2018 STAR SCHOLARS SUMMER SHOWCASE

THURSDAY, AUGUST 30, 2018

Edmund D. Bossone Research Center

9:00am - 5:00pm

DREXEL UNIVERSITY
Office of
Undergraduate Research
Pennoni Honors College

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Pennoni Honors College

SUZANNE ROCHELEAU, PHD
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Office of Undergraduate Research

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

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Bossone Research Center
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Bossone Research Center
First Floor Lobby

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

2:00pm - 3:30pm
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 2018 STAR SCHOLARS SUMMER SHOWCASE.

Over the past seventeen years of the STAR Scholars program, we have seen the effects, both immediate and long-term, of undergraduate research on our students and their faculty mentors, our Drexel community, the City of Philadelphia and our wider world. Since 2002, more than 1,700 Drexel students have participated in the STAR and iSTAR Scholar Programs.

This summer, 176 STAR Scholars, have completed faculty- and professionally mentored projects, working in 10 colleges and schools. Under the direction of their outstanding mentors, our rising sophomore researchers have worked on cutting age projects that contribute to the knowledge bases of their academic disciplines. Twenty-five students worked with faculty in international settings: the Indian Institute of Technology – Madras and SSN College of Engineering in India, the University of Sussex in England, the Universidad de Cienfuegos in Cuba, and through the Dornsife Global Development Program in various countries in Africa. Drexel faculty hosted iSTAR Scholars on bioscience programs in Costa Rica, on a dance program in Beijing, China; and on educational research in Vietnam. And a few of our campus-based engineering STARs were able to join Vertically Integrated Projects (VIP) in 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 18 prestigious graduate fellowships including Gates Cambridge, Goldwater, Fulbright, Truman and NSF- GRFP. More than 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 2017-18 class of STAR and iSTAR Scholars will shine as brightly.

Each summer, as we meet with our STAR Scholars, we see them grow in competence, confidence, and 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. Paula Marantz Cohen, Dean
Pennoni Honors College

Dr. Suzanne Rocheleau, Director
Office of Undergraduate Research

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.

2017 OUTSTANDING MENTOR OF THE YEAR
DR. EDWARD DAESCHLER & DR. KAPIL DANDEKAR

The 2017 Outstanding STAR Mentor of the Year Award was presented to two faculty: Dr. Edward (Ted) Daeschler (Academy of Natural Sciences, BEES) and Dr. Kapil Dandekar (Electrical & Computer Engineering). Both Dr. Daeschler and Dr. Dandekar received a plaque engraved with their names, as well as a $1,000 grant to support their further work with undergraduate researchers.

DR. TED DAESCHLER

DR. KAPIL DANDEKAR

It is for Dr. Ted Daschler and Dr. Kapil Dandekar's commitment to educaitng and mentoring students, both in the STAR program and in the research setting, that we honor them as our 2017 Outstanding Mentors of the Year.

2017 OUTSTANDING MENTOR OF THE YEAR
DR. EDWARD DAESCHLER

Dr. Edward (Ted) Daeschler is an associate professor in the department of Biodiversity, Earth & Environmental Science, as well as Associate Curator of Vertebrate Zoology and Vice President for Systematic Biology and the Library at the Academy of Natural Sciences of Drexel University. Dr. Daeschler's responsibilities at the Academy of Natural Sciences of Drexel University focus on research, collections building, and on public programs within the museum. He served as a scientific advisor for the renovation of the Academy's Dinosaur Hall, and a variety of other paleontological exhibits. Dr. Daeschler's work is a reflection of the rich history of vertebrate paleontology at the Academy of Natural Sciences, both in research and in public education.

"I was an 18 year old with a handful of classes in the field under my belt, driven by 90% passion, and 10% technical knowledge, who had just discovered a new species, because for some strange reason, Dr. Daeschler saw some potential in me, set a tray of fossils from a chunk of Devonian rock in the Canadian Arctic in front of me and told me to figure out what was there. He opened the doors and set me on a path to do something most 18 year olds don't dare dream of….I didn't expect to discover a new species, I aspired to find the most complete specimen of something. But here I was, literally beyond a dream come true, I was a real paleontologist, because Dr. Daeschler facilitated my growth as a scientist and person."

-AR Ciccariello.

"At (a recent symposium) one of the keynote speakers made a point of acknowledging academic lineages, how we can trace mentorship like family back through the years to the forefathers of scientific inquiry. I will be forever be grateful that I am part of (Dr. Daeschler's) lineage, and for the opportunities I have been given."

- Kevin Sievers

2017 OUTSTANDING MENTOR OF THE YEAR
DR. KAPIL DANDEKAR

Professor Kapil Dandekar is a professor in the department of Electrical and Computer Engineering and Associate Dean for Research and Graduate Studies in the College of Engineering, as well as director of the Drexel Wireless Systems Laboratory. His current research interests and publications involve wireless, ultrasonic, and optical communications, reconfigurable antennas, and smart textiles. Dr. Dandekar holds several patents in the area of wireless systems, and intellectual property from DWSL has been licensed for use in commercial products. In 2007, Dandekar received the ECE Outstanding Research Award from the Department of Electrical and Computer Engineering, and in 2015, he received the Outstanding Research Award from the College of Engineering at Drexel University.

"Dr. Dandekar goes out of his way to help us students and makes sure we are comfortable with our projects, that we're having fun doing it and suggests ways we can improve it. He…answers our questions, gives us alternatives, provides us more information than we asked for and, best of all, treats us like accountable adults instead of…freshmen doing menial projects."

"The core values that he advocates and exemplifies can be seen in every aspect of the Drexel Wireless Systems Laboratory. The positivity, trust, and patience of Dr. Dandekar is unrivaled by any other faculty mentor."

"He commends our work to encourage us to do better, yet he simultaneously makes sure to praise work that has been developed through substantial effort—thus inpsiring us to work extremely hard for his appreciation. Lastly, Dr. Dandekar helps us expand our thinking by suggesting additional factors we should consider. He demonstrates how important it is to think through different perspectives and to encompass the most we can through our creations here at the Wireless Systems Lab."

- Jui Hanamshet, Joshua Cohen, Brent Lee, Manniska Kshettry & Saloni Purswani

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

STOYAN GEORGIEV

Anoinette Westphal College of
Media Arts & Design
Architecture

Faculty Mentor: **PROF. RACHEL SCHADE**
Architecture, Design & Urbanism

Wolfram Arendt
Co-Mentor

DESIGNING A SUSTAINABLE AND AFFORDABLE ROWHOME

According to the EPA in 2016, commercial and residential buildings contributed 11% of the US carbon emissions in 2016, and the electricity sector 28%. Row houses are the most common building type in Philadelphia, consisting of 60% of buildings according to the Washington Post in 2015. The logical conclusion is to make row homes more sustainable so that our carbon footprint in Philadelphia can be reduced, and this project tries to do just that.

