co-Mentor: Edward Waddell

INVESTIGATING THE EFFECTS OF 1700 FDA APPROVED DRUGS ON PRONEURAL PROTEIN KNOCKDOWN IN DROSOPHILA MELANOGASTER

Basic Helix-Loop-Helix (bHLH) proneural proteins comprise a superfamily of transcription factors that are critical to early development. This superfamily includes the Daughterless (Da) gene in Drosophila melanogaster, the fruit fly, and the homologous TCF4 gene in mammals. These genes have many essential functions in sex determination, cell proliferation, muscle development, and neurogenesis. In addition to these roles in development, our laboratory has shown that both Da and TCF4 function in mature, differentiated neurons, where they restrict neurite branching and synapse number. Knockdown of Da thus results in decreased motor function, a readout of proper glutamatergic neurotransmission. These results are important because mutations in TCF4 have been associated with the neurodevelopmental diseases Pitt-Hopkins syndrome and schizophrenia. The purpose of this research is to screen 1700 FDA approved drugs in our Da knockdown model with the hope of using this information to better determine future therapy for individuals with Pitt-Hopkins and schizophrenia.

JORDYN D. F. CALDWELL

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Faculty Mentor: **DR. RYAN J. PETRIE**
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Co-Mentor: Tia M. Jones

ANILLIN MAY CONTROL ACTOMYOSIN CONTRACTILITY DURING CELL MIGRATION

A cancer cell's ability to migrate through a three-dimensional (3D) matrix drives cancer metastasis. Therefore, understanding the molecular mechanisms of 3D migration is essential to blocking metastasis. For cells to move, they must rearrange their cytoskeleton, a network of filaments that helps maintain cell shape and generate force. This force is generated by the contraction of actin and myosin II containing filaments under the control of the small GTPase, RhoA. It's unclear what activates RhoA and actomyosin contractility during 3D migration. Our initial data suggested the cytokinetic protein anillin was a candidate to control this pathway. We found that in cells on a two-dimensional surface, anillin is predominantly localized to the nucleus. Remarkably, anillin is translocated to the cytoplasm in cells moving through 3D collagen. This cytoplasmic localization is consistent with when anillin is triggered during mitosis, suggesting it could coordinate cytoplasmic contractility during 3D movement. Hence, we hypothesize that anillin helps create the intercellular force necessary for 3D migration. This work could potentially open the door to new therapies and medications that target abnormal cell motility and tumor growth.

CIARA DANAE BUDD

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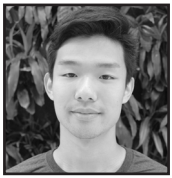
Faculty Mentor: **DR. NIANLI SANG**
Biology

ROLE OF CYTOPLASMIC HDAC5 IN CANCER CHEMORESISTANCE

Histone deacetylase 5 (HDAC5) shuttles between the nuclei and the cytoplasm and deacetylates specific proteins. Previous work showed that nuclear exporting of HDAC5 promotes cell adaptation to metabolic stress, hence enhancing cell survival by facilitating HIF-1a maturation and ATP production. We hypothesize that constitutive expression of HDAC5 in the cytoplasm plays a critical role in cancer chemoresistance. We constructed two HDAC5 mutants which exclusively localized to cytoplasm and the nucleus respectively and isolated stably transfected clones by a G418 selection approach. Primary characterization reveals that cells expressing cytoplasmic HDAC5 correlating with the formation of multi-nucleated, slow proliferating cells. The genotype and expressing status of HDAC5 will be confirmed by genomic PCR and western blot, and potential effects on cancer cells*f??* response to chemotherapy and metabolic stress will be investigated. This study may potentially pave a way to improve chemotherapy and minimize side effects of classical chemotherapies.



KEVIN ZHAO

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Biology

CNE-2 CELL LINE CHARACTERIZATION

Nasopharyngeal carcinoma (NPC) is a major type of cancer in Southeast Asian associated with EBV infection, but NPC cell lines for research use is very limited. Since its establishment in 1983, CNE2 has been used in numerous studies. Initially, CNE2 was reported as a pure line representing poorly differentiated EBV+ NPC. However, it is recently reported that CNE2 contains multiple types of cells which be resulted from HeLa contamination, hence complicating the interpretation of data obtained from CNE2 and restricting its future use in research. Our goal is to isolate subclones from individual cells of the original CNE2 and determine their identity and characteristics with various molecular and cellular approaches. We have isolated 5 apparently distinct subclones from CNE-2 and determined their EBV/HPV status by genomic PCR. Primary characterization has provided evidence that some subclones exhibit different biological responses to wound healing test, chemotherapy, and metabolic stress. We continue to run wound healing assays under specific conditions such as metabolic stress and exposure to drugs to farther characterize these subclones. These sub-lines will provide useful models for NPC research.

SAMUEL BEANE

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Biological Sciences

Faculty Mentor: **DR. ALEISTER SAUNDERS**
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INVESTIGATING THE EFFECTS OF G-QUADRAPLEX MEDIATED REGULATION OF APP GENE EXPRESSION IN ALZHEIMER'S DISEASE

Alzheimer's disease(AD), a progressive neurodegenerative disorder, is a leading cause of death in the United States. AD is associated with the accumulation of amyloid β plaques (Aβ) in brain, leading to loss of neuronal function. Aβ plaques result from proteolytic Aβ peptide, a product of the amyloid precursor protein(APP). Increased expression of APP is correlated with an increase in Aβ. Thus, it's important to understand how APP gene expression is regulated. In the 5' and 3'UTR of the APP mRNA there are regulatory sequences that affect the stability,structure and translation of APP mRNA.

Guanine(G)quadruplexes are stable secondary structures with RNA sequences containing repeating guanine tetrads and they could provide a better understanding of APP gene expression. We used two luciferase reporter constructs: a human wild-type APP 3'UTR sequence placed after the stop codon of firefly luciferase gene, and a mutant form of the construct with mutated 3'UTR G-quadruplex sequence. Luciferase assays were conducted in HEK 293 cells transfected with these constructs and then normalized to mRNA levels in the cells. These experiments will help determine the consequences of disrupting the 3'UTR G-quadruplex sequence on APP gene expression.

MICHELLE LAU

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Faculty Mentor: **DR. ELIAS T. SPILIOTIS**
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Co-Mentor: Megan Radler

EFFECTS OF SEPT7 AND SEPT9 KNOCKDOWN ON NEURITE GROWTH CONE MORPHOLOGY AND AREA

Neurons are the building block cells of the nervous system. Neurons develop protrusions that branch off from the main cell body and termed neurites. Neurites grow and differentiate into neuronal axons and dendrites, which allow neurons to communicate with one another through the formation of synapses. At the tip of neurites, a structure known as the growth cone drives the growth and directionality of neurite elongation. Growth cones consist of the dynamic cytoskeletal polymers of actin and microtubules, which are essential for neurite growth and directionality of movement. Recently, a group of GTP-binding proteins called septins have been discovered to localize with actin and microtubules. This study aims to gain a better understanding of how septins coordinate actin and microtubules shift in determining growth cone morphology in the early stages of neuronal morphogenesis. Using immunofluorescent staining, our results show that septin 7 and septin 9 are critical for the morphology and area of growth cones in neurons of different stages of development. Our data indicate that septin 7 and septin 9 are critical for the organization of growth cone actin and microtubules and neurite development.

CAROLINE ADAMS

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Chemistry

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Chemistry

DETECTING POLLUTANT EMISSIONS FROM THE PETROCHEMICAL INDUSTRY IN PHILADELPHIA

Two classes of airborne pollutants of concern are volatile organic compounds (VOCs) and toxic acid vapors, both of which can be emitted from vehicles and oil refineries. Two methods were used to sample outdoor air. A solid-phase microextraction (SPME) device coupled to a gas chromatograph-mass spectrometer (GC-MS) was used to measure VOCs; however, high background signals likely resulting from septum and column bleed led to insufficiently low detection limits. Identifying these issues advances future work that may be done. An iodide chemical ionization mass spectrometer (CIMS) was used and detected gaseous hydrogen fluoride (HF) and isocyanic acid (HNCO). If verified, the likely source of HF is the Philadelphia Energy Solutions refinery, part of which exploded in June. HNCO concentrations in ambient air range up to 124 ppt based on instrument sensitivities estimated from prior studies. Future work will focus on calibrating the CIMS and investigating if the instrumental "zero" was measured correctly. Although the HF concentrations detected are likely too low to cause adverse health effects, their mere presence indicates that detection of this toxic compound merits further quantification.

AMANDA MILO

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Communication

Faculty Mentor: **DR. RONALD BISHOP**
Communication

RUNNING THE BASES BACKWARD: EXPLORING THE EVOLUTION OF SPORTS JOURNALISM'S COVERAGE OF MENTAL ILLNESS

Sports journalists have been writing about athletes' lives on and off the field for over a century. Today, there has been an increase in awareness of mental health in sports. The awareness has spread from outspoken athletes such as Kevin Love, an NBA player who went public with his depression in a 2018 interview. However, as groundbreaking as this is in the world of sports, mental health is not a new concept. In fact, sports writers often singled out athletes with mental illness for their "abnormal" behavior. They coined offensive terminology or attempted to make the athlete appear as "normal" as possible. This is furthered by the hegemonic masculinity ingrained in the tradition of sports. The misconception that mental illness makes a person weak has lead to many athletes verbally suppressing their illness. This has given us an opportunity to go into the archives of old newspapers and highlight the diction used by sports journalists to describe an athlete with mental illness. While this project spans over many decades, I have chosen to research two athletes from the 2000s: Ron Artest and Zack Greinke. With this information, we hope to impact the sport industry by changing future coverage of athletes suffering from mental illness.

ABIGAIL HAAS

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Faculty Mentor: **DR. ALEXANDER JENKINS**
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Co-Mentor: Dr. Hilde Van den Bulck

THE TRIANGLE EFFECT: WHAT IS CELEBRITY ATHLETE'S ROLE IN SOCIETY?

Using a framing approach, this project analyzes a sample of sports celebrities, media outlets, and audience reactions to better understand the triangle relationship in the creation of celebrity. While celebrity generally is considered an important part of contemporary culture and society, its exact role in media remain under-explored, a knowledge gap this study helps to fill.

The paper combines insights from celebrity, media, sports, and journalism studies. In particular, it considers celebrity as a construct resulting from continuously negotiated relations between a sports celebrity, the media, and audiences. Empirically, the study analyzes a sample of online news coverage and audience reactions for high-profile sports celebrities from various disciplines. Data identifies the problem, cause, solution and moral evaluation.

The analysis is ongoing. Results will elaborate on how different media outlets (mainstream vs. gossip) frame athletes actions, words, attitudes, and how audiences react. Furthermore, we analyze how celebrity athletes use social media to endorse political, social and health-related causes. The study contributes to understanding the role of media in the relationship between celebrity athletes and audiences.

MADELINE G. LARKIN

Pennoni Honors College
Custom-Designed Major

Faculty Mentor: **DR. ROBERT KANE**
Criminology & Justice Studies

THE POLICE–NURSE COMMUNITY HEALTH PARTNERSHIP

Many people in vulnerable communities are in a "Calm-to-Crisis" health cycle. They live in a calm state (don't need acute health resources) until they experience a health crisis and call 911. These people use ER services as pseudo primary care providers as they don't often have a primary care provider (PCP). This causes early mortality and large societal economic costs through federal healthcare dollars. The Police-Nurse Community Health Partnership (PNCHP), which I've been researching with Dr. Kane, is an emerging field trial that hopes to help people break this cycle.

The PNCHP will use police officers as case finders while on routine patrol duties to find people in calm states. Police will ask these people a few questions to assess risk of nearing hospitalization. Officers send results to the nurse-care coordination team, who will then make a home visit to enroll residents in the 12-week intervention, if eligible. The PNCHP will help participants find a PCP, increase self-efficacy and health literacy, and self-manage symptoms, all with the main goal to reduce 911 calls and risk of hospitalization. It will also help police better understand their community-health roles and improve police legitimacy among community members.

ABIGAIL KELLER

College of Nursing & Health Professions
Heath Science

Faculty Mentor: **PROFESSOR JILL MOSES**
English & Philosophy

Co-Mentor: Dr. Danielle Cullen

ANALYZING THE USAGE OF SUMMER LUNCH PROGRAMS IN PRIMARY CARE SETTINGS

Summer is a challenge for food insecure families who depend on free lunches during the school year for their children. During the summer of 2017, Complete Eats, a Summer Food Service Program (SFSP) was started by Dr. Danielle Cullen, who is affiliated with the primary care settings at CHOP. Including CHOP's current four sites in primary and subspecialty care locations, there are over 1000 SFSP's in Philadelphia. However, studies show that only 1 in 7 children who are eligible for free meals over the summer receive them. In addition to providing free lunches, another initiative of Complete Eats is to collect data of the participants to understand why children are not being connected with the resources available to them.

After a child receives a meal, their caregiver is recruited for participation in a survey about their prior knowledge of SFSPs, difficulties they encounter finding a site near them, and their intention to use an SFSP in the future. Follow-up surveys are collected via call and text to see how many times a family used an SFSP 30 days after their initial visit to CHOP. This research is being performed to see if providing information about SFSPs at primary care settings will increase the use of SFSPs in Philadelphia.

ARATHI PILLAI

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **DR. LLOYD ACKERT**
History

AN ARCHIVAL EXPLORATION OF RUTH PATRICK'S ENVIRONMENTAL ADVOCACY IN THE 1970–1980S

Ruth Patrick (1907-2013) was an environmental scientist whose interdisciplinary approach to ecology and environmentalism engendered a profound sense of environmental advocacy. Remarkably as a female in a predominantly male dominated field, Patrick was considered one of the top ecologists in the 20th century. She spent her entire career at the Academy of Natural Sciences, where her major contributions included novel approaches to studying rivers and especially diatoms. Her development of "The Patrick Principle" played a pivotal role in environmental advocacy as it emphasized measuring the health of ecological systems.

My reading of her correspondence, scientific publications, and memorabilia – in the context of the secondary historical literature – reveals her unique ability to cross institutional boundaries, uniting government, industry, science, and the general public. Central to my investigation is how Patrick's ecological research represents a synthesis of her scientific innovations in ecology, strong organizational abilities, and gregarious personality facilitated a new approach to advocacy during the environmental movement of the 1970-1980s.

JULIANA WALLGREN

College of Engineering
Electrical Engineering

Faculty Mentor: **DR. KATHRYN STEEN**
History

FLEXIBLE SPECIALIZATION AND PUBLISHING IN EARLY 19TH CENTURY PHILADELPHIA

In the 1980s, historian Philip Scranton described a form of industrial organization known as flexible specialization. In contrast to the reigning theory of mass production, which centered on large volumes of standardized goods, Scranton claimed that some businesses thrived by being able to produce a range of specialized, built-to-order items. Scranton applied this idea to Philadelphia, focusing on textiles, steel, and other traditional manufacturing industries while developing and proving his idea of flexible manufacturing. However, one field Scranton identified as important but excluded from his thorough investigation was Philadelphia's printing and publishing sector. This project explores the Carey & Lea publishing house during the late 18th and early 19th centuries, evaluating the company's business decisions against Scranton's theory of flexible specialization. We used records housed in the Historical Society of Pennsylvania archives. As the present-day economic and industrial landscape becomes more complicated, it is necessary to consider a variety of approaches to producing and marketing output, and understanding the applications of flexible specialization offers insight into Philadelphia's past successes and failures.

MICHAEL BECHT

College of Arts & Sciences
Mathematics

Faculty Mentor: **DR. PAVEL GRINFELD**
Mathematics

NUMERICAL SEMIGROUPS IN POLYNOMIALS

We have formulated a hypothesis that connects to complex polynomials and numerical semigroups. The study of numerical semigroups arises in the solution of so-called "coin problem" that asks for the largest monetary amount that cannot be obtained using only coins of specified denominations. That amount is known as the Frobenius number. The amounts that are obtainable are said to form a numerical semigroup. For a given Frobenius number, a numerical semigroup that correspond to the fewest number of unobtainable amounts, known as "gaps", is called irreducible. We have observed that the critical values of complex polynomials whose terms correspond to the gaps of irreducible numerical semigroups exhibit a number of special properties. Our hypothesis, therefore, has the potential to connect two mathematical fields previously believed to be completely unrelated.