As part of this research we joined the local Living Building Challenge (LBC) community, in partnership with Community Ventures, a non-profit developer of affordable housing, to create a hypothetical project of eleven rowhomes on a block in the Belmont area in Philadelphia. This strives to achieve the LBC certification, one of the most difficult to achieve for sustainable design, while also keeping the affordability of traditional rowhomes. We approach the challenge from multiple angles, from water and energy conservation to smart building materials. While this project focuses mainly on design, we have explored this challenging standard and projects that have achieved it. We aim to create a model project that can inform better, more affordable and sustainable housing in the future.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

ALEXANDRA JEREZ

Pennoni Honors College
Custom-Designed Major

Faculty Mentor: **DR. JOSEPH H. HANCOCK, II**
Design & Merchandising

ONE MAN CAN BE A CRUCIAL INGREDIENT: THE IMPORTANCE OF MALE BASKETBALL PLAYERS IN BRANDED MASS FASHION

Since the first dribbles of basketball were taken in 1891, this sport has become a prominent part of mainstream American popular culture influencing such areas as sports, politics, economics, and most recently mass fashion. In this paper, sponsorship and partnership with fashion sportswear and the growth of basketball players as potential celebrity endorsers of brands within the fashion industry will be examined. Traditionally, basketball players such as Michael Jordan, have been used to promote athletic apparel. With the success for such items as the Air Jordan sneaker and the ability to tell a good fashion story (Hancock 2016), basketball players have become key branding elements. However research in how these players have been used for sportswear companies has been ignored. Publications such as Vogue, GQ, the New York Times, Harper's Bazaar and Complex magazine have curated pieces that place importance of basketball players on and off the court.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

CHRISTOPHER BUTLER

College of Computing & Informatics
Computer Science

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

Corey Arnold
Co-Mentor

LEARNING COMPUTATIONAL THINKING THROUGH VIDEOGAMES

As the demand for skilled programmers increases each year, more researchers are seeking effective ways to teach programming skills. One idea growing in popularity is teaching basic skills in computational thinking before students write their first line of code. Computational thinking is sometimes defined as the ability to express a problem and its solutions in a way that a computer can understand and automate. Educational games have been gaining popularity in classrooms because they can intrinsically motivate and engage students. Prevailing research shows that educational games made to teach computational thinking are effective, but creating a specialized game for the curriculum can be expensive and time-consuming. Certain commercial off-the-shelf games have the potential to be a cheaper alternative that are just as effective, if correctly integrated into the curriculum. To determine if it is possible for commercial games to be as effective at teaching computational thinking as serious educational games, I analyzed three games: RoboBuilder, an educational game made to teach computational thinking, Hacktion, an augmented reality educational game, and Opus Magnum, an open-ended puzzle game by Zachtronics.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

LINH DO

College of Computing & Informatics
Software Engineering

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

Corey Arnold
Co-Mentor

UNCONSCIOUS TECHNIQUES IN DESIGNING EDUCATIONAL GAMES

Hardly a day goes by without intellectual advances in education technology. Recently, educators have taken advantage of this progress to adopt an approach called serious games to further engagement of learners via video games. Serious games are a subdivision of video games which serve a purpose beyond just pure entertainment. This research focuses on the possible combination of different methods to design video games to educate learners subconsciously without losing the fun and entertaining nature of video games. These techniques include unconscious learning, stealth teaching, and subliminal priming combined with some principles of game design, such as organic tutorials and graphic design. Several educational video games have been used in this case study: the genre of action video games, a model 3D virtual environment. Moreover, two educational games made by Entrepreneurial Game Studio will be evaluated based on these principles: a mixed-reality game on cybersecurity called Hacktion, and a mobile game experience that allows players to explore medieval science called The Age of Alchemy. This research demonstrates that players are more focused and motivated while playing educational games and can unconsciously obtain new information

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

BEN LEDOUX

College of Computing & Informatics
Computer Science

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

Corey Arnold
Co-Mentor

INTRINSICALLY MOTIVATED PLAY: HOW GAME DESIGN CAN INFORM PLAYER ENGAGEMENT

Unlike typical video games made primarily for entertainment, Drexel's Entrepreneurial Game Studio (EGS) researches and designs "serious games" with goals ranging from education to the promotion of civic art. My research for the EGS revolves around the concept of player engagement - how video games encourage players to continue interacting with a game.

While player engagement is generally considered difficult to predict before playtesting, I set out to find the underlying commonalities across engaging games, connect them to concrete design principles, and determine their roots in psychology. I found that one can implement established psychological theories (specifically cognitive load theory, self-determination theory, and flow theory) within specific aspects of a game's design to better engage and retain players. Using my research as a guide during the design phase, future games created in the EGS will be able to utilize my findings to help foster an intrinsic motivation within players to keep playing within players. With the knowledge of how to promote player engagement, we hope serious games developed by the EGS will be able to better fulfill their intended goals and purposes.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

VARSHA AJITH

College of Engineering
Architectural Engineering

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

Dr. Nicholas Jushchyshyn
Co-Mentor

REVIVING THE PAST USING VIRTUAL REALITY

The Architecture and Engineering disciplines are interconnected and constantly evolving. The problem investigated here is how to best use available textual knowledge, research, and archeological evidence to imagine and recreate Philadelphia structures no longer standing, using Virtual Reality software. This type of investigation is necessary, in the present, when there is a need to understand and propagate stories from historical sources.

My project is based on the late 18th century Philadelphia row home of James Oronoko Dexter, a manumitted slave, and vital member of the early Free African Society. Through this Digital Cultural Heritage project, which demanded engineering solutions, architectural insight and problem-solving, and digital media software skills, my team and I aimed to build a virtual era-accurate row home to allow users to navigate the space, using the Oculus Rift, and experience some of the important events and meetings held in the historic house.

To create the model and furnishings, my main sources were journals and books, insurance records of the house, and archaeological excavation results. We consulted with experts such as an architecture historian, an archaeologist, and a museum curator, and with their guidance, made several site visits to architecturally similar houses built before and during the era of the Dexter house. With this project, my team and I aspire to shine light on an overlooked part of Philadelphia's past critical in not only the formation of the present African American community, but also to the wider Philadelphia cultural heritage.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

ANGEL CHASCO

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

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

Dr. Nicholas Jushchyshyn
Co-Mentor

DIGITAL CULTURAL HERITAGE IN PHILADELPHIA: HOUSES AND DIORAMAS

My STAR research involved work on two Philadelphia digital cultural heritage projects that bridge the late 18th and early 19th centuries: the James Oronoco Dexter House and the Charles Willson Peale Museum. Both projects involved the creation of digital assets, a process which was informed by past research and research which I and other STAR Scholars conducted. For the Dexter House, photorealistic textures of the wooden floors and the walls were needed. The process for creating these involved looking into historical insurance documents as well as traveling to a similar house, the Todd House, to take photos and notes on the house to better understand and replicate what the Dexter House may have looked like. The textures will be applied to the Dexter House model at a later date. For the Peale Museum, I worked on the creation of 3D digital bird dioramas which originally consisted of taxidermy specimens, watercolor backgrounds, physical flora, and some simulated materials, such as rocks and eggs as described in The Selected Papers of Charles Willson Peale. My research and that of other STAR Scholars working on the project contributed to the creation of digital dioramas.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

XANDER LEATHERWOOD

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

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

DIGITAL RESTORATION OF CHARLES WILSON PEALE'S BIRD SPECIMENS

In the early 19th century, Charles Willson Peale owned a museum in Philadelphia in which he showcased art, technology and natural specimens, including taxidermy animals and minerals. For a time the Museum was the largest museum in North America and was a prominent tourist attraction. Peale's Museum is regarded as one of the first museums to make use of dioramas. The Museum closed in 1827 shortly after Peale's death and unfortunately, his bird dioramas have not survived.However, written descriptions of the dioramas do exist. In addition Alexander Wilson the famed ornithologist is known to have used many of Peale's dioramas as models for his prints of birds published in his 8 volume ornithology.In order to digitally recreate several of the bird specimens Peale exhibited, I used Wilson's prints as references for creating models of the taxidermy birds using Autodesk Maya and Mudbox software. These models will be used to digitally recreate Peale's dioramas which will form part of the virtual recreation of Peale's Museum, enabling users of the computer program to explore the museum just as it had existed when it was housed in Independence Hall, 1801-1827.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

NICHOLAS MOY

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

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

Dr. Nicholas Juschyshyn
Co-Mentor

DIGITAL RESTORATION OF PEALE'S MUSEUM

My research focused on the Charles Willson Peale Museum, an early American museum established in 1785 as a "world in miniature." Peal saw his museum as a national resource and sought government support for most of his adult life. Unfortunately, support was never secured and the museum closed shortly after his death in 1827. He wanted to inform the public about art, technology and the exotic creatures in the world. My work contributes to the ongoing Peale project to create a 3D digital model of his museum to raise awareness of these subjects in the American Federalist period. I modeled and textured objects that were in the museum. We took field trips to places like Independence Hall to gather reference material. I mainly modeled a physiognotrace, a device used to trace the profile and make silhouette portraits of museum visitors. The portraits were made by Moses Williams, an African slave who eventually gained freedom. I also worked on an animated Public Service Announcement (PSA) about Pennsylvania's Archaeology Month which will run on the PECO building in October. To make the PSA, I consulted with Chief Historian and Archaeologist, Jed Levin at Independence Park and used artifact photos from the Park's collection.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

MARIIA OSANOVA

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

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

Dr. Nicholas Jushchyshyn
Other

WHERE HISTORY MEETS TECHNOLOGY

My research this summer centered on Digital Cultural Heritage. I focused on investigating Charles Willson Peale's Philadelphia Museum which featured art, technology and Natural History in the late 18th and early 19th centuries. The purpose of my research was to inform the production of a digital interactive 3D model of the Museum, which will be used for educational purposes. The main goal of my work was to bring the model to a level of convincing photorealism. My contribution to the project took forward the work of previous generations of STAR Scholars and Drexel faculty by supplementing it with additional 3D objects and textures, as well as getting all the past files up to date with the latest technological standards.

In addition, I have also worked on one of two animated Public Service Announcements (PSAs) that call attention to Philadelphia's Archaeology Day, a free annual public event held at the National Constitution Center. The event is sponsored by Independence National Historical Park and the Philadelphia Archaeological Forum. The animation will run on PECO'S Crown Lights for 3 days in late September and/or early October.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

CHHIVHUNG ENG

Antoinette Westphal College of
Media Arts & Design
Design and Merchandising

Faculty Mentor: **PROF. GENEVIEVE DION**
Fashion Design

KNIT STRUCTURE REFERENCE GUIDE

Functional fabrics, which makes up smart garments, refers to textile that have been engineered to perform tasks that goes beyond traditional textile. Smart garments doubles as a medical device that can monitor the user's heartbeat, medical condition, or performs other tasks deemed useful to the user. The Center for Functional Fabrics is a place where different disciplines work together to produce innovative textiles. An important factor in developing these textiles, is to understand their properties and how they are fabricated. For example, knit structures which make up a textile, not only contribute to the overall aesthetic of the garment, they also play a major role in the functionality and comfort of the garment. Certain structures are known to have qualities that contribute to its flammability, wicking, and many other characteristics. To learn more about knit structures and their properties, I surveyed research papers and text books and compiled the findings in a reference guide. By understanding the unique traits of each knit structure, we are able to make educated decisions on how to construct garments to maximize its design, comfort, performance and functionality.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

BRIGHT HSU

College of Engineering
Computer Engineering

Faculty Mentor: **PROF. GENEVIEVE DION**
Fashion Design

Richard Valleyy
Co-Mentor

BUILDING LAB SCALE EQUIPMENT FOR FUNCTIONAL FABRIC PROTOTYPING

Functional fabrics are textiles with intrinsic functionality. They change color, store energy and sense touch and motion using specialized fibers and yarns. These fibers and yarns use experimental materials not available in large quantities. Traditional yarn manufacturing machinery is often too large to produce small volumes and no such small-scale equipment exists. To fill this gap, we created a series of small, precision winders that can collect delicate yarns in small quantities. The winder's hardware was modeled and simulated in Autodesk Inventor. The control and user interface were created using the Arduino and Processing IDEs. The device is modular and extensible. Future work involves incorporating yarn twisting and wrapping hardware and further UI development.

EMILY GIORDANO

Antoinette Westphal College of
Media Arts & Design
Graphic Design

Faculty Mentor: **PROF. MARK WILLIE**
Graphic Design

A STUDY OF THE FATHER OF POLISH POSTER DESIGN: HENRYK TOMASZEWSKI

The main reason for pursuing this STAR research project were the donations from the Lewalski and Fox families. These two collections were gifted to Drexel's Westphal College to teach students about the history of poster design and the significance of the medium. The motivation to research and organize the Polish Posters was to make it easier for students and faculty to have access to the works and interact with them through a database. The STAR project was finding a way to organize the posters that coincided with previous organizational plans of former STAR students as well as researching the artists and cultural context. The student went about accomplishing this by making data sheets on the data points of works, making a booklet on a specific artist, and photographing posters to update the database for more detail. The results were seen in more data points on the main polish poster artist, a booklet printed for the showcase, a book in the works of being printed for class settings on poster design, and updated images in the online collection for Hagerty Library's iDEA database. The implications of this are the idea that students, with access to these amazing and important posters, can learn and integrate to their own work.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

ALEXANDRA BALLANCE

Antoinette Westphal College of
Media Arts & Design
Fashion Design

Faculty Mentor: **PROF. SANDRA PARKS**
Performing Arts

THROUGH THE EYES OF DANCE

Beijing and Washington D.C. are on opposite sides of the world and have two distinct cultures. What makes them unique and what similarities do they share? What has shaped and influenced today's culture and how do we experience these two cities? Looking closer, a city's culture is reflected in its products and its people. Some typical examples of these products are architecture, art, language, fashion, food, and dance. Dance is the focus of this project for two important reasons: first, the significant exposure to dance in the Washington D.C. area for many years; and second, the opportunity to spend two weeks in Beijing at the Beijing Dance Festival, immersed in the city's modern dance community. Diving deeper, it is clear to see the essence of these two cultures through the eyes of dance. Based on experience and research, this project discusses the comparisons and observations about these cultures. It aims to reveal how dance is a clear reflection of its environment and its society.