MICHAEL DAVID QUILLEN, JR.

College of Engineering
Engineering

Faculty Mentor: **DR. HUGO J. WOERDEMAN**
Mathematics

CONSTRUCTING A SOLUTION TO A. HORN'S PROBLEM

In 1962, A. Horn proposed certain inequality conditions three n-tuples must satisfy for Hermitian matrices A and B to exist with the given n-tuples as the eigenvalues of A, B, and A+B. A. Knutson and T. Tao proved Horn's conjecture in 1999, but their proof was not constructive. More recently, Professors Lei Cao and Hugo Woerdeman devised a constructive linear algebraic proof for the cases $n \leq 3$ by relating Horn's problem to real zero polynomials. In this project, we set out to reduce the quadratic constraints present for $n>3$ to linear constraints and thereby extend Cao and Woerdeman's proof for Horn's conjecture to $n>3$. However, we discovered that in addition to increasingly complicated quadratic constraints, for each $n>3$ the number of variables increasingly exceeded the number of constraints. As a result, we began forming an entirely new linear algebraic proof. We viewed matrix A as a diagonal matrix with its ordered eigenvalues along the diagonal and B as the product of a unitary matrix, a diagonal matrix of eigenvalues, and the unitary matrix inverse. Constructing unitary matrices from products of rotation matrices allowed us to explore the relationship between the angles and Horn's inequalities.

ADAM J. DUNLOP

College of Arts & Sciences
Physics

Faculty Mentor: **DR. MICHELLE DOLINSKI**
Physics

Co-Mentors: Erin Hansen

MEASURING BEHAVIOR OF CHARGED DAUGHTERS IN EXO-200

The Enriched Xenon Observatory, or EXO-200, was an experiment designed to observe the rare radioactive decay of xenon-136. Normally this decay releases two electrons and two neutrinos, but EXO-200 aimed to observe a decay event where only two electrons are released. Observing this decay would prove that the neutrino is its own antiparticle, both matter and antimatter at the same time. Such a discovery would be groundbreaking and would pave the way for new discoveries in particle physics.

After an exciting multi-year run, EXO-200 was shut down in late 2018, with plans to be replaced by a much larger detector, nEXO. Before retiring EXO-200, scientists used the device to make some final measurements of radon decay. My job has been to optimize the data selection from the radon measurements by using data analysis techniques to maximize the ratio of signal to background. This data will be used to model how the charged particles resulting from radioactive decay behave in a detector like EXO-200 or nEXO.

SEBASTIAN WIGGINS

College of Engineering
Chemical Engineering

Faculty Mentor: **DR. MICHELLE DOLINSKI**
Physics

DESIGNING AND SIMULATING THE OPERATION OF THE CRYOGENIC SYSTEM FOR THE NEXO PROJECT

The nEXO project aims to observe neutrinoless double beta decay, an extremely rare type of radioactive decay not yet proven to exist, in xenon. This type of decay is unique because it relies on neutrinos being their own antiparticle. If observed, this event would allow physicists to explain more about the origin of all matter in the universe. 5 tonnes of xenon for the experiment need to be cooled to around -100°C in order to keep them in the denser liquid state. Because of the scale of the project, as well as the sensitivity, the cryogenic system for the experiment has to be carefully designed. A current proposal for the initial cooling of the xenon is to circulate HFE-7000, a heat transfer fluid, to a heat exchanger far enough from the detector equipment to reduce its radioactive interference with the experiment. I created various models for such a recirculation system using SolidWorks, a computer aided design and simulation software. I had to account for the fact that the system would run both at the initial room temperature and the final cold state. This affects characteristics of the fluid such as density and viscosity. I compared the results of the simulation to aid in final design choices.

HELEN ROSENBRIEN

College of Arts & Sciences
Physics

Faculty Mentor: **DR. FRANK A. FERRONE**
Physics

THE OXYGEN SPONGE

Sickle Cell Disease (SCD) is a blood cell disorder in which red blood cells sickle and become rigid, which can cause clogged blood flow. This results in tissues not receiving oxygen carried by these red blood cells, destroying the tissues. SCD is diagnosable when a blood sample has no oxygen in it, as this is when it polymerizes and rigidifies. One can see this result visually through deoxygenated sickle blood traveling up a 0.25μL glass capillary significantly slower than healthy blood. Previously, the deoxygenation of blood has been achieved using added chemicals. Using nitrogen and Teflon tubing, I attempted to create a way to gas deoxygenate blood to be tested for SCD without the extra steps the use of chemicals demand. By dropping blood into the center of porous Teflon tubing encased in a sealed vial of nitrogen, oxygen is released through the pores of the Teflon without the blood following it, as Teflon is hydrophobic. In this way, the Teflon works as an oxygen sponge, absorbing the oxygen from the blood, leaving behind deoxygenated blood. By creating a repeatably conclusive experiment, the results from my research could be used to create a simple and cost-efficient blood test to determine if one has Sickle Cell Disease.

VELAY FELLOW

CHRISTOPHER MORRIS

College of Arts & Sciences
Physics

Faculty Mentor: **DR. STEPHEN MCMILLAN**
Physics

FINDING PAST INTERACTIONS OF OUR SUN THROUGH SIMULATING ORBITAL DISTRIBUTIONS OF TRANS-NEPTUNIAN OBJECTS

The Kuiper belt consists of thousands of low mass objects orbiting between 30 and 50 au from the sun. Because of their low mass, Kuiper belt objects have little gravitational attraction with each other, meaning that their orbital states are based mainly on their past interactions with objects outside the belt. Our Sun was formed in a star cluster, so it has had many interactions with other stars. The Kuiper belt formed early in the formation of the sun and existed during these interactions, so we may be able to clarify the characteristics of the interactions by using the Kuiper belt. We simulated millions of interactions using the AMUSE framework and the Huayno integrator. Each simulation consisted of the Sun, an incoming star, and, because they are gravitationally independent, a single Kuiper belt object. The parameters for the incoming star and Kuiper belt object were systematically controlled to see if any produced distributions of Kuiper belt objects similar to that of our own Kuiper belt. Our simulations were done with a small number of different parameters, so in order to get a better understanding and more conclusive results, simulations would have to be done over every single parameter.

RAFAY AHMED

College of Computing & Informatics
Computer Science

Faculty Mentor: **DR. RUSSELL NEILSON**
Physics

ANALYZING IBD-LIKE BACKGROUND EVENTS IN THE PROSPECT DETECTOR

Neutrinos are elementary particles which interact only via weak subatomic forces or gravity. Scientists today are working to detect a new particle called the 'sterile' neutrino which does not interact with matter, making it very difficult to observe. Recent antineutrino experiments have produced a deficit in the detected flux of observed neutrinos as compared to the predictions. This 'Reactor Flux Anomaly' has led to an intriguing question - are antineutrinos transitioning to sterile neutrinos due to neutrino oscillations?

The PROSPECT team is working to address this question through its reactor experiment where neutrinos are detected by inverse beta decay (IBDs), generating a broad spectrum of neutrino energies. My research in particular is based on investigating the energy spectrum which subtracts background events which resemble IBDs using the data taken when the reactor is turned off. The focal point of my research is an anomalous region in the spectrum which originates due to an excessive subtraction of background events from total neutrino interactions. Resolving this issue would help the team get a better understanding of the events in the region and make any necessary corrections to the experiment.

DECLAN MCCLOSKEY

College of Engineering
Electrical Engineering

Faculty Mentor: **DR. RUSSEL NEILSON**
Physics

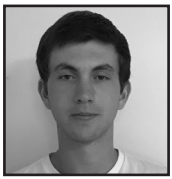
Co-Mentor: Matthew Bressler

A STUDY ON THE IMPACT OF HIGH-Z CONTAMINANTS ON THE GAMMA BACKGROUND REJECTION CAPABILITIES OF BUBBLE CHAMBERS

Recent research by the PICO collaboration suggests that trace amounts of Iodine caused a deviation from their ionization model of nucleation in C3F8 bubble chambers, devices designed to detect WIMPs in a search for dark matter. Since high-z elements like Iodine can produce significant local energy through an Auger cascade, they propose that bubble nucleation through Auger processes is dominant over ionization nucleation when available.

These findings motivate the spiking of the Drexel Bubble Chamber with contaminants to observe an impact on its gamma background rejection. Argon was chosen as the first element to test, and is added incrementally to the chamber to observe its effects. It's theorized that the possibility for an Auger cascade due to K shell electron photoabsorption causes a higher gamma induced nucleation rate. Xenon spiking will soon be tested for the same reasons.

Additionally, a previous model of the chamber utilizing GEANT4, a particle tracking monte carlo simulation, is updated to reflect recent construction changes as well as the gamma source used in testing. This model is then used to aid in the interpretation of data from the Argon spikes by simulating events and evaluating the Auger cascade model's validity.



TREVOR MCCAFFREY

College of Arts & Sciences
Physics

Faculty Mentor: **DR. GORDON T. RICHARDS**
Physics

Co-Mentor: Dr. Amy E. Kimball

EXPLORING THE ORIGIN OF RADIO EMISSION IN QUASARS

The brightest known phenomena in the universe are quasars -- which is short for "quasi-stellar radio sources". A quasar is essentially a galaxy with a super massive black hole in the center of it accreting material, which in turn emits a broad band of light across the entire electromagnetic spectrum.

However, our understanding of the physical mechanisms behind the radio emission in quasars has remained rather primitive since the discovery of quasars as radio sources in 1963. To gain a better understanding of these mechanisms, we analyze a set of 48 different quasars at redshift z=1.6 drawn randomly from different corners of a parameter space determined by a machine learning algorithm applied to the optical and UV spectra of quasars that were observed as part of the Sloan Digital Sky Survey.

The observed radio from our 48 targets is taken from the Very Large Array in New Mexico and observed by us using the Common Astronomy Software Application (CASA). By studying how the type, and strength, of radio emission spans across this parameter space, we aim to gain a better understanding of what further observations may need to be made in a larger survey to expand our knowledge on the mechanisms behind the radio emission in quasars.

MARÍA PAULA MIJARES

College of Arts & Sciences
Communication

Faculty Mentor: **DR. ZOLTAN BUZAS**
Politics

THE UNIVERSAL PERIODIC REVIEW, FREEDOM OF EXPRESSION AND ITS CORRUPTION IN LATIN AMERICA

What does the UN Human Rights Council's Universal Periodic Review (UPR) tell us about freedom of expression in Latin America? Is there any relationship between the level of corruption in these countries and their freedom of expression? Some studies have examined the UPR, while others have analyzed issues regarding corruption or the freedom of expression in Latin America. But, to our knowledge, there are no studies linking together the UPR, the freedom of expression, and corruption in these countries. This research aims to fill this gap. I have read over 342 UPR documents regarding 19 Latin American countries, and coded for a number of issues regarding the right to freedom of expression such as the number of recommendations made about this right, and I compared this information to other indexes that evaluate Latin American countries' record on the freedom of expression and the level of corruption in these states. The study provides two types of findings: one is to offer an overall view of Latin American countries' UPR records regarding the freedom of expression, another is to explore the relationship between this right and the level of corruption in these countries.

SOUKAYNA MARDAS

College of Arts & Sciences
Physics

Faculty Mentor: **DR. RICHARDSON DILWORTH**
Politics

THE THREAT OF SEA LEVEL RISE ON LOW-LYING COASTAL CITIES

With rising sea levels, low-lying coastal cities risk damage and property value loss. While climate change has been an existing problem, new research shows that it has the possibility to affect all aspects of life. Previous research has helped identify how climate change affects flooding and sinking cities, but has not studied how these aspects affect individual properties. Rising sea levels pave the way for increased flooding and therefore have the ability to change property values in threatened cities. Examining exactly which cities are most endangered allows lawmakers, in correspondence with contractors and builders, to target damage and work proactively. This study investigated 9 North American cities that have faced rising sea levels in recent years and delved into how administrations are responding to this danger. Researchers studying Growth Machines in these at-risk cities allow residents to see which local governments are willing to start combating climate change, and which ones are willing to succumb to property value loss. This research is especially important for city officials and building associations. Protecting property values in these cities would include adaptive infrastructure and new housing.

USWA MUTAAL

College of Arts & Sciences
Political Science & Economics

Faculty Mentor: **DR. AMELIA HOOVER-GREEN**
Politics

HOW DO RELIGIOUS ELITES EVADE ACCOUNTABILITY IN SECULAR STATES?

There exists a robust literature on the relationship between developing states and traditional elites. However, very few scholars have examined the ways in which traditional elites maintain power in strong states. In the United States, for example, the Constitution and judicial system offer religious institutions some exemptions and freedoms, including the ability to lobby and "institutional access". In this article I ask: How do these liberties allow religious institutions in strong states to create and maintain their own parallel systems of governance? Additionally, I ask: how do religious institutions maintain public legitimacy in strong states, despite usurping some state functions, and evading legal accountability in cases of outright breach of the law? To answer this set of questions, I undertake a comparative case study of sexual abuse scandals in the Roman Catholic Church and the LDS Church. I analyze data sources including investigative journalism and internal Church documents to track recurring patterns in religious leaders' responses to sexual abuse within their churches, in order to maintain their "moral authority" while evading accountability by secular law.

MEDINA TALEBI

College of Arts & Sciences
Political Science

Faculty Mentor: **DR. AMELIA HOOVER-GREEN**
Politics

MAPPING THE NARRATIVE OF SHIA GENOCIDE

A small transnational cadre of activists is working to reframe violence experienced by Shia Muslims as genocide. But the Shia genocide framing has yet to gain wider traction. Why? In this article I map this emerging, transnational social movement, with the aim of better understanding its organization, prospects, and limitations. I draw on data from nine original interviews with activists, academics, and religious leaders, as well as secondary sources about violence against the Shia. I find that key stakeholders disagree significantly about the appropriate framing of violence experienced by the transnational Shia community. I demonstrate that organizing around the "genocide" label contrasts significantly with the locations of targeted violence. And I argue that the absence of a consensus among these groups — not an absence of violence — is a key reason why the Shia genocide framing has struggled thus far. This issue of framing is crucial because it shapes discourse surrounding mass violence and ultimately, the possibility of formulating solutions.

ATHARVA BHAGWAT

College of Arts & Sciences
Environmental Studies & Sustainability

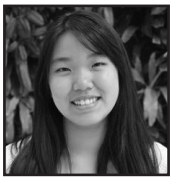
Faculty Mentor: **DR. ALISON KENNER**
Politics; Center for Science, Technology, & Society

UNSEEN: THE FIGHT FOR BREATH IN PHILADELPHIA

Philadelphia is consistently identified by regulatory agencies as a city with poor air quality. Public health experts connect the city's poor air quality with the local asthma epidemic and other socioeconomic inequities. As many as 1 in 5 children have asthma, for example, and the percentage of adults suffering from respiratory illnesses is staggering as well. Numbers don't tell the story of air quality's impact like people do, however. Using ethnographic methods, this project investigated the impact that air pollution has on Philadelphians' homes, neighborhoods, and work environments.

My work engaged with three cases of air pollution in Philadelphia: the PES refinery in Southwest Philadelphia; a community air monitoring project in Kensington; and community-based climate education workshops held in low-income neighborhoods. Data was collected using participant observation, in-depth interviews, and analysis of news articles and social media trends.

Our findings show that even when technology is implemented to address neighborhood level air pollution, historically marginalized communities continue to experience negative impacts. This research resulted in three multimedia essays, which are published on The Asthma Files website.