JENNA DEMER

Antoinette Westphal College of
Media Arts & Design
Dance

Faculty Mentor: **PROF. SANDRA PARKS**
Performing Arts

WOMEN IN DANCE

Inequality between the sexes is a historically based but presently prominent social, political, and economic issue. The social construction of gender and the attributes associated with being female are dependent upon history and culture and are embedded in everyday life. Inequalities can be reflected on and through the body, often unknowingly reproduced by women's conformity to social standards. These expectations of what it means to be a woman are reflected in many arenas of life, but my interest lies within its application to the dance community, and how gender discrimination and/or expectations are presented through dance itself. Is there a way to combat the idealization of woman through dance—through movement motifs, choreographic structure, spacing, costuming, and underlying or visible themes? What do my personal experiences speak to, and how are they relevant in the broader context of the dance world and community? I seek to raise questions, provoke interest, generate awareness, and incite curiosity about the embodiment of gender discrimination, and how cultural and historical ideals can be represented and reinforced through unknowing vehicles and learned social normalcy.

ETHAN O'GRADY

Antoinette Westphal College of
Media Arts & Design
Photography

Faculty Mentor: **PROF. ANDREA MODICA**
Photography

HIDDEN PAIRS: AN ACCURATE PORTRAYAL OF QUEER RELATIONSHIPS, LOVE, AND INTIMACY

Being a photographer gives me the opportunity to confront the issues and complexities that not only I face as a queer individual, but also those of other queer people. A difference in perception from my closeted adolescence to now relates to my personal view of queer relationships. Media showed me ideal-bodied and hyper-sexualized pairs, and connections stifled by infidelity and narcissism. The truth is the complete opposite. I set out to photograph couples in the LGBTQ community in order to disprove the same misconceptions I had about queer love and intimacy to the general population. We often hear about â€œsafe spacesâ€ and their importance for marginalized groups. Therefore, I photographed each couple in their shared home to see how they create a space of sanctity for their own relationship. I also chose an analog process rather than digital, each time shooting with a medium-format camera and B&W film. While I was wary at first, the images that followed make up the most honest and raw work in my portfolio to date. The ultimate goal for this project is to let outsiders in on these moments of love and intimacy and convince them that there is nothing strange or unnatural going on behind closed doors of queer existence.

BREANNA BECHTOLD

Antoinette Westphal College of
Media Arts & Design
Product Design

Faculty Mentor: **PROF. MICHAEL GLASER**
Product Design

EXAMINING URBAN SPACES AND TRASH RECEPTACLES THROUGH DESIGN

Initial research into Design for Good led to the examination of smart cities as a leaders in environmental sustainability. Initiatives such as PlaNYC and Sidewalk Toronto are taking steps to bring environmentally conscious infrastructure to the Western Hemisphere as it is being done in European nations such as Germany and Denmark. Public spaces play a large role in creating safer, more habitable urban environments; â€œactivated spaceâ€ is a term used by urban planners and designers to describe any feature which positively contributes to the value of a given area through functional, visual, or interactive appeal. These areas are not only vital in the creation of successful public spaces, but they also contribute to healthier neighborhoods and communities at large.

This research prompted the conducting of independent, design-based research into the development of unique, environment-appropriate trash receptacles in public spaces as part of a collaboration with Philadelphia design firm Shiftspace. Over two weeks, a trash can sporting a different lid each day was placed on a lawn previously devoid of disposal amenities in order to observe the interactions people had with it.

LAUREN BEICH

Antoinette Westphal College of
Media Arts & Design
Product Design

Faculty Mentor: **PROF. MICHAEL GLASER**
Product Design

FACILITATING CREATIVITY IN PUBLIC SPACES

In acknowledging the "Design for Good" movement's goal to facilitate a positive social, environmental and economic community impact, this research looks into how Design for Good can be achieved through the creation of public spaces. Looking into the renovation of vacant spaces as public parks shed light on the recent social media trend of Urban Exploration. In Ted talks, urban explorers Bradely Garrett and HK Urbex describe overregulation in cities as inhibiting creativity. To further support a decline in creativity, multiple studies conducted on youth have shown a decrease in creative aptitude scores over the last four decades. My aim is to investigate the potential to address concerns of a "creativity crisis" by facilitating creative decision making in public spaces.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

CHARLOTTE GUEDALIA

Antoinette Westphal College of
Media Arts & Design
Product Design

Faculty Mentor: **PROF. MICHAEL GLASER**
Product Design

CONSTRUCTED CONNECTIONS: HUMAN INTERACTION WITH THE BUILT WORLD

Individuals are inevitably impacted by the built world through interactions with structures and objects on a daily basis. Similarly, individuals imbue the objects in their surroundings with meaning. This reality caused several questions to arise: What types of objects do people really need? How do people and objects shape one another? And, most importantly, how involved should people be in determining the objects that they interact with? This research provides insight into the stated questions through a combination of "Design for Good" methodologies, positive psychology and the psychology of identity. Hands-on interviews with individuals and sessions with professionals provided further insights. Ultimately, this research posits that the unique impact of human interaction with objects is significant to both designers and individuals.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

GRACE LANDRY

Antoinette Westphal College of
Media Arts & Design
Product Design

Faculty Mentor: **PROF. MICHAEL GLASER**
Product Design

MINDFUL PRACTICES FOR UNDERSERVED YOUTH

Design for Good strives to address a social, economic, or environmental problems through a human centered design process. The focus of this summer's research is studying mindfulness among children living in highly concentrated low-income, urban areas. This research investigated empirical evidence on the benefits of mindfulness programs in schools. Studies have shown increased self awareness, focus, and positive psychological health. Also, through a visual design research activity, local, West Philadelphia, middle school students described their lack of interest in the term "mindfulness" despite their enthusiasm for mindful activities, such as yoga. However, inadequate funding presents obstacles for schools trying to obtain mindfulness programs for children in those areas. Focusing on the concept and practice of Design for Good, the research question became, "Can shared knowledge and practices of mindfulness be implemented in innovative and accessible ways?"