CHRISTINA GIAN

College of Nursing & Health Professions
Nutritional Sciences & Foods

Faculty Mentor: **DR. EVAN FORMAN**
Psychology

Co-Mentor: Rebecca Crochiere

THE RELATION BETWEEN DISTRESS TOLERANCE AND SUBCLINICAL EATING DISORDER SYMPTOMS IN A WEIGHT-LOSS SEEKING SAMPLE

Low distress tolerance (DT; ability to withstand negative emotions) has been associated with eating disorder (ED) symptoms (e.g., emotional eating) in populations with clinically diagnosed EDs'. However, the relation between DT and ED symptoms has never been examined in a behavioral weight loss (BWL) sample, which may be important given that individuals with ED symptoms often have worse WL outcomes. This study aimed to analyze the relation between DT and ED symptoms in (N = 180) adults with overweight/obesity participating in a BWL program. Participants completed the Distress Tolerance Scale (DTS) and the Eating Disorder Examination Questionnaire (EDE-Q) at baseline. Pearson's Correlations showed difficulty with DT was positively (and, primarily, strongly) associated with every EDE-Q Subscale: Restraint, $r = .21$, $p = .01$, Eating Concern, $r = .30$, $p < .001$, Shape Concern, $r = .48$, $p < .001$, Weight Concern, $r = .35$, $p < .001$, Global, $r = .48$, $p < .001$. Results suggest that difficulty with DT is strongly associated with subclinical ED symptoms in patients seeking weight loss. Future research should examine if DT temporally predicts ED symptoms, in which case targeting distress tolerance may improve ED symptoms and facilitate WL.

JULIA DENGLER

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

Faculty Mentor: **DR. JOHN MEDAGLIA**
Psychology

EFFECTS OF TRANSCRANIAL MAGNETIC STIMULATION ON COGNITIVE CONTROL

Executive functions and cognitive control are used daily to regulate thoughts and perform actions. Various diseases and disorders can affect executive function and alter a person's cognition. Understanding brain networks and their responses to perturbation is crucial in increasing the wellbeing of those with cognitive impairments. Behavioral testing and neuroimaging data were collected from healthy participants before and after exposure to Transcranial Magnetic Stimulation(TMS) administered to the left middle frontal gyrus(MFG, n = 16), a region implicated in cognition, or a sham condition administered at the top of the head(n = 12). The use of continuous theta burst TMS(cTBS) on the left MFG is thought to inhibit brain activity and affect behavior. We utilized an adapted version of the Navon Task, which tests flexibility, that required subjects to switch focus during fMRI(functional MRI) scanning. Through fMRI data, we found that there were no significant differences in brain activation in the left MFG before and after TMS, but there were significant changes in performance. Overall, performance decreased after TMS was applied specifically in the non-switching condition, suggesting a role of the left MFG in sustained focus.

AUDREY COFFEY

College of Arts & Sciences
Psychology

Faculty Mentor: **DR. DAVID DEMATTEO**
Psychology; Kline School of Law

ADVERSARIAL ALLEGIANCE IN FORENSIC EVALUATIONS

Forensic psychology is a newer field due to the need to provide justice for those with mental health issues. Forensic psychologists are retained by a side of a legal case to offer an objective opinion on a defendant's mental state. Research, however, has suggested that experts may be biased towards the side that hires them. Current studies have focused on how evaluators score defendants differently on evaluation tests, but there is no research on bias based on expert opinions themselves. Our project is investigating if there is adversarial allegiance, which is bias based on the side that forensic psychologists are retained by when providing evaluations. My specific role is analyzing further if demographics of the forensic experts influence bias.

Our methods are emailed surveys consisting of a hypothetical legal case. The participants are randomly assigned to one of three sides: prosecution, defense, or court-appointed as a control group. The participants receive the same scenario, therefore if there are discrepancies in answers there is bias. Discovering bias is the first step to change how the field conducts evaluations in order for defendants to receive fair evaluations and for courts to make properly-informed decisions.

AMANDA T. MA

College of Nursing & Health Professions
Nursing

Faculty Mentor: **DR. SUSAN BELL**
Sociology

Co-Mentor: Dr. Lillian Walkover

THE MIGRATION PATHWAY OF REGISTERED NURSES FROM INDIA AND THE PHILIPPINES TO THE US

By 2030, at least 37 states will face some degree of a registered nurse (RN) shortage. The US relies on exporting countries such as India and the Philippines to alleviate this crisis. Despite the RN shortage in the US, stringent policies, visas and relicensing requirements deter international RNs from employment where they are needed the most. This literature review examines Indian and Filipino RN's migration patterns and US policies in order to gain deeper insight into why RNs emigrate and factors that restrict their mobility in entering and practicing in the US. India and the Philippines are failing to retain their own RNs due to low nurse to patient ratio, hostile environment, cultural stigmatization, and low wages. In turn, working conditions in the US are more desirable, pulling RNs from their originating countries. However, barriers to obtaining a US visa include high costs, long wait times and potential sponsorship scams. This is followed by relicensing, a multistep process that is also costly, time consuming and varies by country of origin. It is important for policy advocators to understand the push and pull factors within countries in order to promote a stable supply of RNs for the future.

MERLE CURRAN-ACKERT

College of Arts & Sciences
Global Studies

Faculty Mentor: **PATRICE WORTHY**
Writers Room

Co-Mentor: Professor Rachel Wenrick

EXAMINING THE UNIVERSITY-COMMUNITY RELATIONSHIP

Writers Room is an organization that practices creative placemaking and art for social justice. With the changes in West Philadelphia, Writers Room coheres community for both residents and students while improving the relationship Drexel has with the surrounding neighborhood. One of Writers Room*f??*s goals is to create opportunities for students and residents to engage in cooperative living. I investigated whether or not residents and Drexel students would be interested in cooperative living by developing ways to collect this data. I created a survey for Drexel students, interviewed participants at a Writers Room event, and coded an interview regarding the history of the neighborhood. Through these methods, I found that students are wary of the surrounding neighborhoods and becoming involved in the community, though many said they are planning on moving into this area during their time at Drexel. Conversely, my coding and interviews showed that residents are interested in living cooperatively with students and want them to be a part of the community. In summary, students may be more receptive to community involvement if they engaged in programs such as Writers Room that foster relationships with community residents.

ALEXANDER DANIEL DEVIDO

College of Computing & Informatics
Computer Science

Faculty Mentor: **DR. SPIROS MANCORIDIS**
Computer Science

Co-Mentor: Aviel Stein

MALWARE ANALYSIS METHODOLOGY USING NSA GHIDRA

When cybersecurity specialists encounter a new threat within the systems they protect, there are several possible steps they could take to mitigate and counter the attack. According to the NSA, common mitigation strategies include software upgrading, continual searching for breaches, and introduction of multi-factor authentication for system accounts. However, one possible mitigation strategy that specialists could overlook is reverse engineering of malware with the purpose of quickly gaining knowledge needed for strengthening system defenses. With the release of the NSA Ghidra tool, specialists have free access to an effective RE tool that presents important information about a program in a well-organized format. With this tool, we sought to develop a methodology by which specialists can analyze malware as quickly and efficiently as possible.

ZOE I. LEVINE

College of Computing & Informatics
Computer Science

Faculty Mentor: **DR. WILLIAM M. MONGAN**
Computer Science

Co-Mentor: Dr. Kapil Dandekar

ADAPTIVE LOCALIZATION

Indoor localization is at the heart of Internet of Things and Smart City research, but no one system has achieved the widespread acceptance of GPS for outdoor positioning. In traditional applications of fingerprint-based localization, all of the data must be collected and post-processed, prohibiting real-time deployment. We propose a self-updating fingerprinting system that aims to improve the accuracy of the xArray, an existing localization system at the Drexel Wireless Systems Lab. This will require continuous data collection and post processing.

Our current work focused on the algorithm and end node development. We used a Monte Carlo Localization system, implementing a modification to adjust the unreliable location provided by the xArray. Initially, the sensor information is stored according to the location given by the xArray, and over time the algorithm refines the locations provided. The end nodes consisted of an Arduino, xArray reference tag, light sensor, accelerometer, and gyroscope. The accelerometer and gyroscope were used to determine the distance traveled by the tag between measurements and the accuracy of the lux reading given by the light sensor.

JESSE R. STOVER

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **DR. WILLIAM M. MONGAN**
Computer Science

REDUCING MULTI-PATH FADING USING A STATIONARY REFERENCE TAG

Traditional respiration monitoring techniques can be too cumbersome for use on ambulatory patients in intensive care. We propose tracking RFID signal strength via a tensile antenna worn by a patient as an alternative to current methods. To facilitate this tracking, we reduce interference caused by multipath fading in real-time using a second stationary antenna and RFID tag. First, we apply a Markov Chain Monte Carlo method to the time series data received from each tag to classify and remove data where the two antennas are coupled due to close proximity. Next, for each tag, distributions of signal strength, velocity calculated using Doppler shift, and a correlation of these two values are calculated using a sliding window. For each window, we then calculate the distance between each concurrent distribution pair using the Mahalanobis Distance Measure. The result is a time series comparing the two signals, where values falling within a certain range can then be associated with either a relaxed non-breathing state or a stretched breathing state. By using these measurements to increase the accuracy of our data, we conclude that RFID tags can be a viable, non-invasive alternative to current biomedical monitoring techniques.

GUADALUPE FERNANDEZ-NUÑEZ

College of Computing & Informatics
Computer Science

Faculty Mentor: **DR. DARIO SALVUCCI**
Computer Science

MODELING EFFECTS OF MUSIC ON DRIVING PERFORMANCE

The field of computational cognitive modeling of human behavior in computer science is relatively new and vast with respect to its capabilities. Several frameworks, referred to as cognitive architectures, exist in aiding the development of computational models by considering the realistic capabilities of humans. Complex tasks, such as driving, have been successfully modeled, allowing researchers to examine what processes in the brain are invoked. While existing models have been attentive to a human's abilities and limitations, the effects of individual differences in attributes and environmental conditions haven't been as extensively researched. Attempting to integrate such differences is essential to applying a model's findings to realistic conditions. With regard to driving, humans regularly find themselves in situations where music is played aloud, which takes up a portion of their cognitive abilities. Through attempting to model this common occurrence of music playing during a complex task, such as driving, there can be a deeper analysis and discussion behind the cognitive, perceptual, and motor processes involved, allowing for a comprehensive application to actual human behavior.

VELAY FELLOW

MUBASHER ANSARI

College of Computing & Informatics
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Faculty Mentor: **DR. BRIAN L. STUART**
Computer Science

AN ARTIFICIAL INTELLIGENCE MODEL'S RESPONSE TO COMPOUND CONDITIONING

Artificial Intelligence has been a topic of discussion for almost as long as computing has existed. My research pertains to a specific part of artificial intelligence, learning. My research consisted of testing how an artificial intelligence model responds to classical conditioning. More specifically, I studied how it responds to compound conditioning. The model had already been found to respond to simple first order compound conditioning and extinction similarly to how biological organisms respond. In my research I found that the model still retains a connection between the two initial stimuli even after extinction. After extinction, if one of the stimuli is conditioned for some other response, the second stimulus is conditioned faster than a different stimulus. Biological entities also create a connection between the two stimuli after being compound conditioned, similarly to the model. This research can be used to further our understanding of artificial intelligence, and perhaps even the human brain.

ARYA NGUYEN

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THE PSYCHOLOGICAL AND BIOLOGICAL PLAUSIBILITY OF A COMPUTATIONAL MODEL FOR ARTIFICIAL INTELLIGENCE

The basic objective of artificial intelligence is to construct a machine that can perform high-level learning tasks such as problem solving, decision making, perception, and linguistics. According to Gagne, higher orders of learning build upon the lower levels, such as classical conditioning and instrumental conditioning; therefore, it is important to produce a system which is capable of performing low level learning found in natural intelligence. Cybernetic automation, a computational model for mimicking low-level learning ability, is an adaptive finite state automaton with probabilistic outputs. This research focuses on reproducing published results by other psychologists to illustrate the model's natural intelligence and to test its biological and psychological plausibility. After applying our model to multiple sets of data, we determined that the results are in substantial agreement with earlier observations. Overall, the model successfully emulates a large variety of psychological learning phenomena. There are significant promise and potential for this model to simulate high-order learning mechanisms and, hopefully, basic brain functions.

ANCA SCARLAT

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THE SKINNER BOX EXPERIMENT ON A MACHINE LEARNING MODEL

Artificial Intelligence is the perfect way to explore the intersection of Psychology with Computer Science. In my research project I am studying the way operant conditioning works on machines by replicating a famous psychology experiment called the Skinner Box. Originally the experiment was performed to test animal behavior and their learning path to a reward (usually food) in a controlled environment by analyzing their responses after the initial stimuli are affected. The model used in this research is Dr. Brian Stuart's Cybernetic Automaton, an adaptive finite state machine that has probabilistic results and displays properties of instrumental learning and classical conditioning. Instead of analyzing animal behavior I am analyzing the way the model reacts in a Skinner Box experiment. The cybernetic automata theory is meant to suggest a model for natural learning and my research aims to test the way the model reacts when creating a more realistic Skinner box environment for the machine by adding various directions and positions to the initial tests performed when creating the model. The degree of learning proved uniform among the changes to the environment that we studied.

SRIRASHMI GUDUR

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Information Systems

Faculty Mentor: **DR. MICHELLE L. ROGERS**
Information Science

USABILITY EVALUATION AND REDESIGN OF MYCHOP

The Children's Hospital of Philadelphia (CHOP) is responsible for thousands of patients each day, and oftentimes these patients commute from hours away to attend their clinical visits. To make the lives of their doctors and patients easier, the hospital introduced an app named MyCHOP that allows patients to complete tedious tasks (i.e. scheduling appointments, acquiring medical records, or asking physicians simple questions about a child's health condition). However, the MyCHOP app is not as successful among users as was originally intended by the informaticists at CHOP. My objective is to provide design recommendations for the app that can bridge the communication gap between doctors and patients. To fulfill the purpose of my research, I conducted a usability evaluation which included a workflow analysis, semi-structured interviews, and observations to understand how users engage with the app and what is unsuccessful about the system. This research is significant because it revolutionizes the way doctors interact with their patients. Face-to-face interactions have always been the norm for the healthcare industry, but this technology will drastically change that.

TAPASYA SHARMA

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Data Science

Faculty Mentor: **DR. CHRISTOPHER YANG**
Information Science

Co-Mentor: Ou Liang

CONSTRUCTING AN ONLINE PEER SUPPORT COMMUNITY (OPSC) THROUGH FACEBOOK AGAINST THE RISING DRUG OVERDOSE DEATHS

Statistics tell us that Philadelphia represents itself as the third-highest city for drug overdose deaths in the USA. With the deaths reaching a colossal number of 1217 in the year 2017, they have become a grave issue to tackle. The research I am working on introduces an innovative twist to the traditional method of a face to face support group which is largely used to address the issue of substance abuse.

The College of Computing and Informatics in collaboration with the Caring Together Program of the College of Medicine has come up with an e-version of these face to face support groups. Using Facebook groups as a platform for the patients to interact, we aim to evaluate the outcome and the benefits of an Online Peer Support Community (OPSC) of which all patients would-be participants. As a Data Scientist, I work on setting up the environment for the Data Extraction and Analysis of the relevant information from the actual Facebook Group which will be going live for a duration of three months in late 2019. The extraction and analysis take place through the interaction of Python and Facebook's Graph API.

In the long run, the study helps in expediting the process of overcoming addictions; hence decreasing drug overdose deaths.

ADIN B. SOLOMON

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Computer Science

Faculty Mentor: **DR. CHRISTOPHER YANG**
Information Science

USING SENSOR DATA TO PREDICT DRIVING BEHAVIOR

In coordination with the Transportation Research Board of the National Academies, The Federal Highway Administration of the U.S. Department of Transportation, and the American Association of State Highway and Transportation Officials, The United States Congress began the second Strategic Highway Research Program (SHRP 2). Between its initialization in 2005 and 2012, a large amount of data was collected through the Naturalistic Driving Study (NDS) of over 3000 vehicles (driven by at least 3000 participants, presumably). The participating vehicles were equipped with a variety of sensors including cameras and microphones to collect data from real driving trips. Sensor data was aggregated into tables containing over 170 variables. In addition to the sensor data, trips during which events of interest (crashes, near-crashes, etc.) were annotated with respect to event type, driver behavior, and other situational information. This study is concerned with the sensor data's predictive power over annotations of driver behavior and secondary tasks the driver may have been participating in. This analysis is in preparation for the production of a predictive model for those behaviors.

IAN K. NAREWSKI

College of Engineering
Chemical Engineering

Faculty Mentor: **DR. NICOLAS ALVAREZ**
Chemical & Biological Engineering

3D PRINTING CONTINUOUS COMPOSITES USING FUSED DEPOSITION MODELING

Fused Deposition Modeling (FDM) is the most common method of 3D-printing objects. It uses a heated nozzle to melt and extrude thermoplastic to build the objects layer by layer. However, these parts are typically weak, and therefore are not usually suitable for end use. One way to make plastic parts stronger is to reinforce them using fibers. A common method used to make these composites is pultrusion. In pultrusion, fibers are pulled through a vat of thermosetting resin so they are completely saturated, and then consolidated and cured. This project aims to combine pultrusion with FDM. Some of the major challenges involved include: (1) Splaying the fiber before it enters the vat of resin; (2) Finding a resin that wets the fibers quickly but is viscous enough to remain in the nozzle; (3) Keeping tension on the fiber both as it enters the nozzle and as it exits the nozzle; (4) Curing the material once it is laid down. We aim demonstrate a working prototype for the printing of thermoset reinforced resin on a modified FDM printer.

KIRA HUDSON

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Chemical & Biological Engineering

MONITORING AIR QUALITY METRICS USING KITES

Air quality monitoring technology is crucial for informed air quality decisions seeking to improve air quality of communities. This research focuses on using kites as a vehicle for deploying air quality measurement systems in two scenarios: (1) suspending tethered tubing from the kite line to deliver air samples to ground-based sensors and (2) lifting lightweight air quality sensors. The tethered tubing system consists of a pulley and lifting line connected to an aerodynamically stabilized mount with 3D printed pieces that supports 100 ft of tubing and is connected to ground-based sensor equipment. The design of the tubing system involved kite aerodynamics, CAD design, fluid mechanics of air flow through tubing. The lifting of air quality sensors included a Kestrel 5500 weather meter and a PocketLab Air mounted on aerodynamically stabilized platforms suspended from the kite line.The PocketLab Air measures ambient conditions (temperature, pressure), concentration of gases (CO_2, O_3), and particulate matter. Data analysis involved statistics, graphics, and field logs for field observations. Research findings suggest further exploration of air quality sensors with higher quality measurement procedures to accurately assess air quality.

DAVID ZHANG

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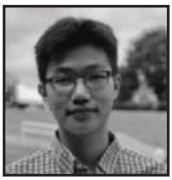

Faculty Mentor: **DR. AARON FAFARMAN**
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Co-Mentor: Jacob Bolduc

OPTIMIZING THE FORMATION AND ENCAPSULATION OF $MAPbI_3$ SEMICONDUCTORS

With increased demands for sustainable energy, hybrid organic-inorganic halide perovskites are a promising solar cell material, increasing in PCE from 3.8% to 23.3% in the last decade. However, perovskites become ineffective with exposure to air over an extended period. Encapsulation via polymer lamination is a process to seal and prevent perovskite exposure to air. The purpose of this research project is to optimize the formation and encapsulation of $MAPbI_3$ semiconductors via a pneumatic pressure process by varying temperature and pressure. At 100 bar and 200°C, $MAPbI_3$ undergoes plastic deformation, transitioning from a grey rough surface to a black smooth surface, and PVDF also flows, forming a cohesive seal over the perovskite. A device stack consisting of silicon/perovskite/PVDF polymer/glass was employed to test if the lamination could preserve the PL of the perovskite. Not only does PVDF lamination preserve PL in open air, it even enhances the carrier life time as compared to perovskite conventionally encapsulated under inert atmosphere. Future work involves understanding the morphology of the perovskite layers after applying high pressure and improving the adhesion between the polymer laminate and the perovskite coating.

ROBERT LIGNOWSKI

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Faculty Mentor: **DR. VIBHA KALRA**
Chemical & Biological Engineering

Co-Mentor: Rahul Pai

TUNING PORE SIZES OF CARBON NANOFIBER-BASED HOST MATERIALS IN LI-S BATTERIES

The energy demands of the world are increasing. This rise in consumption is influenced by the growing prominence of rechargeable electronics, such as laptops and smart phones. For the most part, lithium-ion batteries are the status quo in these devices. However, they have reached their achievable theoretical capacity. Other battery chemistries must be sought out to fulfill our energy needs. Lithium-sulfur battery chemistry is one potential solution, due to its high theoretical capacity and energy density. Sulfur is abundant, environmentally safe, and cheap. This project focused on the development of host carbon nanofibers with variation in porosity for use as cathodes in Li-S batteries. The porous architecture provides a means to introduce sulfur into the cathodes. It also improves electrode-electrolyte contact, enabling better ion-diffusion and sulfur accessibility. Background research indicates that mesopores (>2 nm) allow for higher sulfur loading and redeposition of Li2S while micropores (<2 nm) help in sulfur confinement over long cycle life. The best template would therefore strike a balance between mesopores and micropores. We studied combinations of pores and their effects on electrochemical performance in Li-S batteries.

JHANNAE BURTON MUNDELL

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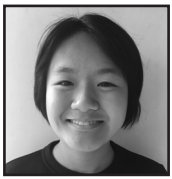
Co-Mentor: James Lansing

INTERMEDIATES OF THE ELECTROCHEMICAL OZONE PRODUCTION PROCESS

Globally, 663 million people live without easy access to clean water. As such, new methods to facilitate water purification are being developed. Ozone purification is one such method which is safer than chlorine water purification. Electrochemical Ozone Production (EOP) is a process used to generate ozone from water electrolysis. However, one disadvantage of the EOP process is selectivity. Due to the thermodynamic favorability of oxygen production, water is more easily oxidized to oxygen than ozone. Better understanding of the EOP mechanism is necessary to improve the selectivity of the reaction. This research focused on identifying the intermediates of the ozone reaction. Ozone was generated electrochemically on a working electrode of nickel- and antimony-doped tin oxide. Indigo trisulfonate was used to quantify the amount of ozone produced. A literature review identified methanol, benzquinamide (BZQ), and pallidol as selective quenchers of OH radicals, O^{2-} radicals, and singlet oxygen, which are possible intermediates. Addition of these quenchers will aid in determining which intermediates are critical to the EOP process.



AMANDA LAM

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Chemical & Biological Engineering

LIF BATTERIES & THE HALL EFFECT

The lithium-ion battery is the current standard for a rechargeable, portable battery model. However, as the use and development of electricity/battery-reliant technologies increase to replace fossil fuels and other energy sources, the need for a more effective and efficient battery is paramount. This project investigates the potential of LiF by using the Hall effect measurement technique to understand its ability to conduct charge. Current progress on this project has been the development of a measurable sample. In order to study the reaction mechanism involved with lithium fluoride and lithium ion transport, samples were made using lithium ink on conductive glass. While conductive $LiFePO_4$ ink formulations have improved through mixing, pressing, and drying methods, the ink samples revealed to have overall suboptimal conductivity, but assured the viability of the project. Alternative methods such as Au lithiation are currently being investigated.

JYRTEANNA TEO

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Faculty Mentor: **DR. L. JAMES LO**
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Co-Mentor: Yun Zhang

ANALYSIS OF NATURAL VENTILATION POTENTIALS IN DOE PROTOTYPE SCHOOL BUILDING

With expanding energy consciousness in the building sector, architects and engineers have been increasingly using natural ventilation as a means to reduce energy expenditures. While natural ventilation has been used for thousands of years in various culture worldwide, the current modern method of designing for natural ventilation requires more precise estimation of ventilation flow rate which cannot be obtained using the traditional rule of thumb methods. Hence, a new approach needs to be developed to improve the natural ventilation estimation method.

The goal of this project was to evaluate the wind-driven ventilation potential of a typical secondary school, one of the 16 ASHRAE commercial prototype building models which represent 80% of the commercial building stock in the United States. A CFD based wind tunnel simulation was automated to investigate building facade pressure coefficients at various wind directions. Using the pressure coefficients and the TYM3 weather data, the hourly air flow rate was calculated from the orifice equation for three different cities. The results were then compared with the ASHRAE minimum ventilation requirements to determine the suitability of adopting natural ventilation.

ADEEB ABBAS

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Electrical & Computer Engineering

Co-Mentor: Dr. Vasil Pano

ACTUATION DEVICE FOR DEEP VEIN THROMBOSIS

Functional fabrics have the potential to provide unobtrusive treatment options for various medical conditions, including Deep Vein Thrombosis (DVT). Researchers in the Drexel Wireless Systems Lab (DWSL) are developing a wearable device that can be worn on a leg to both perform sensing to detect high levels of patient inactivity, as well as therapeutic massage to encourage blood flow. Specifically, we leverage wearable electromyography and an accelerometer to classify what the state of motion is of the subject and use that information to determine when to start actuated massage so that the risk of developing a DVT can be reduced. Instead of using two stepper motors as was done previously, only one is used to provide actuation on the calf muscles of the subject. Data is collected and sent using a Raspberry Pi Zero and a Google Tensor Processing Unit which will do all the machine learning for patient activity state. All the aspects of a previous design were down-sized to a smaller form factor. The new 3D printed designs are not only smaller but lighter as well, making it possible to be carried around more unobtrusively to the patient.

ATANDRILA ANUVA

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Co-Mentor: Dr. William M. Mongan

RFID LOCALIZATION AND MOVEMENT TRACKING

Localization is a process to find and track the movements of devices, which can provide valuable data for new applications of the Internet of Things (IoT). The Impinj xArray, an RFID reader having a range of 1500 square feet, was built to perform RFID localization to provide (x, y) coordinates and to track movements. This method of RFID localization can be implemented in any industry to track the movement of objects using conventional RFID as well as functional fabric RFID tags developed at Drexel. Using the IoT testbed in the Drexel Wireless Systems Lab (DWSL), we developed a Python script to extract real-time data from the xArray and developed a database client code to store and return the data to the user with different functions. Therefore, when we integrate these two codes, a user can start the machine, locate the RFID tags using their live (x, y) coordinates, and also store the data in a database for future use. Future developers can leverage this database to enable new IoT applications in diverse areas including medicine, public safety, and industrial control.

COLLEGE OF ENGINEERING

MUSTAFA YAVUZ GENEL

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INDOOR LOCALIZATION

Indoor Localization: Localization is at the heart of the Internet of Things and Smart City research, but it still steps away from the widespread use of GPS. There are many ways to determine the location of a device indoors, and fingerprinting is seen as one of the more successful systems. Fingerprinting involves extensive data collection to produce a data map of signals. In traditional applications of this system, it is not functional until all of the data has been collected and stored, a precondition that prevents quick installation.

Designing a self-initializing and self-updating fingerprinting system would lessen the obstacles. This system will rely on Impinj's xArray for support and aims to aid with the accuracy of this preexisting approach. In theory, the proposed system should be able to work with any other existing localization system assuming their signals do not conflict.

To build this system, we will fuse the existing xArray system with a LoRa IoT system to eliminate the disadvantages of the xArray system and improve accuracy by using Monte Carlo localization algorithm. We chose to build the LoRa IoT system ourselves; we made the gateway with a Raspberry Pi and a LoRa hat and the end nodes with an Arduino MKR WAN 1300.

TOMMY BUI NGUYEN

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AUGMENTED REALITY VISUALIZATIONS FOR SOFTWARE-DEFINED RADIOS

Software-defined radios harness the power of general-purpose processors to receive and transmit a wide array of radio protocols. Leveraging increasingly powerful processors has introduced unprecedented flexibility in the fields of wireless technology education and research. However, this world of wireless technology remains invisible to the naked eye. The inability to observe wireless communication phenomena can make it difficult for students to develop an understanding and intuition for how these wireless technologies interact. This project explores how augmented reality (AR) can be used to visualize data from the SDRs by leveraging Vuforia, a software kit that facilitates AR development, and Unity, a game development engine that can be used for creating models and animations for wireless interactions. Unity and Vuforia were used to develop a mobile application to perform AR visualization on real-time radio availability. Future work can be aimed at creating more advanced visualizations to explore ways to make wireless communications research and education more engaging to students.

AKASH THAKER

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ROBOTIC POSITIONER AUTOMATION FOR WIRELESS FIELD TESTING

Wireless field testing can have strict requirements in the placement of devices under test. For example, in 5G millimeter wave (mmWave) communication systems, signal blockage is critically important, requiring precise placement of devices under test for controllable and repeatable field testing. This project involved the recommissioning of a linear robotic positioner in the Drexel Wireless Systems Lab (DWSL). The positioner is the TDK RF Solutions PP-02, or Probe Positioner, and is controlled by the SI-300, or System Interface. The PyVISA library in Python was used to remotely program the SI-300, a GPIB device. A GPIB-USB-HS+ adapter from National Instruments was used to establish a communication and control link between a laptop and the SI-300. A command line interface (CLI) was developed to allow for easy use and automated testing of future systems in DWSL. This apparatus can be used to introduce a controlled disturbance in a controlled environment and minimize human error in experiments. Introducing moving blockages in mmWave wireless communication links using the PP-02 can show the signal attenuation that results. Experimental data can then be used to motivate future mmWave antennas capable of beam switching.

VIWING ZHENG

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Co-Mentor: Dr. William M. Mongan

DATA VISUALIZATION WITH SOFTWARE DEFINED RADIOS

Data visualization is the process of representing information and data graphically. Being able to visualize data enables people to more easily analyze and interpret trends and patterns in data. The goal of this project was to create a user-friendly software to display data from radios visually. Drexel's Wireless Systems Laboratory contains a grid of software-defined radios (SDR) that transmit data and interact with one another. This project currently pulls data from the digital interface of the grid, and creates a web-based graphical user interface (GUI) that users can modify radio parameters to see the change in the graphic representation of the change in data. This web-based GUI uses React.js to create reusable components that represents the nodes of the grid. It will also utilize Plotly.js, which is graphing library to create real time graphs to see the effect on the data after modifications are made on the page. We hope to include a way to modify power, frequency, gain levels, etc. via the web GUI. Hopefully, this project will also allow those unfamiliar with data or frustrated by the complexity of data to learn about SDR in a more interactive manner.

SARAH O'CONNER SCANLIN

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Co-Mentor: Vahideh Abdolazimi

OPTICAL CHARACTERISTICS OF pH SENSITIVE LIQUID CRYSTALS

Hydrogen ion concentration (pH) carries important information about chemical interactions in many biological contexts such as bacteria growth mediums and tumor cell metabolism. pH can be measured using conventional methods such as color changing strips, FET sensors, and glass sensors. However, there are some shortcomings associated with their design and operation when measuring in nanoscales. Thus, there is a need to develop new types of pH indicators for nano sensing. We used self-assembled liquid crystals in water which have a pH responsive matrix and can release a drug (fluorescent dye) at different pH volumes according to the shape of their pH dependent crystalline nanostructure. We used polarized microscopy to determine the induced crystal structures by pH. Further, we measured the release rate of the simulated drug using a spectroscopy method. For that, the transmission calibration curve was obtained to assess the drug release rates at various pH solutions. This allows us to determine pH of unknown context by correlation to either microscopic textures of the material or the rate of drug release.

REI BALLABANI

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Faculty Mentor: **DR. GARY FRIEDMAN**
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USING DIELECTROPHORESIS TO DESIGN A MINIMALLY INVASIVE MEDICAL DEVICE

Unlike traditional robots of the past, with harsh and broken movements, soft robots are modelled after living organisms, manufactured out of flexible materials, and controlled in unique ways. The goal of this research is to develop a minimally invasive micro-robotic device that would move within brain tissue without damaging it. Such devices can be inserted into the brain to treat Parkinson disease or monitor epileptic events.

The principle that guides this research is dielectrophoretic force. This force is experienced by polarizable micro-particles suspended in a polarizable medium when immersed in a non-uniform electric field. Previously, it has been used to control and trap particles and cells for the purpose of separation and micro-analysis. Dielectrophoretic force can also be used to create wave-like movements of micro-particles between two soft polymer sheets which will generate its worm-like propulsion.

In this research project, electric fields and dielectrophoretic forces are modeled for a device design based on interlaced electrodes. The models are then employed to design a flexible circuit board consisting of an appropriate micro-electrode array that will be sealed with a polymer film filled with fluid and microparticles.