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

CHLOE TOLDERLUND

Antoinette Westphal College of
Media Arts & Design
Product Design

Faculty Mentor: **PROF. MICHAEL GLASER**
Product Design

ADDRESSING PUBLIC HEALTH ISSUES INHIBITED BY SOCIAL STIGMAS

Design for Good is the implementation of products and systems to provide dignified, alternative options for people in difficult circumstances that promote inclusivity and acceptance within their communities. This research originally explored how sex education was implemented into secondary education systems, searching for what societal barriers were inhibiting the use of a universally effective method in American schools. Initial findings from polling and literature showed that there were many different stigmas surrounding sex education. Stigmas cause discrepancies in policy and public opinion, in which a universal standard can not be agreed upon. On a large scale, this research showed stigmas inhibit society's ability to address a variety of public health concerns, not only sex education. This gleaned a project reframe around stigmas effects on the way society handles public health issues. Further research investigated the environments that perpetuate stigmas and their control over popular thought in creating taboos.

TAYLOR VAN

Bennett S. LeBow College of Business
Finance, Operations & Supply Chain Management

Faculty Mentor: **DR. HUBERT GLOVER**
Accounting

MICROFINANCE IN AMERICA: VOLVE

In 2016, there were 40.6 million Americans living in poverty and about a quarter of Americans do not fully use or cannot use traditional banking services. Microfinance institutions can change that. I am researching how a microfinance institution model can stay innovative, keep operational costs low, be nationwide, and remain active and personal with clients as they become successful self sufficient entrepreneurs. As I began my research, I noticed that most of the institutions that exist today focus on women in third world developing countries -- which is why I wanted to open this opportunity to people in America struggling to access normal financial services. I talked with people around Philadelphia to learn more about microfinance, fundraising, nonprofits, microfinance at Drexel, and the impoverished people I would like to reach with my model. I read about several models from many institutions including Accion, Grameen America, and Kiva. My model includes education, training, credit building, building personal relationships, loaning, networking, digital communication, and being accessible to anyone in America. My model will be called Volve with plans to involve our clients in our services so they may evolve their businesses.

BENNETT S. LEBOW COLLEGE OF BUSINESS

JENNIFER HANCE

Bennett S. LeBow College of Business
Economics

Faculty Mentor: **DR. MURUGAN ANANDARAJAN**
Decision Sciences

Dr. Barrie E. Litzky
Co-Mentor

ENTREPRENEURIAL INTENTION IN THE U.S. AND PORTUGAL

This study investigated the factors that influence entrepreneurial intention between two student populations from the United States and Portugal. The data were obtained through the Entrepreneurship Education Project, a large study that collected over 17,000 responses from students in 70 countries. A subset of this data resulted in 3008 responses from students in the United States and 1026 respondents in Portugal. The model predicted that entrepreneurial intention would be influenced by entrepreneurial capital, general self-efficacy, and entrepreneurial self-efficacy, and that the model results would be stronger in the U.S. than in Portugal. The main effect hypotheses were supported while moderating effect hypotheses were not, although there were some interesting culturally relevant anecdotes. The study contributes to the growing body of literature on personality and cultural influences on students' intentions to become entrepreneurs. Implications for research and teaching are offered.

BENNETT S. LEBOW COLLEGE OF BUSINESS

RYAN HOWELL

Bennett S. LeBow College of Business
Finance

Faculty Mentor: **DR. MURUGAN ANANDARAJAN**
Decision Sciences

Dr. Barrie E. Litzky
Co-Mentor

ENTREPRENEURIAL INTENTION IN THE U.S. AND PORTUGAL

The purpose of this study is to explore the similarities and differences in entrepreneurial intention among the United States and Portugal. This study will also include an investigation into variance among the United States and Portugal with a focus on their entrepreneurial intention affected by cultural influences. Our survey results are derived from the "Entrepreneurship Education Project"; a single survey inquiring about topics such as Prior Family Business Exposure, General Self-Efficacy, and more. From a theoretical perspective, this study will contribute to the literature surrounding the Entrepreneurial Education Program model, with a heavy focus on identifying variance among the United States and Portugal. From a practical perspective, the goal of this study is to further explain the environmental and personality influences that contribute to one's entrepreneurial intent. Overall, the relationships between General Self-Efficacy, Entrepreneurial Self-Efficacy, and Entrepreneurial Intention are stronger in the United States. However, mean Entrepreneurial Intention was greater in Portugal.

ARDITA KOKA

Bennett S. LeBow College of Business
Business & Engineering

Faculty Mentor: **DR. HANDE Y. BENSON**
Decision Sciences, Management Information Systems

OPTIMIZATION OF FINANCIAL PORTFOLIOS

Optimization of financial portfolios is a widely studied problem in mathematics, statistics, and computational finance literature. It addresses the process of selecting the best asset distribution by balancing expected returns with portfolio risk. In practice portfolio optimization is theoretically and computationally challenging given the level of uncertainty inherent in the market. Forecast accuracy is important, but it is also important to be prepared for deviations from forecasts. Currently, literature focuses on building "robust" portfolios that prepare and guard against worst-case scenarios, but loss of opportunity is possible when the worst-case is not realized.

This research is aiming to conduct sensitivity analysis to quantify the true impact of uncertainty on portfolios and find ways to build robust portfolios that have lower losses of opportunity. A forecast-based portfolio was designed using stocks from the S&P 500 for a period of two years. Data collection, forecasting procedures and Markowitz's optimization model were coded in R. Additionally; forecasted-based portfolios were compared to those built on the actual market data and re-balancing speed was also taken into account in order to respond to market changes.

BENNETT S. LEBOW COLLEGE OF BUSINESS

NATHAN A. RUNK

Bennett S. LeBow College of Business
Business & Engineering

Faculty Mentor: **DR. HANDE Y. BENSON**
Decision Sciences, Management Information Systems

MOTION PLANNING OPTIMIZATION FOR AUTONOMOUS VEHICLES

Effective and safe guidance of autonomous vehicles (AVs) requires a systematic decision-making approach that achieves optimal functionality under an array of complicated kinodynamic, collision avoidance, and communication connectivity constraints. In order to optimize motion planning of AV fleets, Multi-Vehicle Motion Planning (MVMP) problems are formulated and solved as Mathematical Programming (Optimization) problems. Still, solving these nontrivial problems can be CPU-time expensive which hinders AVs' ability to operate optimally in real-time.

To address this issue, an antecedent Mixed-Integer Nonlinear Programming (MINLP) model in MATLAB is compiled and customized in Python to improve run time. The model, which represents the salient features of a MVMP problem with communication requirements, is made to relax particular MINLP problems so that solvers can quickly handle the algorithm. In short, the algorithm minimizes distance to a destination subject to path following, vehicular capability, and the aforementioned constraints in order to determine optimal speeds. The decisions are generated and updated in a decentralized and iterative fashion on a rolling horizon, effectively reducing problem size to promote real-time solution.