ARJUN IYENGAR

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Faculty Mentor: **DR. YOUNGMOO KIM**
Electrical & Computer Engineering

Co-Mentor: Andrew Wiggins

MUSICAL GESTURE RECOGNITION

Gesture recognition exists to interpret human movements, generally facial or manual, but less systems exist that accurately provide gesture recognition in a musical setting compared to general gesture recognition. This project focuses on musical gesture recognition, utilizing a machine learning classifier, an arduino accelerometer, and a microcontroller. Data is collected by moving the accelerometer to replicate the motion of a conducting gesture, as if with a baton conducting an orchestra, returning x, y, and z axes that signify the force applied to the accelerometer as the gesture occurs. The data collected was treated to show a set of features that uniquely represented each trial of data. The features were comprised of certain characteristics of the data sets that could be used to identify them such as maximums, minimums, and standard deviation. The classifier was trained with these feature sets to learn how to interpret data from a new gesture and sort it into its corresponding gesture class. In the end the system was capable of taking in data from the movement of the accelerometer and returning the gesture that the data set most closely related to.

MATTHEW MAYGER

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Co-Mentor: Jeff Gregorio

MUSICAL INSTRUMENT DIGITAL INTERFACE (MIDI) CONTROLLER

This project creates a custom music controller using the Musical Instrument Digital Interface communication protocol, or MIDI, the industry standard for electronic instruments. Many off the shelf controllers operate off a closed eco-system and are difficult to modify or change for nontraditional applications. This custom interface is designed and built to be used to assist in testing a digital musical interface that is being developed as part of a PhD dissertation. This custom physical controller is designed and programmed to have an interface that corresponds to the electronic controls through a set of sliders, buttons, and knobs which control various synthesis parameters. Additionally, unlike traditional MIDI controllers this controller is built to be able to monitor and output data on how the controller was used by musicians. This allows for a direct comparison between the differences in use between both the digital and physical interfaces.

EILEEN MOROZ

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Co-Mentor: Andrew Stutzman

WEBSITE DEVELOPMENT WITH WORDPRESS: CONNECTING SMALL BUSINESSES AND COMMUNITIES

Over one-third of small businesses do not have a company website according to recent survey data, yet approximately 70-80% of people research a company before visiting or making a purchase with them (Delgado). In an effort to expand and support the growth of local businesses, the Community Business Collaborative (CBC) was launched within the ExCITe Center at Drexel University. Partnering with local business associations, such as the Lancaster Avenue 21st Century Business Association, the CBC works with business owners to help them develop websites using the content management system, WordPress. Through the program, businesses receive assistance with the initial set up of their website, one-on-one meetings with a member of the CBC to discuss their sites in more detail, along with the opportunity to attend various educational WordPress workshops. As a student developer for the CBC, I worked with 5 businesses from the local West Philadelphia area and assisted in the development of their WordPress websites, along with providing general support to the needs of the CBC.

Sources:
Delgado, Michelle. "Small Business Websites in 2018." Clutch, 31 Jan. 2018
clutch.co/website-builders/resources/small-business-websites-2018

OM UMARE

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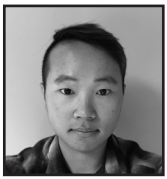
PREDICTIVE VISUAL PURSUIT FOR FAST MOVING TARGET

Predictive visual pursuit is an artificial intelligence technique to track the motion of an object with near-zero lag. This technique is currently used in many application areas such as stock predictions and surrounding object awareness in self-driving cars. Recurrent neural networks, which mimic biological neurons and synapses, can be used to implement predictive pursuit trained using the FORCE algorithm. Unfortunately, the FORCE algorithm performs poorly for fast-moving targets. In this project, we are developing an improved version of FORCE, called full-FORCE, which uses a "hint" signal with a better learning approach to improve the algorithm's learning capabilities for fast-moving targets. We tested the visual pursuit with full-FORCE using high-frequency sine, cosine, square, and sawtooth signals, and show that it performs significantly better than FORCE.



SEAN ZHANG

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EXISTENCE OF SMALL WORLDS IN SOCIAL NETWORKS

Social networks or social graphs are models of the relationships between members of a social platform. The small-world phenomenon is defined as having a relatively short characteristic path length where the characteristic path length is the average shortest distance connecting any two members of a network. A property of a small-world network is the ability for a member to search for another member through few immediate connections with local information.

Two social networks, Facebook and Twitter, are selected for analysis from the Stanford Network Analysis Platform (SNAP) library, a dataset of social and information networks. Using Python, the characteristic path length and clustering coefficient of both networks are calculated and compared to their corresponding equivalent random regular graphs, where equivalent means the same number of vertices and average degree. The results indicate that both networks have a relatively high clustering coefficient and approximately similar characteristic path length compared to their equivalent random regular graphs, implying that both networks could exhibit the small-world phenomenon.

MADISON POINTER

College of Arts & Sciences
Chemistry

Faculty Mentor: **DR. CHRISTOPHER LI**
Materials Science & Engineering

Co-Mentor: Mark Staub

THE PROMOTION AND CONFINEMENT OF POLY-3-HEXYLTHIOPHENE CRYSTALS

When polymer crystals form they tend to follow a predetermined translational symmetry manifesting as profound morphologies with defined facets. In a miniemulsion crystallization process, single crystal growth of linear polymers can be directed at the curved liquid-liquid interface, which produces spherical and hollow polymer crystal capsules termed "crystalsomes" with broken translational symmetry. Recent studies on polyethylene and poly(lactic acid) crystalsomes demonstrated unique mechanical and transport properties of this novel nanostructure. This project will use Poly-3-hexylthiophene-2,5-diyl (P3HT), a semiconducting polymer and explore its crystallization behavior at liquid-liquid interface. P3HT has a unique growth behavior where single crystals grow in a 1D manner producing nano-ribbon morphologies. In this work we show that confinement of the 1D growth at the curved liquid-liquid interface can break the growth behavior of P3HT and produce crystalline P3HT crystalsomes. It is anticipated that this unique structure will provide intriguing optical and electronic properties and give further insight into non-planar crystallography of polymer crystals.

ERIKA GARRO

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Materials Science & Engineering

Faculty Mentor: **DR. MICHELE MARCOLONGO**
Materials Science & Engineering

REGENERATION OF INTERVERTEBRAL DISCS USING SMART SCAFFOLDS

The cost of treating lower-back pain in the United States alone can cost over 100 billion dollars a year. Intervertebral disc degeneration is largely to blame, as aging and physical activities can cause the discs to stiffen or become displaced over time. Research has shown that collagen and chondroitin sulfate (CS) hydrogels are a promising biomaterial to assist in the regeneration of these discs, and the individual materials have been used previously in the medical field for a variety of issues. Collagen is the most abundant fibrous protein in mammals and it is frequently used in wound dressings to promote tissue growth and in vascular prosthetics. CS is a sulfated glycosaminoglycan (GAG) found in the joints and cartilage of the body and is commonly used to treat osteoarthritis. This research aims to create collagen and chondroitin sulfate hydrogels of varying ratios to observe how the viscoelastic properties are altered. A pilot study found that mixtures of collagen and CS do demonstrate hydrogel formation at body temperature, 37°C. Future work includes characterizing the gels using fourier-transform infrared spectroscopy (FTIR) and rheometry.

EMMA CLANCY

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Faculty Mentor: **DR. EKATERINA POMERANTSEVA**
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Co-Mentor: Ryan Andris

UNDERSTANDING ION REMOVAL SELECTIVITY IN HYBRID CAPACITIVE DEIONIZATION APPROACH FOR WATER DESALINATION

The National Academy of Engineering lists "providing access to clean water" as one of its "14 Grand Challenges for Engineering in the 21st century". An emerging energy efficient and low-cost water desalination technology is capacitive deionization (CDI), in which ions are removed from salty water and stored in electrodes in an electrochemical cell construction when a potential is applied. Hybrid capacitive deionization (HCDI) combines a capacitive carbon electrode and a redox active electrode which enables higher ion removal capacities than CDI cells. Past research has tested HCDI cells in single ion solutions but not yet in mixed solutions. To mimic brackish water, a 15mM mixed solution of NaCl, KCl, and $MgCl_2$ was used. Tunnel structured manganese oxide (TuMO) nanowires with 3 different crystal structures were used as redox active electrodes. The structure of TuMOs creates one-dimensional tunnels available for ion intercalation. In this work, I will present chemical composition of the solution at different stages of HCDI process analyzed via ion chromatography. Furthermore, I will discuss how the size of tunnels affect removal of Na+, K+, and Mg2+ ions, which is important to pave the way for selective ion removal via HCDI methods.

CYRA GALLANO

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Materials Science & Engineering

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RECONSTRUCTING LAYERED FRAMEWORK OF 2D TRANSITION METAL CARBIDES (MXENES) VIA MODIFICATION OF ANIONIC SUBLATTICE TOWARD FORMATION OF NEW OXIDES

Improved energy storage properties are necessary for a sustainable future. Nanomaterials can significantly improve current battery technology. Transition metal oxides (TMOs) are promising cathode materials due to their high redox activity, however they exhibit low electronic conductivity. Transition metal carbides, known as MXenes, and graphene are both two-dimensional nanomaterials with high electronic conductivity and remarkable mechanical stiffness. Layering these materials to create nanostructures yields a synergistic electrode material. To create nanostructures, different synthesis procedures were investigated to turn titanium carbide (Ti_3C_2) and vanadium carbide (V_2C) into TMOs. MXene derived TMOs were reliably synthesized by oxidizing MXene using hydrogen peroxide (H_2O_2) in neutral and basic solution. Various cations such as, lithium, sodium, and potassium are pre-intercalated through the addition of their respective alkali metal chloride during synthesis. TMOs were also grown directly onto graphene, via a hydrothermal approach, to produce lithium titanate-graphene nanostructures. These results provide the basis for further analysis of the performance of these materials as high performing electrodes in metal-ion batteries.

VELAY FELLOW

DAVID AUSTIN

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Co-Mentor: Vignesh Perumal

LATTICE INTRODUCTION TO ADDRESS HOTSPOTS FORMED DURING METAL ADDITIVE MANUFACTURING

There is a great demand for lightweight and customized components that can be reliably designed and manufactured, particularly in the aerospace industry. This has drawn designers to computer-aided optimization, as well as additive manufacturing methods which can build complex 3D geometries. Selective Laser Melting (SLM) is the most popular form of metal additive manufacturing but has limitations. Specifically, hotspots during manufacturing can create severe local deformation and cause damage. This project investigates the use of cellular lattice structures that are selectively and optimally inserted in the volume of the 3D printed part in order to assist with the dissipation of the excess heat during the SLM processes. Such hotspots can be predicted by appropriate manufacturing process simulations. Using the results of such simulations, lattices are placed near predicted hotspots in order to transfer heat to the surrounding air. To demonstrate the approach, process simulations were attempted on an aerospace component to identify hotspots. A method of determining the location of latticed regions using topology optimization was explored. Process simulations were attempted again after latticing to verify the reduction of hotspots.

DANIEL ERBYNN

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Computer Engineering

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Mechanical Engineering & Mechanics

Co-Mentor: Rudi Weinberg

TOWARDS AUTONOMY IN UNMANNED AERIAL VEHICLES

There has been an increasing interest in autonomous Unmanned Aerial Vehicles (UAVs) in the fields of medicine, transportation, public safety and others. Companies such as Google and Amazon envision using UAVs to deliver packages to consumers while government agencies such as NASA and FAA are looking to create appropriate regulations to make this possible. In this context, necessary functions to enable autonomy include the computation of altitude, location in space and relation to obstacles. To achieve such function, a variety of equipment is used on UAVs such as gyroscopes, accelerometers, magnetic sensors and electromagnetic sensors. Therefore, to understand and create autonomy it is essential to research and understand how these components work in UAVs. To this aim, the focus of my project is on analyzing the operation of onboard equipment on a custom-made UAV to create the appropriate framework of achieving UAV autonomy.

CHRIS FINIZIO

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WHAT MAKES A DRONE FLY?

Drones are becoming increasingly evident in society. To ensure safe and successful flight a keen understanding of the components must be present, and the assembly must be properly completed. Each component on a drone has a specific job that must be executed for the drone to fly. These jobs range from transmitting communications to the rc receiver, to the electronic speed controllers controlling power flow to the motors. If communication between anyone of these components is interrupted it could result in a failed or harmful flight. The assembly of a drone consists of soldering skills, meticulous work, and improvisation. The risk for error is large therefore research of previously built drones is collected and analyzed to apply to a new drone. The goal of this project is to obtain a substantial amount of information on both the assembly and components of a drone, while using the necessary skills to assemble and fly a drone to its full capabilities.

KEVIN LIU

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IMPLEMENTING SAFETY MEASURES FOR DRONES

Drones are becoming increasingly widespread in society, from recreational beginners to professional workers. This is due to the variety of components that can be replaced to upgrade drones. In this project, we attempted to convert a remote-controlled drone to an autonomous one. To accomplish this goal, we had to implement a GPS and computer software to give the drone instructions. We also had to replace hardware to make it compatible with the computer software. We divided the main goal into separate components: autonomy, hardware, software, and safety. I focused on safety, which included adding failsafe measures to prevent injury. Throughout this project, safety measures were used in each step, not just during pre-flight checks. I also investigated safety mechanisms present in other drones. The safety measures include a hardware safety switch (a button on the drone and a switch on the remote control) that kills the motors when it is activated. There is also a software shutdown built into the remote control. At the end of the project, we expect to have a drone that is able to fly along a set path without human intervention. Autonomy will make the drone safer as it will reduce human error and increase the possible functions.

AVIROOP MAJUMDAR

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Co-Mentor: Rudi Weinberg

INSTRUCTING AND CALIBRATING THE AUTONOMOUS DRONE

There is a lot of current research in the drone industry. With unsupervised, autonomous flight of a drone we can attain several applications. Delivery of objects to inaccessible regions, carrying loads and capturing videos are few of them. In this STAR project, I am involved in a group effort to build a drone with the ability to follow a specified, preprogrammed route. My specific research is oriented towards the efficient interaction of the ground software with the on-board equipment. We are using a Flight Controller (FC) (placed on the drone) and a Software to interact with it from the ground. Uploading the route, initial and final points and some certain specifications like waypoint radius and default altitude in the software will allow the drone to go in an autonomous mission. In order to connect the software with the FC, every component needs to be calibrated. This involves four steps- accelerometer, compass/ GPS, remote and Electronic Speed Controllers (ESC). My research will help to efficiently read and understand the interface of the software and also help in connecting with the FC and other components on the drone to make the it fly autonomously.

DARRELL EMAKE OMO-LAMAI

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Faculty Mentor: **DR. ANTONIOS KONTSOS**
Mechanical Engineering & Mechanics

Co-Mentor: Emine Tekerek

MICROSTRUCTURE AND MECHANICAL BEHAVIOR OF ADDITIVELY MANUFACTURED ALUMINUM ALLOYS

Additive Manufacturing (AM) is a rapidly emerging class of techniques that involve synthesizing parts layer-by-layer. The creation of highly complex geometries with high dimensional precision and good surface integrity, in contrast to traditional manufacturing techniques which limit design freedom, enables AM processes to be desirable choices in industrial applications. Nonetheless, in order to attain desirable metal products, relationships between manufacturing methods, observed microstructures, and resulting mechanical behaviors must be contrasted. A material's microstructure has a crucial impact on its mechanical properties due to the phase distribution and grains in the material itself. Furthermore, variations in metal additive manufacturing processes induce alterations in the microstructure of materials, thereby affecting the overall mechanical behaviors of their structures. Therein, this study focuses on the correlations between the microstructure and the tensile properties of an aluminum alloy (AlSi10Mg) fabricated through AM as compared to literature. Furthermore, the impact of heat treatment on the tensile behavior of AlSi10Mg is investigated with an emphasis on microstructural evolution.

NOM PHAN

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OBSTACLE AVOIDANCE FEATURE USING A COMPUTER VISION BASED ALGORITHM

Obstacle Avoidance is an important feature of an autonomous drone. For a quadcopter to be fully autonomous, it needs to have the ability to respond to various outdoor situations. In this project, the main goal is to implement obstacle avoidance feature to a quadcopter. The scale of this project is to help the drone autonomously operating in outdoor flight environment and avoiding outdoor objects such as trees or lampposts.

For the implementation of this project, I need to create Computer Vision based Algorithm using Python on OpenCV and run this Algorithm by a microcomputer module, which is a Raspberry Pi 3B + in this case. At the beginning of the process, image data will be collected frame by frame using a Raspberry Camera module that is connected directly to the Raspberry Pi 3B+. After executing some image processing steps to determine objects and free space, this Raspberry Pi 3B + will send commands to the drone's flight controller to help the drone to navigate through obstacles that pop up on the pre-planned way point autonomy mission.

DHRUV SHAH

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IN-SITU MONITORING FOR FDM PRINTERS WITH ACOUSTIC EMISSION

Fused deposition modeling (FDM) is the mainstream additive manufacturing process available for consumers. This process deposits sequential layers of polymer in layered profiles to achieve complex geometries with a single machining setup. With this robust manufacturing process comes disadvantages that include poor reliability and inconsistent part production. To address these drawbacks, acoustic emission (AE) technology was employed to monitor a 3D printer's states during the manufacturing process. Specifically, this project focused on developing an effective closed-loop system that provides sensory feedback to monitor FDM machine states. To achieve this goal, AE data collected in real-time during printing was first processed offline using a machine learning method capable of attributing sets of data to a given machine state. A database of AE data was then developed for critical states on a given 3D printer. The concept was then validated in real-time by programming a controller to receive AE data and running the machine learning algorithm to diagnose changing states of the printer. Future steps for this project include the integration of the identified states with the actual printing process to enable higher-quality printing.

GEDALIA KOEHLER

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Faculty Mentor: **DR. AJMAL YOUSUFF**
Mechanical Engineering & Mechanics

CUBE SATELLITE NAVIGATION SYSTEM FOR AUTONOMOUS DOCKING

Five weeks ago marked the 50th anniversary of the moon landing. This signifies a continual pursuit of knowledge that has occupied human thought for millennia - understanding the cosmos. The drive to push us farther into deep space is still prevalent as NASA and SpaceX race towards the Moon and Mars.

A new technology called Cube Satellites (CubeSats), which are benefited by their low cost and small 10x10x10 cm size, open the possibility for larger spacecrafts to be built in space through docking CubeSats like building blocks.

I am working on the navigation aspect of docking two CubeSats. Initially, I planned to autonomously bring two Cube Satellites together, and decided that one would be stationary, and one would be the chaser. Next, I researched and deliberated on what systems to use to accomplish this, which resulted in the plan to use radio signals to find the direction of one CubeSat relative to another, and camera-based image processing to find and align with the docking face of a target CubeSat, with the help of laser and distance sensors. By allowing the CubeSats to start within view of one another, I have successfully simulated autonomous docking. The radio direction finding is still in progress.

CHIARA L. O'NEILL

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TILT PLATFORM

The Tilt Platform is a platform that is connected to a baseplate via four independently controlled legs. Through various combinations of leg angles, a wide range of pitch and roll motions can be achieved while also maintaining a sturdy platform for a propeller assembly, a solar panel, or other piece of instrumentation to attach to. The platform would allow for the user to tilt the working axis of the instrumentation by changing the orientation of the plane's defining vector.

A primary goal of the project is to have the platform move from one position to another with speed and precision when given a user input. The position command will be given as pitch and roll degrees but will then be translated, via a coded algorithm, into the distances that each shuttle must travel to achieve the desired angles. Position sensors accurately monitor the distance between each shuttle and its respective corner, and a gyroscopic sensor is utilized for fine adjustment of the plate's angles. In addition to being responsive to live commands, the platform can also be preprogrammed to perform a series of motions smoothly and efficiently.

ALEXANDRA PITTS

College of Arts & Sciences
Psychology

Faculty Mentor: **DR. GIRIJA KAIMAL**
Creative Arts Therapies

Co-Mentors: Dr. Arun Ramakrishnan,
Katrina Carroll-Haskins

ART THERAPY APPLICATIONS IN VIRTUAL REALITY AND INDIGENOUS ART FORMS

The field of art therapy is ever evolving, but many have failed to consider its benefits due to its seemingly niche audience. Although the idea of creating art seems intimidating to many, art therapy's purpose is not to improve one's artistic skills, but instead use art as a medium for improving one's emotions and psychological well-being.

The purpose of my research was to investigate two seemingly different expressive medias and their benefits in helping art therapy become more wide reaching. Building upon Dr. Kaimal's study on the benefits of art making, we applied the format to a virtual environment. Specifically, I explored the effects of virtual reality (VR) in exposure therapy and pre-existing VR art apps. These applications can be applied to art therapy by creating an immersive environment for people who do not consider themselves artists. In said environment, art become a therapeutic outlet and enhances feelings of self-efficacy.

Drawing from the history of art, I researched indigenous art forms that contain therapeutic benefits specific to each culture's practice. In Canada, Australia, and Ireland, art is connected to spirituality, community building, and psychosocial learning through storytelling.

JESSICA CUNALATA JHA

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Computer Science

Faculty Mentor: **DR. ELLEN BASS**
Health Systems & Sciences Research
College of Computing & Informatics; School of Biomedical Engineering, Science, & Health Systems

INTEGRATING UNMANNED AIRCRAFT SYSTEMS INTO U.S. COMMERCIAL AIRSPACE

The word "drone" is used to describe $50 aircraft that a child can fly, multimillion-dollar autonomous vehicles used for dangerous military excursions, and everything in between. Many companies across different disciplines have identified these unmanned aircraft systems (UAS) for many commercial applications such as border patrol, airborne pollution monitoring, and one of the biggest - automated cargo shipping. There have been many test runs, however, the Federal Aviation Administration (FAA) limits commercial use of drone delivery for several reasons; the prime rationale being the unknown safety risks and concerns UAS will have within the National Airspace System. It is imperative to identify the specific human factors issues contributing to the certification of automated civil and commercial UAS flight. Under Dr. Bass, I will be helping conduct dataset analyses of safety reports from NASA's Aviation Safety Reporting System, the National Transportation Safety Board (NTSB), and the FAA using the taxonomy called Human Factor Analysis and Classification System (HFACS) to inform recommendations on the implementation of standardized safety protocols and training routines for the future of regulated UAS flight.

COLLEGE OF NURSING & HEALTH PROFESSIONS

FAITH CAO

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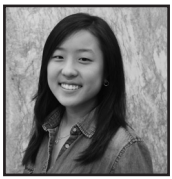
Co-Mentors: Shawn Riley, Emily Riahi, Dan Dychtwald, Jacquelyn Walther, Taylor Hisek, Dr. Ann Klassen, Karon Martyn

SELF-EFFICACY AND PREPAREDNESS TO MANAGE NUTRITION-RELATED CANCER TREATMENT SIDE EFFECTS AMONG INDIVIDUALS WITH GASTROINTESTINAL CANCER AND THEIR FAMILY CAREGIVERS

Background: Gastrointestinal cancer patients (PT) often experience nutrition-related treatment side effects. However, little is known about the self-efficacy and preparedness among family caregivers (CG) for managing side effects at home. **Objective**: To describe the prevalence and severity of PT nutrition-related side effects, PT and CG self-efficacy for managing symptoms, and CG preparedness. **Methodology**: Using a mixed methods design, PT and CG completed surveys and interviews. Surveys assessed PT treatment side effects, PT and CG self-efficacy, and CG preparedness. In-depth interviews explored nutrition-related challenges. Descriptive statistics were calculated. **Results**: 42 PT (n=23, 44% female, 96% >55 yrs) and CG (n=19, 58% female, 84% >55 yrs) completed the study. Common side effects were fatigue (78%), dry mouth (43%), parageusia (35%), taste discomfort (30%), and difficulty swallowing (30%). Self-efficacy (PT= 73±18; CG= 62 ±25; 10-100 scale) and CG preparedness were generally high (3±0.65; 0-4 scale). CG reported needing guidance in nutrition activities, disease progression, and emotional coping. **Conclusions**: Supportive care should be tailored for families experiencing GI cancer and include training in preparedness.



KIANNA LY

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Co-Mentor: Joseph Stanzione

DETERMINING THE ACCURACY OF RESTING METABOLIC RATE PREDICTION EQUATIONS FOR ATHLETES

A person's resting metabolic rate (RMR) is the energy required to perform basic functions when at rest. The Metabolic Cart is known as an "indirect calorimeter" that measures the oxygen consumed and the carbon dioxide expired to calculate how much cellular respiration is being performed by a person's cells. Different types of RMR prediction equations also exist, but they vary in terms of accuracy and specific factors taken into account by the researchers who developed them (i.e., age, lean body mass, fat mass). Researchers have shown that these equations tend to overestimate RMR, but the majority of sample sizes used for analyses were either small or favored a specific population.

In our study, we collected data from Masters Athletes (26 years of age), who represent a wide variety of sports and backgrounds. We measured their RMR via indirect calorimetry and compared the measured RMR to four prediction equations: the Mifflin-St. Jeor, Harris-Benedict, Cunningham, and Owen equations. By evaluating the differences between measured RMR and the prediction equations, it will allow for better nutritional planning and fitness guidance.

COLLEGE OF NURSING & HEALTH PROFESSIONS

ISHAN K. SHAH

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

Faculty Mentor: **DR. ARUN RAMAKRISHNAN**
Office of Research, Discovery, & Innovation

GET SAFE AT HOME: A SELF-GUIDED ONLINE HOME SAFETY ASSESSMENT TOOL FOR OLDER ADULTS AND THEIR FAMILY MEMBERS

Older adults want to age in their long-term residence, but their housing may pose a health risk. These include, falls, difficulty bending, inability to enter the home, visual impairments, and mobility challenges. As the overall aging population increases, these risks have led to an increase in injury and fall death rates in the United States. To address this issue Dean Gitlin created HEAP (Home Environment Assessment Protocol), a paper-based tool which would allow caregivers to perform a walk-through evaluation of the older adult's house. The HEAP tool will provide a room report with a hazard, adaptation, and visual cue score.

In order to increase awareness to home safety, we created an online app called "Get Safe at Home" which will enable both caregivers and the older adults to conduct a home safety evaluation and generate a personalized hazard mitigation report that can be used to guide home improvement projects to make their home safer. We developed this app using REDCap. With feedback from two focus groups consisting of 21 older adults 23 health professionals we upgraded the app to better suit the older adult's needs. The response to the app was overwhelmingly positive especially on its ability to create awareness to in-home hazards that older adults may face. We also created an accompanying website that the older adults can use to learn more about our home safety evaluation tool and to connect them with helpful local and national organizations and programs.

ELIZABETH GREUBEL

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Nursing

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PhD in Nursing Science Program

A COMPARISON OF NUTRITIONAL STATUS IN YOUNGER AND OLDER ADULTS WITH CHRONIC LEG WOUNDS

Older adults are at risk for malnutrition due to physiological and psychosocial factors. Nutrition plays an important role in wound healing. However, it is not known if there are differences in nutritional status in younger and older adults who present with chronic leg wounds (diabetic foot ulcers and venous leg ulcers). The purpose of this study is to describe the differences in baseline nutritional status in younger and older adults with chronic leg wounds. We will analyze baseline nutrition data of the first 60 subjects enrolled in a double-blinded randomized controlled clinical trial (NIH 5R01NR015995, PI: Lewin) to examine the impact of low-frequency low-intensity ultrasound therapy on healing chronic wounds. We will compare differences in nutrition variables (body mass index, serum albumin, Mini-Nutrition Assessment Score, hand-grip strength) by age (< 65 and > 65 years of age). Findings from this study may help inform the development of targeted nutrition interventions for older adults with chronic leg wounds.

LEANNE KHOV

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PhD in Nursing Science Program

A COMPARISON OF INFLAMMATORY MARKERS IN YOUNGER AND OLDER ADULTS WITH CHRONIC LEG WOUNDS

The incidence of chronic leg wounds (diabetic foot ulcers and venous leg ulcers) is expected to rise due to an increase in the aging population. Chronic leg wounds are associated with increased healthcare costs and can impact quality of life. Wound healing can be delayed by poor nutrition and of inflammation, and aging is associated with chronic inflammation. The purpose of this descriptive observational study is to describe differences in baseline inflammatory markers in younger and older adults with chronic leg wounds. We will analyze baseline inflammatory biomarkers of the first 60 subjects enrolled in a double-blinded randomized controlled clinical trial (NIH 5R01NR015995, PI: Lewin) to examine the impact of low-frequency low-intensity ultrasound therapy on healing chronic wounds. We will compare differences in baseline serum inflammatory biomarkers (IL-6, IL-10, TNF-a, and hsCRP) by age (< 65 and > 65 years of age).The findings from this study can inform the development of tailored ultrasound treatments that take into consideration baseline inflammation to improve the healing of chronic wounds and quality of life.

NAM LE

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Computer Science

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PhD in Nursing Science Program

Co-Mentor: Dr. Arun Ramakrishnan

DESIGNING AND DEVELOPING AN INTERFACE FOR FLUID INTAKE MONITORING IN OLDER ADULTS

Heart failure (HF) is a common chronic condition in older adults and is associated with increased health care costs. Individuals with HF are often fluid restricted, therefore monitoring fluid intake is important for self-care management. There is an unmet need to develop strategies to promote HF self-care management. The Smart Cup was developed to promote self-care management through real-time monitoring of fluid intake. A previous iteration of the Smart Cup captured fluid consumption data, but the data was not displayed in a simple, easy to understand interface for the end-user. The purpose of this project was to develop the interface (using LabView) that processes data gathered in real-time from sensors on the Smart Cup to provide information on the patient's fluid consumption. By introducing a finite state automaton based on the gyroscope, accelerometer and weight readings from the cup, we further increase the interface's reliability and accuracy, with the long-term goal of improving health outcomes for older adults with HF. A prototype of the interface was also designed using Adobe XD with adherence to universal design principles for older adults to facilitate transition of the interface onto a mobile platform.

ALEXIS MELSON

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Faculty Mentor: **DR. ROSE ANN DIMARIA-GHALILI**
PhD in Nursing Science Program

A COMPARISON OF METHODS TO CALCULATE LEG WOUND MEASUREMENTS

Chronic leg wounds (diabetic foot ulcers and venous leg ulcers) are wounds that have not shown significant progress towards healing in a timely fashion. The purpose of the parent study is to observe the effect of a low frequency, low intensity ultrasound on wound healing, and health-related quality of life (NIH 5R01NR015995, PI: Lewin). There are several methods to measure wound size. The purpose of this study is to determine the reliability of different methods used to calculate the size of chronic leg wounds. The research team has designed a method to calculate wound size by taking a digital photograph and analyzing the traced image in MatLab. This method is labor-intensive, and the size cannot be calculated at the point of care. Alternatively, other methods including commercial apps are available to calculate wound size. Before we can adopt commercial apps, we need to compare reliability within and between methods. We are currently analyzing the data and comparing the reliabilities. The findings will inform the selection of methods used to quantify wound size in future studies.

AMAIYA HARRELL

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PhD in Nursing Science Program

THE VALUE OF SIMULATION TECHNOLOGY IN CLINICAL RESEARCH

Simulation technology is used to replicate clinical scenarios and settings. This technology includes a range of methods including computerized mannequins and standardized patients (i.e., actors). Simulation is mostly used in health professional education to improve the clinical skills of students in a risk-free environment. There is also potential value in clinical research. This exploratory-descriptive study used mixed methods of data collection and analysis to explore the occurrence and perceived value of simulation in clinical research. A review of 30 evidence-based articles uncovered the lack of occurrences in which simulation is part of the procedure. Only 6 of the articles used simulation to replace human subjects. Its role in education was studied more often. Preliminary analysis of interviews with nurse scientists (n=5) revealed that one value of simulation is that potential risks to patients are eliminated. Disadvantages are that simulation is expensive and time consuming. Data analysis is ongoing, but findings so far suggest that researchers might consider using the technology more often because it eliminates the risk to human subjects, allowing for more control over the research condition.