ELIZA DRAGOMIR

Bennett S. LeBow College of Business
Finance

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

Dr. Mark Stehr
Co-Mentor

GET DIVORCED FOR THE KIDS: DOES THE INCREASE IN COLLEGE TUITION EXPENSES INCENTIVIZED DIVORCE FOR PARENTS OF COLLEGE-BOUND CHILDREN?

Tuition prices have increased over the last 30 years, but the incentives to finish college are proportional to the high education expenses. Therefore, by getting a strategic divorce, families may have found a way to obtain more financial aid. When claiming in the FASFA form that their parents are divorced, the applicant can access higher financial support from the Government or the University. Looking at the variables that influence the decision of getting a strategic divorce, we analyzed how in-state tuition expenses have changed over the last 30 years, and we also gathered data on divorce costs and laws by state, along with divorce rates for the last decade. To analyze the difference between the gains and the expenses of getting a strategic divorce, we searched for the most convenient forms of getting a legal separation, the "no-fault" divorce law. We connected the literature on this topic with statistics and data gathered from each particular state. Another concept that plays an important role in our research is "empty-nest syndrome. We gathered the literature that explains this psychological experience to test its implications for whether parents get divorced when their children leave for College.

IREM BAYTAS

Bennet S. LeBow College of Business
Economics, Business Adminstration

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

DIVERSITY IN FIRM GOVERNANCE: IS IT BETTER TO BE ALIKE OR DIFFERENT?

In an era of increasing competition, firms emphasize continuous innovation to get ahead of their competitors. As a result, greater attention has been place on diversity in the workforce and its link to productivity. Boards of directors are key players in a firm's strategy and culture and reflect the diverse attributes valued. Analyzing proxy statements for a large sample of publicly traded firms, we focus on firms that clearly state board qualifications needed and link these to director attributes. We find that only 5.6% of firms that transparently list their board skills include diversity as a criterion. Given this small percentage, it is not clear what role diversity plays in the boardroom. Does diversity limit groupthink and lead to increased board creativity? Or, could having directors with too varied of backgrounds trigger conflicts and create paralysis?

To better understand diversity's role, we analyze changes in board diversity across time and examine its correlation to firm performance. Director diversity includes factors such as gender, age, and race as well as unique director experiences and skills. Overall, our results provide direct evidence of the role diversity plays in work efficiency and business success.

AMELIA QUAZI

Bennett S. LeBow College of Business
Finance

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

CYBERSECURITY AND BOARDS OF DIRECTORS: WHO'S WATCHING?

With a growing reliance on technology, it is crucial that companies protect their customers' as well as their own data against security breaches. Evidence suggests that boards of directors, those elected to represent shareholder interests in a company, are now being held more responsible for a firm's strategy relating to data management and protection. Therefore, boards are increasingly expected to possess specific technology and cybersecurity knowledge. While prior studies evaluate specific data breaches or cybersecurity in general, little is understood about how cybersecurity relates to directors' skill sets.

To examine this gap in the literature, we explore the effect of data breaches on the qualifications of a firm's board of directors. Specifically, we examine firms in high-risk industries, such as Health Care, Finance, and Manufacturing, that experienced a breach in the past five years to determine if they subsequently alter their director skill sets. We find that companies with a recent cyber-attack emphasize technological and cybersecurity skills on their boards after these breaches. These results confirm that companies value directors and their specific qualifications as an integral part of managing cybersecurity risks.

MUHAMMAD UBAID ULLAH

Bennett S. LeBow College of Business
Economics, Finance

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

IMPACT OF BANK LOAN COVENANT VIOLATION ON THE PROBABILITY OF A COMPANY TO BE ACQUIRED OR MERGED

Whether a company chooses to seek a potential sale or merger, in the mergers and acquisitions market, is one of the most disruptive corporate decisions it can face in its lifetime. In this study, we investigate if the company's bank loan covenant violation is an event that would influence the company to do so. We hypothesize that bank loan covenant violation would encourage a firm to seek a merger as a way of alleviating financial distress.

We first search the SEC filings of over 13,000 firms from the time-period of 1995 to 2016 to record quarterly bank loan covenant violations, we then merge the accounting data of these firms to obtain the acquisition/merger dates. We concluded that firms with recent violations are 30% more likely to be acquired than those with no recent violations, which is a result of statistical significance, hence confirming our hypothesis.

HONGYE (JARVIS) ZHANG

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

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

COVENANTS VIOLATION FREQUENCY AS A MACROECONOMIC INDICATOR

Lenders use loan covenants, an early warning signal of financial distress, to protect their interests. Violations to these covenants are an event of default, and they typically happen before bankruptcy. We hypothesize that the aggregate frequency of firms violating loan covenants can serve as an early indicator of macroeconomic conditions. We test this hypothesis formally by examining whether violations are correlated with and proceed the delinquency rate and the charge-of rate on Commercial and Industrial Loans.

Examining disclosures in more than 400,000 quarterly reports with the SEC to measure violation frequency, we create a 20 years aggregated time series of violation frequency and use regression to eliminate seasonality and trend that is apparent in time series. We find a statistically significant positive correlation between violation frequency, delinquency rate and charge-off rate with a lag of three to four quarters. These results serves an indictor forecasting macroeconomic conditions.

JUSTIN LUU

Bennett S. LeBow College of Business
Business & Engineering

Faculty Mentor: **DR. GEORGE TSETSEKOS**
Finance

THE PHOTON OF FINANCE: CAN BITCOIN BE USED TO INCREASE FINANCIAL INCLUSION IN OTHER COUNTRIES?

Recent developments in digital currencies have brought attention to Bitcoin as both a currency used for transactions and as a speculative investment. In particular, Bitcoin has been used in transferring funds across borders and saving on fees that are taken by more traditional remittance services like WesternUnion and MoneyGram. A comprehensive literature review was conducted to examine ways that Bitcoin has been used to increase financial inclusion in underbanked countries such as the Philippines. We developed a comparative study by examining the percentage of processing fees taken by traditional remittance services such as WesternUnion, MoneyGram, and Transferwise, relative to Bitcoin-based remittance services. A holistic approach of the pros and cons of using Bitcoin compared to traditional services was included as well.

CARINA CONSOLO

Bennett S. LeBow College of Business
Finance

Faculty Mentor: **DR. YANLIU HUANG**
Marketing

Zhen (Jay) Yang
Co-Mentor

HOW A PAPER VERSUS DIGITAL CALENDAR INFLUENCES CONSUMER'S PLANNING AND EVERYDAY ACTIVITY

Purpose: Understanding consumer planning and shopping behavior could improve marketing strategies. The purpose of this study is to explore whether or not people will be more committed to plans made on paper than those made on smartphones.