LILLY ONI

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Biological Sciences

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Biochemistry & Molecular Biology

Co-Mentors: Dr. Srinivas Somarowthu, Andrea Rosenkranz, Ronak Loonawat, Allison Yankey

LNCRNA'S ROLE IN MAINTAINING DIFFERENTIATION IN PRIMARY RAT HEPATOCYTES

Primary hepatocytes, a major cell type of the liver, tend to dedifferentiate, becoming less specialized and, in essence, cease to be hepatocytes when plated. Over time, this leads to greater morphological changes and changes in the expression of proteins and RNA. In the past decade, long non-coding RNAs (lncRNA) have emerged as key players in cell growth and development. Here, we hypothesized that lncRNAs also play a critical role in liver dedifferentiation. We analyzed transcriptome-wide RNA-Seq data and identified lncRNAs that are differentially expressed when hepatocytes are plated. Through RNA isolation and RT-qPCR, changes in the expression of lncRNA as hepatocytes dedifferentiate will be confirmed. In addition, we will analyze the expression of lncRNAs in two oxygen conditions. One of the many factors that differ between the bodies of living organisms and a petri dish is the oxygen levels that are present in each environment. The air around us contains 21% oxygen, while the liver experiences a much lower concentration at 6% oxygen. These experiments will eventually allow us to define mechanisms that maintain hepatocyte differentiation and aid in ensuring the physiological relevance of studies in these systems.

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HBV REGULATION OF EIF4E IN A NOVEL 3D LIVER MODEL

Globally, hepatitis B virus (HBV) chronically infects approximately 250 million people and is a leading cause of liver cancer. Recent studies have shown that transformation of HBV-infected hepatocytes may be due to the virus's manipulation of cell metabolism. Most protein synthesis in cells is regulated by the mechanistic target of rapamycin (mTOR). We hypothesize that HBV activates an alternative pathway, the AMP-regulated kinase (AMPK)-MNK-eIF4E signaling axis, to stimulate synthesis of HBV proteins. To test this hypothesis, a pan-MNK inhibitor was used to assess how MNK inhibition affects eIF4E activation and HBV-protein synthesis. Upon treatment, a decrease in expression of HBV proteins would show that HBV uses this alternate pathway. To enhance the biological relevance of our studies, we are analyzing the effects of the MNK inhibitor on HBV protein expression in a system we call the "flip-coin" 3D liver model that allows co-culture of hepatocytes and non-parenchymal liver cells. This system is a physiologically relevant model of the liver wherein hepatocytes remain differentiated for longer than in conventional systems. Understanding how HBV affects metabolic activities may provide insight into how it causes liver cancer.

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LYTIC INACTIVATORS OF HIV-1

The focus of my STAR project is to understand the mechanism of action of cyclic peptide triazole thiols (cPTTs) on pseudo HIV-1 viruses. HIV-1 is still one of the leading causes of death around the world, for which, despite HAART treatment, a cure is yet to be found. cPTTs are a class of compounds that inhibit HIV-1 infection and cause virus envelope protein inactivation, including gp120 shedding and virus membrane lysis. Env trimer rearrangements are hypothesized to be important for inactivation but are not well understood. We addressed two key questions about cPTT mechanism: the importance of gp120 disulfide bonds and the role of gp41 six-helix bundle formation. Previous experiments on envelope mutants missing important cysteine residues revealed that cPTTs trigger disulfide exchange. For my project, we formed several single and double mutants to determine which gp120 cysteine participates in exchange with cPTT thiol. Another vital part of the cPTT mechanism is six-helix bundle formation, a complex derived from trimers of gp41 during fusion with host cells prior during infection. We conducted assays showing that cPTT lysis is competed by T20, a drug that prevents six-helix bundle (6 HB) formation. These preliminary data show tha

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TARGETING CYCLIN DEPENDENT KINASE (CDK) INHIBITORS TO TREAT GLIOBLASTOMA

Glioblastoma Multiforme (GBM) is the most aggressive form of cancer that develops from star-shaped glial cells that support the nerve cells in the brain. Due to the location of the tumor, its resistance to therapies and minimal treatment options, the need for new treatment options is critical. In most cases, the tumor arises due to the dysregulation of cell cycle genes called cyclin-dependent kinases (CDK). One CDK that has been implicated in GBM is CDK5. CDK5 phosphorylates tumor suppressors like retinoblastoma (Rb) protein. It is known that GBM converts acetate to acetyl-CoA via the enzyme ACSS2 (Acyl-CoA Synthetase Short Chain Family Member 2). Our lab has shown that the enzyme O-linked N-acetylglucosamine transferase (OGT) is overexpressed in GBM, that OGT regulates ACSS2 protein expression causing GBM growth and that CDK5 is responsible for phosphorylating ACSS2. Thus, I hypothesize that targeting CDK5 with pan-CDK inhibitors like Dinaciclib and Fx-310 would reduce viable cells in GBM cell lines. Here, using crystal violet staining, I show that treating GBM cells U98-MG or T98G with Dinaciclib or FX-310 reduces the growth of cells. Hence, targeting CDKs may be a viable therapeutic strategy in treating GBM tumours.

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THE EFFECT OF ASTROCYTE FUNCTION DURING CHRONIC ETHANOL EXPOSURE ON REWARD SEEKING BEHAVIOR IN ETHANOL-DEPENDENT FEMALE MICE

Alcohol use disorder (AUD) is a chronic disease associated with inflexible reward-seeking and altered astrocyte immunoreactivity. Our findings indicate that ethanol-dependent female mice exhibit similar reward-seeking behavior to controls, but are resistant to extinction of reward-seeking. Dependent female mice also exhibited a reduction in astrocyte immunoreactivity in the nucleus accumbens (NAc). Thus, we tested the hypothesis that astrocyte activation in the NAc would reduce reward-seeking behavior in ethanol-dependent female mice. Female mice received injections of a virus expressing a designer receptor exclusively activated by designer drugs (DREADD) in NAc astrocytes. After induction of ethanol dependence by chronic intermittent exposure to ethanol vapor, mice underwent food-conditioned place preference (CPP) testing to assess reward seeking. Expression, extinction, and stress-induced food CPP were measured. Our results showed that astrocyte activation decreased basal reward-seeking behavior but did not affect stress-facilitated reward-seeking in ethanol dependent female mice. Thus, these findings implicate NAc astrocyte function in the regulation of reward-seeking in ethanol-dependent females.

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RURAL DEVELOPMENT: IMPLEMENTING WASTE MANAGEMENT

India has the highest rate of Open Defecation in the world. Improper Water, Sanitation and Hygiene (WASH) behaviors directly impact child health. Bacteria and germs in the feces reach children causing diseases and infections such as diarrhea and typhoid. Diarrhea alone kills 2,195 children every day. These diseases also leave a significant negative impact on those who survive, stunting their physical and mental growth.

Working closely with World Vision International in India (WVI), the Lucknow Area Program emphasizes the Solid and Liquid Waste Management (SLWM) initiative, a part of open-defecation sustainability. Due to the prevalence of open drainage and lack of proper waste water treatment process, children and adults are at an increased risk of catching infections and diseases.

Five villages per district were selected by WVI for low-cost effective SLWM implementation. Interviews were conducted with government officials and WVI staff including District Facilitators and Gram Pradhans (Village Council Heads) to document the entire process that has taken place until now for the creation of a sustainable SLWM system in these villages. The aims of this work are to record and observe the entire waste management process, understand previous challenges faced in the field, and predict challenges that might arise in the future. Recommendations were provided to advance SLWM implementation in other villages, blocks and districts.

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INDIA'S WinS IMPACT ON BEHAVIOR

The world is experiencing a global water and sanitation crisis, disproportionately affecting the health of populations in low to middle-income countries. Specifically, school children are put at a greater risk of contracting and transmitting waterborne diseases due to the scarcity in improved water, sanitation, and hygiene (WASH) and infrastructure for access to clean water in education facilities. In 2018, World Vision India partnered with Rotary International to intervene in children's lives to fulfill their rights to quality WASH, education, and well-being by implementing WASH programs in government schools across the country. Previous reports suggest that WASH in schools (WinS) can promote good hygiene habits, but is more knowledge and exposure translating to changed behavior? The aim of this research is to assess the impact of WinS on students' behavior change to further grasp the complexities of WASH. Twelve months of consistent behavior change software on hygiene practice was followed by a qualitative study in 6 Delhi primary schools. After conducting focus group discussions, a thematic analysis of reported outcomes revealed improved attitudes, behaviors, and increased enrollment but mixed results in student attendance.

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SYNTHETIC LARYNX DESIGN AND FABRICATION

In the evolving world of biomedical engineering, 3D Modeling has become a useful tool to understand the functioning of the human body. The causation and development of various speech impediments can be examined using a 3D model of the larynx. This work used MATLAB and 3D printing to create and analyze synthetic vocal folds for various vibratory patterns. This began through MATLAB where a code was created to understand the shape of three vocal fold degrees based on the M5 Model design: -10, 0 and 10. Then, using the findings, molds of the folds were developed using Creo Parametric and were 3D printed. Next, five 3D models of vocal tracts were created that represented the vowels"a", "e", "i", "o", "u". This was later combined with a lung model to show a full synthetic design of the way voice is projected in the human body. Finally, the model was tested for various acoustic parameters to understand the changes that occur when the degree of the vocal folds change. The testing was done perceptually, where sound was analyzed, and acoustically, where frequencies were analyzed. This work is crucial as if the model proves successful, it can be further manipulated to model and provide more information on various pathological cases.

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VIRTUAL REALITY AS A TRAINING TOOL FOR CHILDREN WITH NEURODEVELOPMENTAL DISORDERS

Virtual Reality (VR) has shown potential in various disciplines ranging from therapy to education and training. Previous research suggests that VR has been successful in helping people overcome phobias, social anxiety, post-traumatic stress disorder, and other conditions. This project seeks to explore the efficacy of virtual reality as a training tool for children with Neurodevelopmental Disorders (NDD's), specifically Autism, Attention Deficit Hyperactivity Disorder, and Dyslexia. Several VR environments teaching colors, words, shapes, and counting were created and converted to a mobile device compatible with a VR head-mounted display. EEG signals from NDD children exposed to the VR tasks were acquired and compared to EEG signals from NDD children trained with traditional methods, like flashcards. Using a combination of MATLAB and EEGLAB, the acquired signals were separated into alpha, beta, theta, delta, and gamma bands and extraneous noise, including eye blinks and head movement, were removed. The EEG signals were processed, and various features were acquired. The analysis of the comparison between VR and non-VR exposure serves as the method in which the effectiveness of VR as a training tool can be quantitatively examined.

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EFFECTS OF ALGAL-BASED FERTILIZERS ON NITROGEN PRODUCTION IN FIELD CROPS

Biologically-based fertilizers are used to supply crops with limiting nutrients. Interest in biofertilizers, specifically algal-based fertilizers, is rising due to potential for cultivation of algae in waste-water treatment systems, therefore recycling the nutrients, and potential to use them as biostimulants for crops. While beneficial effects of biofertilization on crop performance in lab experiments have been reported, previous studies have not considered the environmental effects, nor the harvestable yield of agricultural crops. To address this gap, we have designed an experiment with common wheat (T. aestivum) grown in infertile soil (sand) with an application of 11 different algae (Scenedesmaceae spp)/fertilizer (ureaammonium-nitrate) ratios to assess which would produce the most available nutrients for plants. We tested the amount of nitrate (NO_{3-}) and ammonium (NH_{4+}) produced by mineralization. We found that the ratio resulting with the fastest production of nutrients for plants was 30% algae with 70% fertilizer. This will be used in an experiment with three soil types where wheat will be grown, and environmental effects of algal fertilizer will be assessed to determine the nitrous oxide (N_2O) emissions and grain yields.

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SYNTHESIZING AND CHARACTERIZING MICROSPHERES USING SOL-GEL BASED COATING

The growth of cost-effective renewable energy sources is deterred by the stagnation in solar cell technology. Concentrating photovoltaics (CPV) achieve high efficiency but require expensive mechanical motors. However, passive tracking is a potential cost-effective solution which involves a reflective-opaque surface that becomes transparent when exposed to concentrated radiation. Light can pass through the transparent opening into an external reflective cavity where the solar cell lays. One method for optical passive tracking involves absorptive black microspheres that repel and form an opening hole upon applying concentrated radiation. Although light passes through, absorptive particles lower the power of the sun's rays, reducing the performance of the cavity. Therefore, the goal was to synthesize the optimal microparticle assembly from a mixture reflective white particles and absorptive black particles that will induce passive tracking and maintain high efficiency. The project separately utilized silver and glass microparticles as a potential reflective component. For absorptive microspheres, one option was silver oxide encapsulated in sol-gel—silica glass—and another was glass microspheres coated in a sol-gel and carbon mixture.

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FABRICATING POLYSTYRENE SPHERES MONOLAYER ON SILICON SUBSTRATE VIA LANGMUIR BLODGETT

Langmuir Blodgett technique provides a versatile system for fabricating homogenous and compact monolayers and to study the interaction between the molecules of monolayer under controlled conditions. Langmuir monolayers are the films of a thickness of just one molecule which are widely used in many practical and commercial application such as sensors, detectors, displays, coatings and electronic circuit components. The goal of my project was to create compact and homogenous monolayer of polystyrene spheres on silicon wafer. The polystyrene spheres were mixed with 3 ml of ethanol and injected into the surface of water using conduit plate and syringe pump. Trace amount of ethylene glycol was injected into the subphase after the monolayer was settled on the surface of sub-phase so as to overcome the ionic repulsion between the charged polystyrene spheres. The deposition was then done by successively raising the Silicon substrate through the subphase from the monolayer while simultaneously keeping the surface pressure constant by a computer-controlled feedback system. Finally, a compact and homogenous monolayer of around 20 micrometers was fabricated on Silicon wafer which was then etched to make nanowires under controlled conditions.

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Department of Desalination and Water Treatment

LASER-INDUCED GRAPHENE FOR SOLAR EVAPORATION

Carbon containing surfaces such as polyimide, polyether sulfone (PES) films and membranes (UP 10) can be irradiated using 10.6 œm CO_2 infrared laser cutting systems to be converted into porous graphene, also known as laser-induced graphene (LIG). The unique properties of LIG membranes (antifouling, high electrical and thermal conductivity, high surface area etc.) allow for use in water treatment and desalination processes. However, they lack the pore depth and mechanical stability when using certain commercial films. Here we show a novel lasing method for the production of LIG including a hexagonal layering pattern on both sides of the membrane. By utilizing this method on varying thicknesses of the PES membrane, we were able to produce a 62% increase in the evaporation rates between 600m and 300m, and 16% increase between the control group and 300m membrane. This change implies an increase in pore depth and consequently the evaporative qualities of such membranes, applying not only to inland evaporation to increase productivity in evaporation ponds for industrial waste and brine evaporation, but in oceans for production of fresh water in combination with membrane distillation.

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VALIDITY AND RELIABILITY OF THE UPPER EXTREMITY MODEL USING 3D MOTION CAPTURE ON PATIENTS WITH BRACHIAL PLEXUS INJURIES

The Motion Analysis Center at Shriners Hospital performs clinical evaluations of the upper extremity on patients with brachial plexus injuries, which causes inhibited motion in their arms. The purpose of this study was to validate the motion capture of the upper extremity model comparing it to values obtained from a goniometer. The skeleton's humerus and scapula moved between 0-135° during three motions across the transverse, sagittal, and coronal planes. The study also tested the inter-reliability of the model. Ten reflective markers were placed on each segment of a patient's upper extremity, including the thorax, scapula, and humerus. The patient performed nine motions twice, each time using a different tester. Data was collected using a 12 camera Vicon system and Nexus. The angles between the three joints were modeled using linear algebra to represent the upper extremity motion. All motion capture measurements were within 0-12° of expected positions as measured by the goniometer on the skeleton model. For the two testing sessions, the data obtained showed ICC's ranging from 0.07 to 0.98. Future work should include ensuring the patient's motions are consistent during each test and specialized training for physical therapists.

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Smad9 FUNCTIONAL ROLE IN MDX MUSCLES

Duchenne Muscular Dystrophy (DMD) is a muscular degenerative disease that afflicts up to 1 out of every 3,500 newborn males. This genetic disorder leads to changes in skeletal muscle morphology, including increased fibrosis and migration of myonuclei internally. Our lab found that Smad9 is upregulated in DMD skeletal muscles. The goal of this research is to determine the role of Smad9 in DMD. To do so, analysis of muscle morphometry was conducted using knock-in reporter mice where two reporter proteins, eGFP and luciferase, were inserted into the Smad9 gene via CRISPR/CAS9 technology. This mouse was then crossbred to the mdx mouse model of DMD, mdx^{5cv}. This project quantified wildtype histological changes and compared mdx reporter mice skeletal muscles at two different ages. Analyses consisted of light microscopy paired with quantification of internal nuclei from various muscle fibers along with quantification of trichrome stained cells for fibrosis through *ImageJ*. It was found that morphometry of the young mice shows no difference between mdx and wildtype mice. These data show that the Smad9 reporter mouse strain recapitulates mdx disease in skeletal muscles and that the reporter proteins can be detected by immunofluorescence.