Methodology: We asked participants to fill out surveys, develop either a technological based or paper-based calendar for 10 days, and journal their daily activities to determine if they were making time for those plans. Data was collected and analyzed.

Results: The study found that people who used paper calendars were more committed to their original plans; they were more likely to do the planned activity at the time scheduled.

Conclusions: Involvement when making plans affects plan execution. Making plans on a paper calendar could make people more committed compared to making plans on a smartphone calendar possibly because people are more involved when handwriting than typing plans. Given that using smartphones to plan is becoming a trend, people need to be more aware of the negative consequence of convenience in technological-based calendars. To compensate for possibly not committing to plans, smartphone planners could set a timer for the events they've planned for to ensure commitment.

SPENCER ROSS

Bennett S. LeBow College of Business
Management Information Systems, Business Analytics

Faculty Mentor: **DR. ELEA MCDONNELL FEIT**
Marketing

MEASURING USER SENTIMENT FOR VIDEO GAMES THROUGH TEXT ANALYSIS

With the growing importance of Big Data, business must learn to utilize all available resources to understand customers' opinions about their products and adjust their products accordingly. One of the largest data sources comes in the form of customer reviews of products on public websites. Reacting to customer feedback is crucial for a good product, and we show how the review analysis process can be automated so that companies can visualize customer feedback and correct flaws in their product. We illustrate this approach using comparing reviews for several video games including *Star Wars Battlefront II*, *Battlefield 1*, and *Call of Duty: WWII*.

Using Amazon and MetaCritic as our primary sources, we scraped over 3,000 customer reviews. These reviews scored for the sentiment of each review and the most frequent topics customers discussed. Common topics in reviews included gameplay, graphics, and microtransactions. After comparing the results of *Star Wars Battlefront II* with those of 4 other games in the same market, it was evident that users were extremely dissatisfied with the prevalence of microtransactions within the game.

ANDREW ANTWI

Bennett S. LeBow College of Business
Marketing

Faculty Mentor: **DR. RAJNEESH SURI**
Marketing

Hongjun Ye, Siddharth Bhatt
Co-Mentors

THE EFFECT OF THE EXTENT OF HUMANIZING AND AUTOMATING ON RETAIL PERCEPTIONS

Over the last decade, robots such as Amazon's Alexa and Google's Home Mini have infiltrated our daily lives. A report from McKinsey & Company indicates that by 2030, as many as 800 million workers worldwide could be replaced at work by robots. One of the main questions we wanted to dissect how the look of robots affected consumer's willingness to trust, purchase or use them. We wanted to measure the uncanny valley which explores the relationship between the degree of an object's resemblance to a human being and the emotional response to such an object. To measure this, we created a survey of four robots ranging from human looking to machine-like. We created a scenario where each robot type was an employee at an Office Store and we asked questions based on trust and comfort to asses consumers opinions on how the look of these robots affected their shopping experience. This data allowed us to see how the look of the robot plays an essential role in automation in the retail industry. The next step will be to evaluate how these opinions vary when the robots are put in other settings like restaurant, hotels and other places.

ALEXANDRA ELLIS

Bennett S. LeBow College of Business
Organizational Management, Marketing

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

IMPACT OF GERBER'S BABY WITH DOWN SYNDROME ON BRAND PERCEPTION

To determine the impact of Gerber Product Company's inclusivity on brand perception among consumers, I conducted an experiment containing pertinent information regarding its photo advertisement campaign. The purpose of the experiment was to compare the effectiveness and consumers' perceptions of two Gerber campaigns. Participants were randomly assigned to evaluate one of the two campaigns. Half of the participants were asked to answer a set of questions after reviewing information about Grace, a neurotypical Gerber baby from 2015, while the other half of the participants were asked to answer the same set of questions after reviewing information about Lucas, the first ever Gerber baby with Down Syndrome and the current spokes-baby. After analyzing responses from participants, I found that on average, participants who viewed the inclusive advertisement were more likely to recommend this brand to other consumers, more likely to agree that Gerber Product Company prioritizes inclusion, encapsulates beauty in diversity, and extends a social impact, and more likely to experience positive reactions than those who received the advertisement with the neurotypical baby.

DEREK HENGEMIHLE

Bennett S. LeBow College of Business
General Business

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

COFFEE SHOPS AT DREXEL AND HOW THEY SUCCEED IN A STUDENT-ONLY MARKET

For most college students, the morning begins with an important necessity: a cup of coffee. This necessity provides an exciting opportunity for coffee shops on campus and drives hundreds of local sleepy students through their doors during all times of the day. With the coffee shop industry already being so uniquely competitive, this creates an intense market on campus. At Drexel University, three main coffee chains compete for the same customers, day in and day out. To be successful, these coffee shops need to implement unique and specific marketing strategies that develop place attachment (a consumer's emotional bond with a location) with the student body. My research is focused on understanding what strategies a coffee shop owner on campus can implement to most efficiently establish the downstream variable of customer loyalty. In order to learn more about this casual effect link, I first collected qualitative data by interviewing customers and managers of the coffee shops. Then I conducted a survey to understand customers' perceptions of the coffee shops on campus. By analyzing this qualitative and quantitative data, I found that Drexel students value a fair price and quality and are drawn to a corporate style coffee shop.

DUNG "CAROLINE" LE

Bennett S. LeBow College of Business
Marketing, Business Analytics

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

APPLE AND *THINK DIFFERENT*: MORE THAN JUST BEING GRAMMATICALLY INCORRECT

On August 2nd, 2018, Apple has become the first company in the U.S. that reaches $1 trillion in value. Even before that, the giant tech company remains to be one of the most valuable brands based on its financial performance and influence worldwide. However, more than two decades ago, Apple was once close to bankruptcy before its original leader, Steve Jobs, was brought back to his chair in 1997. Steve Jobs' return to the company and his *Think Different* campaign have become the greatest corporate turnover. The idea behind the striking black-and-white commercial, featuring footage of revolutionary personalities, is that Apple is built on the notion of "difference," and the company embraces creativity by bringing unconventional products and values like the iconic thinkers. Using the data from the survey, we examine the reason behind the massive success and influence of the campaign. Our research has proved that the effect of the survey lays on the connection among the revolutionary thinkers, Apple's brand image, and the aspiration of Apple's users.

CASSANDRA SULLIVAN

Bennett S. LeBow College of Business
International Business

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

VOITURE VS. 자동차: PEUGEOT'S MARKETING STRATEGY IN FRANCE AND SOUTH KOREA

In an era of growing international awareness, businesses are seeing the importance of appealing to an international market. However, the entry into foreign markets may serve as a challenge due to linguistic and cultural barriers. In order to appeal to these markets, a company may decide to change their branding, marketing strategy, or product.