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DRESS FOR SUCCESS AND WOMEN'S FIGHT FOR EQUITY IN THE WHITE-COLLAR WORKPLACE

There is a significant lack of women in high level and leadership positions in business. Despite feminist attention to this issue, women have yet to be able to gain any ground in terms of leadership equality in the white-collar workplace. Due to emphasized societal expectations placed on women, they are judged more heavily than men on first impressions and appearances, and therefore held to a higher standard in terms of dress and appearance. I am researching the effect dress and appearance has had on women's success in the workplace. I chose to focus my research on the 'dress for success' ideology that arose in the 1970s encouraging women to 'dress the part' in the workplace. I seek to find out if 'dress for success' as an ideology has been empowering for women, or if it has placed yet one more unfair burden on women trying to break through the glass ceiling. Having interviewed 14 professional women, as well as volunteered at Career Wardrobe, a second-hand retail site for professional clothing, I've learned that dress and appearance in the workplace places a large burden on women more so than men, and creates another game that women have to play to survive in a man's world.

CAROLINE KOTTMEIER

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SEX AND SEXUALITY IN THE '90s, THROUGH *Beverly Hills 90210*

From 1990-2000, teen drama Beverly Hills 90210, followed the lives of the elite from high school to their mid-20s. During this time, many critics derided the show for its portrayal of sex, drugs, and mental health, among other issues, where the teenage audience felt that the show accurately represented these 'real' issues. Through reading books, primary sources from the 90s, and watching all 10 seasons of the show, I studied how 90210 represented sex and sexuality. 90210 showed teenagers with growing sexual independence, which is a portrayal consistent with the culture of the 90s in America. The 90s saw the start of 3rd wave feminism, the creation of the world-wide web, and slow treatment of the AIDS crisis. 90210 has its flaws, but it also breaks stereotypes by having emotional male characters and sexual female characters. Male and female characters are given space to express their sexuality, and it is consistently shown that characters whom openly communicate their needs and desires are happier than those who do not. Over the years, other teen dramas have reproduced these ideas, with only slight changes in terms of raunchiness.

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AGE- AND SEX-RELATED CHANGES IN PELVIC MORPHOLOGY IN PEDIATRIC SUBJECTS

There is limited data in the literature on changes in pelvis morphology as a function of age and sex. The objective of this study was to quantify the effects of age and sex on pelvis morphology in pediatric subjects. Using retrospectively obtained abdominal CT scans from 54 males and 49 females ages 1-19 years, the 3D pelvis geometry was reconstructed using Mimics (Materialise Inc), and 19 bony landmark points (LMPs) were identified using MATLAB (Mathworks Inc). Using these LMPs, a total of 21 pelvis geometry measures were computed. For each measure, linear regression models were fit, and descriptive statistics were computed. The growth rates and , median and inter-quartile (IQR) values were compared using t-test and z-test, respectively. Pelvis width, height and depth, and inter-acetabular distances significantly correlated with age. Significant sex-related differences in median and IQR values were found for pelvic height, and distance between left tip of superior iliac crest and S1. There were no significant sex-related differences for growth rates. These measures can be used for medical device design and sizing, and to develop computational models. Future work could focus on pediatric size-invariant shape models of the pelvis.

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

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VALIDATION OF CHAMBER FOR IN VITRO EXPOSURE OF CELLS TO ULTRASOUND

Nearly 6.5 million U.S. patients are affected by chronic wounds, which average 13 months before wounds closure. Our research team has developed a low-frequency (20 kHz), low-intensity (<100 mW/cm^2 SPTP) therapeutic ultrasound (LFLI US) device that healed diabetic ulcers (n=4) 3 times faster than controls (n=4), in pilot human clinical studies. To clarify the biological mechanism of LFLI US, we developed a closed loop chamber for exposing cultured cells to LFLI US in a controlled manner. The purpose of this research is to assess the viability of M1 macrophages and to measure changes in cell media temperature in the chamber after treatment with LFLI US. M1 macrophages were cultured at 37°C, seeded on 12 well plates, and treated with 15 minutes of LFLI US at intensity levels of 10, 50, and 100 mW/cm^2 or sham. Cell viability was assessed using a MTT Cell Proliferation Assay (BioVision); there was no significant difference ($p>0.05$) between cells treated with LFLI US and those treated sham, with percent variations of 22, 52, and 36%. Cell media was tested for temperature increases using a thermocouple; the temperature remained within viable cell culturing range (37°C to 40°C) throughout the exposure period at each intensity level.

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DESIGNING AND CHARACTERIZING POROUS GELATIN METHACRYLATE HYDROGELS FOR BIOMATERIAL-BASED THERAPEUTICS

Biomaterial therapies are used to promote tissue repair and regeneration following disease or injury, but are subject to the foreign body response (FBR), which can lead to fibrotic encapsulation or rejection of the biomaterial. Macrophages and their phenotypic transition from the 'pro-inflammatory' M1 to the 'anti-inflammatory' M2 are critical in modulating the FBR and tissue regeneration. Synthetic hydrogel porosity has shown to aid polarization towards M2 macrophages. However, naturally derived porous hydrogels have not been studied this way. We hypothesized that porous naturally derived hydrogels would promote an M2-like phenotype. Three gelatin methacrylate hydrogels were fabricated by passing pre-warmed hydrogel solution back-and-forth within two syringes with varying levels of air content (0%, 11%, and 20%) to generate pores. Density was 10% lighter with the air integrated hydrogels, but differences between aerated hydrogels were seen only in pore frequency: 80% more pores per mm^2 in 20% than 11% hydrogels. M0 macrophages were seeded onto the hydrogels for 72 hours and analyzed for gene expression to determine phenotypic changes. The results of this work will help inform future drug-free immunomodulatory biomaterial designs.

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MACHINE LEARNING IN MEDICINE: PREDICTING CHRONIC WOUND HEALING OUTCOME

Over 6.5 million Americans suffer from chronic wounds, an epidemic increasing with the growing aging population and rising incidences of chronic conditions such as diabetes and obesity. The accepted diagnostic metric to determine healing is reduction in wound size, but this has proven to be inaccurate. The development of a data-driven diagnostic tool utilizing machine learning to predict healing outcome can assist in determining treatment, improving patient quality of life, and reducing cost of care. For example, patients predicted not to heal with standard treatments could be fast-tracked to more advanced options. To achieve this, decision trees were built using the R Statistical Language. The data, consisting of 42 patients with varying medical observations, was sorted and classified. The models were then trained with 65% of the data and tested on the remaining 35%. Healing outcome predictors were based on literature review of medical factors such as Age, BMI, Sex, etc., with decision tree predictions reaching accuracies of 90%. The proposed application would review inputted patient data and display machine learning analytics accordingly. Future work consists of refining learning algorithms and expanding diagnostic capability.

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A BIOCOMPATIBLE, AUTONOMOUSLY EXPANDING BLOOD SHUNT FOR PEDIATRIC PATIENTS

Hypoplastic left heart syndrome (HLHS) refers to a complex set of cardiac defects in which the heart's left-sided pumping chamber is underdeveloped and cannot drive blood to the body. The treatment for HLHS begins with the implantation of a fixed-diameter shunt to redirect and balance blood flow from the body to the lungs. These shunts, however, do not fully support an increase in blood volume due to the baby's growth. To address this unmet clinical need, we seek to properly distribute blood volume with growth by designing a new shunt that incorporates a tunable inner diameter over time. Our geometrically tunable, hydrogel-based blood shunt includes a fixed outer sheath coated internally with a thick layer of a hydrogel. By controlling the degree of chemical crosslinks in the hydrogel polymer, the inner diameter of the shunt contracts and widens to increase blood flow. Leveraging prior work, this project involves a detailed systematic review of available biomaterials with hydrogel polymer compatibility, and we identified the optimal material combination so that we can begin pre-clinical testing. If successful, the infant mortality rate is expected to substantially decrease for this high-risk population.

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DEVELOPING A NEW METHOD OF FORMING TPGS MICELLES IN SE61 MICROBUBBLES

Hypoxia, the lack of oxygen in tissue, reduces the effects of radiation therapy in tumors. Oxygen filled microbubbles (MBs) named SE61, which shell consists of sorbitan monostearate and water-soluble vitamin E (TPGS), are used to deliver oxygen to hypoxic tumors with the use of ultrasound. Since tumor oxygenation is too short for use in humans, the incorporation of a drug to increase this time has been explored. Research has shown that creating TPGS micelles prior to MB creation significantly improved the number of MBs formed but lead to poor drug loading. Increasing drug loading was investigated using the solvent casting technique, in which micelles are formed from a thin film of TPGS and drug cast from a chloroform solution. This is believed to allow TPGS micelles to better trap the drug. Empty MBs were first created to confirm that no acoustical differences occurred. Dose response curves for the standard method resulted in an enhancement of 18.24 ± 2.35 dB at a dosage of 280 µL/L, while the solvent casting method produced 19.00 ± 0.12 dB at a dosage of 380 µL/L, concluding that similar MBs are formed through both methods. Next, a model drug was incorporated into the MB shell using both methods and were acoustically tested.

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

Faculty Mentor: **DR. MARGARET A. WHEATLEY**
Biomedical Engineering

Co-Mentor: Brian E. Oeffinger

THE EFFECTS OF POLY-VINYL ALCOHOL ON THE FORMULATION OF POLYMER MICROBUBBLES

The overall goal of this project is to use echogenic, poly-lactic acid (PLA) microbubbles (MBs) subjected to ultrasound to deliver small interfering ribonucleic acid (si-RNA) to assist in the healing of spinal cord injuries. Our PLA MBs are created using a water-in-oil-in-water double emulsion method, in which the second water phase utilizes a 5% (w/v) poly-vinyl alcohol (PVA) solution. Changing the concentration of this solution alters the viscosity, which can lead to changes in bubble size and acoustical interactions. Three different concentrations of PVA were evaluated, 3%, 5%, and 7% (w/v), and the resulting acoustical and morphological properties were investigated. Acoustical dose response results show that the most effective PVA concentration was 3% since it generated MBs with the highest enhancement of 19.3 dB at a dosage of 13.5 mg/mL. The 5% PVA had a maximum enhancement of 17.1 dB at a dosage of 13.5 mg/mL and 7% PVA had a maximum enhancement of 6.8 dB at a dosage of 15 mg/mL. MB size was also investigated using dynamic light scattering. Overall, we have shown that altering the concentration of PVA effects acoustical and sizing properties of our PLA MB.

VELAY FELLOW

SCHOOL OF EDUCATION

MORGAN MURTAGH

College of Arts & Sciences
Psychology

Faculty Mentor: **DR. JAMES CONNELL**
A.J. Drexel Autism Institute

A STUDY IN GENDER DIFFERENCES USING THE ADOS-2

According to the Centers for Disease Control, 1 in 58 people are diagnosed with ASD (autism spectrum disorder; 2014). Among them, the ratio of boys to girls on the spectrum is 4:1 or higher (Fombonne, 2009). This demonstrates a major gender difference within the autistic community, despite the fact that both girls and boys are diagnosed using the same criteria. Many researchers who have looked further into this topic have discovered many possible reasons for this gender gap. Some of the most prevalent ones are the fact that girls tend to be under/misdiagnosed more frequently than boys (Lai & Baron-Cohen, 2015) and that girls tend to be diagnosed at a later age (Giarelli et at., 2010). It is thought that both of the previously mentioned facts are due to "social camouflage", which means that girls tend to struggle less with non-verbal communication skills than boys due to pressure to conform to gender norms (Dean, Hardwood, & Kasari, 2017). This raises the question as to why they are not captured early using the gold-standard diagnostic assessment tool, the Autism Diagnostic Observation Schedule - 2 (ADOS-2). In this study, the contrast in behaviors between males and females is evaluated through the ADOS-2 assessment scores.

PANOTE NUCHPRAYOON

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

Faculty Mentor: **DR. KAREEM EDOUARD**
School of Education

DESIGN EDUCATION: UNIVERSAL APPROACH TO DESIGN TEACHING

Design process applies to multiple fields in the age of technology, from the arts to engineering. Though design principles and methods are described and published by various sources, they aim to target professionals. Only few target younger audience, and even less curricula focus on more than one discipline of design. Nevertheless, through studying numbers of design methods and approaches, all have large intersections and parallels across multiple disciplines. This is particularly useful for younger audience since the design methodology is universal and allows adaptations. The project proposes a universal simplified design process with examples to enhance the understanding of how design process can be applied across fields. Since design covers a large area of subjects, it can also enhance the community within the discipline and bridge among different fields. However, in such a world of specialization, further research is needed on how design curricula can encourage growth across fields.

SCHOOL OF EDUCATION

ZYRAH ALVI

College of Arts & Sciences
Political Science

Faculty Mentor: **DR. KRISTY KELLY**
School of Education

GENDER AND CORRUPTION IN EDUCATION AND POLITICS

Men's and women's intersectional social, political and economic positions in society shape their experiences with, definitions of, and strategies for dealing with corruption. Nevertheless, gender and corruption literature tends to devalue these experiences. My research aims to fill this gap by examining how university students think about inequality and corruption in education and politics. Through media analysis and interviews with college-age students in Philadelphia and Baltimore, this project builds on previous research and raises important questions about the role of gender, race, and corruption in education and politics. Findings suggest a diversity of responses depending on how involved students are in their educational institutions or in politics. An important pattern regarding how students defined education or politics as 'fair' or 'unfair' suggests students may shy away from areas of life they deem 'unfair.' While findings are preliminary, this study raises important questions about how politics and education are framed in ways that reveal or make invisible corruption in everyday life.

SCHOOL OF EDUCATION

TRANG MINH HOANG

College of Computing & Informatics
Computer Science

Faculty Mentor: **DR. KRISTY KELLY**

Co-Mentor: Dr. Brian L. Stuart

VIETNAMESE GENDERED EDUCATION AND TECHNOLOGY DEVELOPMENT

Over the past century, the world has undergone a lot of changes due to the technological revolution. Vietnam has witnessed both improvements and hindrances with the application of technology in everyday life. My research examines the relationships between technology, education, and gender. Specifically, the study focuses on educational development in Vietnam and its ethnic minority groups in Northwestern mountainous areas. It uses qualitative research methods, including interviews, participant-observation and document review to understand existing issues in technology usage caused by and resulting in inadequate education. Findings suggest that the allocation of educational and technical resources under-serves rural areas and women. Different educational methods and technology implementations tailored to specific areas are required. Furthermore, good use of technology and education is tied closely with gender equality. If education is gendered and women do not receive the same education or as much, they risk being left out. My aim is to bridge the gap and raise awareness of the challenges underprivileged groups face daily.

FRANCES VELAY FELLOWS

The 2019 STAR Scholars cohort includes our third cohort of Frances Velay Fellows, thanks to the generous support of the Panaphil and Uphill Foundations. This cohort of 11 women in STEM fields have participated in the full STAR Scholars Experience while also having the opportunity to engage in additional programming, including a book club and biweekly luncheons with other women in STEM from Drexel faculty, Drexel's graduate student population, and local industry professionals. Through this program, we were able to provide these exceptional young women 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 on campus and elsewhere in the Drexel network who support and encourage them in their future goals.

The Frances Velay Science Fellowships have been created in the memory of Frances Velay, a remarkable scientist, artist, musician, and ciizen, 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.

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 have come together to support these exceptional women throughout the summer.

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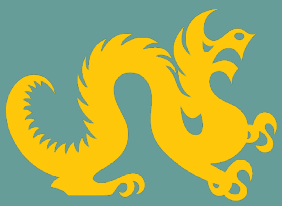
SPECIAL THANKS

We would like to extend our sincere gratitude to all Faculty Mentors, Graduate Students, and others at Drexel University and at our international partner locations 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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