In this research, I focused on Peugeot, a French automotive manufacturer, to explore its international marketing strategy. The purpose of this research was to answer the question: In order to appeal to a foreign market, how does Peugeot market their cars differently in South Korea, compared to domestically in France? To further investigate its international marketing strategy, I compared similar Peugeot TV ads for France and South Korea. I noted the similarities and differences, as well as translated the audio/ on-screen text. Then, I conducted an experiment to gather primary data on the noticeable differences and compared the effectiveness between the two versions. Results from this study show that Peugeot tends to standardize the product itself but adapts the way it is presented and branded to foreign markets.

CENTER FOR FOOD & HOSPITALITY MANAGEMENT

CECILIA CIRNE

Center for Food & Hospitality Management
Culinary Science

Faculty Mentor: **PROF. ROSEMARY TROUT**
Culinary Arts & Food Science

Dr. Michael Tunick
Co-Mentor

CHEMICAL AND ATTITUDINAL DIFFERENCES BETWEEN COMMERCIAL AND ARTISANAL FOODS

The Agriculture and Food Chemistry Division hosted a highly successful symposium on artisanal foods at the ACS Spring National Meeting in 2017. As a follow-up to that symposium, a study was conducted in the Philadelphia area that explored the chemistry responsible for the differences between artisanal and mass-produced food, the rationale that artisans have toward making their products, and consumer attitudes toward purchasing artisanal food. For the purpose of this study, the products being focused on are cheese, coffee, ice cream, chocolate, and grains. The contrasting techniques used in manufacturing these two classes of food lead to differences in composition, flavor, and texture. For example, dairy products made from pasture-fed cows display more complex flavor profiles due to the greater variety of plants the animals consume. Consumers are willing to pay more for artisanal food, feeling that it tastes better, is healthier, and helps support family-owned operations. Producers not only want to be able to own and control their businesses, but also wish to create better and more authentic food in an environmentally friendly manner. Part of the psychology surrounding artisanal food is based on their chemistry.

KYLE MOYNAHAN

College of Engineering
Chemical Engineering

Faculty Mentor: **DR. SEAN O'DONNELL**
Biodiversity, Earth & Environmental Sciences

Katie Fiocca
Co-Mentor

THE EFFECT OF DIET AND SOCIAL BEHAVIOR ON CASTE DETERMINATION IN TROPICAL PAPER WASPS

Within highly eusocial insect species with dimorphic castes, larval diet determines adult morphology. The way castes are determined in a primitively eusocial species with monomorphic castes is less clear. Mischocyttarus paper wasps are primitively eusocial with females either functioning as egg layers or foragers. Females emerge morphologically identical but differentiate themselves into social castes via dominance interactions. Adult behavior and diet are believed to play a role in determining a female's caste post-emergence. Previous studies on eastern yellow jackets suggest that individuals from different social castes were fed diets from different trophic levels, with reproductive castes being fed from the highest trophic level (Schmidt et al., 2012). Using stable isotope analysis, we plan to explore the ratios of nitrogen (δ15N) and carbon (δ13C) in wasp samples to examine the diet of the wasp. Samples with higher nitrogen ratios are a result of a diet richer in animal tissues and are indicative of high trophic level diet. By examining dominance behavior and diet of Mischocyttarus paper wasps, we aim to better understand the social caste determination of primitively eusocial insects.

SERENA JOURY

College of Arts & Sciences
Environmental Science

Faculty Mentor: **DR. DANE WARD**
Biodiversity, Earth & Environmental Science

Meghan Barrett
Co-Mentor

CONDITIONING BEES IN CUBA: ASSESSING THE COGNITIVE BEHAVIOR AND COLOR PREFERENCES OF *Melipona beecheii* THROUGH VISUAL ASSOCIATIVE LEARNING ASSAYS

The ability to learn information is critical for bees interacting with complex environments. Innate color preferences, as well as the ability to learn visual cues, have already been shown in honey and bumble bees. However, bees that evolved in more consistent tropical environments, such as the stingless bee species *Melipona beecheii*, may have different innate preferences and learning abilities that explain influential ecological and evolutionary factors across tropical and temperate environments. Using the Free Moving Proboscis Extension Response (FMPER) protocol, *M. beecheii* bees were tested for individual color preference and the ability to learn an association between color and a sucrose reward. The color preference test suggested a bias for yellow over blue, and no preference between blue and orange. Associative learning assays showed that *M. beecheii* bees are not highly motivated to learn (34%, n=117) but those that are motivated are highly successful (75% passed the associative learning test after five conditioning trials). These investigations reveal that learning visual cues is important for foraging social bees in tropical environments.

CHANDLER OLSON

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Biological Science

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Meghan Barrett
Co-Mentor

VARIATION IN WORKER CASTE MORPHOLOGY OF *Melipona beecheii beecheii* BEES IN CUBA

Social insects employ multiple strategies to divide labor within the worker caste, including temporal or morphological task allocation. Temporal task allocation occurs when workers perform specific jobs as they age, while morphological task allocation occurs when workers are physiologically specialized to perform a specific job. Flying social insects, such as wasps and bees, commonly evolved temporal task allocation however the first examples of morphologically distinct guards have been found in stingless bees. The frequency of morphological task allocation in this group is currently unknown but previous work suggests in may be widespread across several genera. We assessed the morphology of worker bees of *Melipona beecheii beecheii*, a stingless bee used for meliponiculture in Latin America. Guard and forager bees were collected from three sites in Cuba and ten morphological measurements were taken per individual. There is variation in the worker caste between guards and foragers; furthermore, guard morphology varies between colonies. The presence of morphologically distinct guards may represent an evolutionary need for increased protection from predators and parasites.

ZACHARY SMITH

College of Arts & Sciences
Environmental Science

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MICROHABITAT AND INTRODUCED SPECIES' EFFECTS ON NATIVE BEE COMMUNITY STRUCTURE IN CIENFUEGOS, CUBA

Local ecosystems are supported by specific species interactions that can be altered by introducing new species. Particularly, the unique endemic community of bees in Cienfuegos, Cuba may be altered by the introduction of the eusocial stingless bee, *Melipona beecheii beecheii*, as a part of a new university meliponiculture program. Collecting and surveying bees using insect nets and bee bowls provides insight into current community structure by gathering different genera across three variable microhabitats. Over a period of six days, these methods yielded a total of 63 bees and showed that five genera of bees were living on or near the campus. Lasioglossum sweat bees were the most abundant genera collected, accounting for 42.86% of the survey population. The locations and abundance of the genera surveyed suggest that the introduction of *M. beecheii* would not significantly alter the structure of the current bee community. In addition, data suggests that microhabitat variables may affect the bee communities across sites.

MARGARET MCCURDY

College of Engineering
Environmental Engineering

Faculty Mentor: **DR. DANE WARD**
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Meghan Barrett
Co-Mentor

LIMITED THERMOREGULATORY MECHANISMS IN FORAGING *Melipona beecheii* BEES

Increasing global temperatures may threaten the survival of species in thermally challenging environments or those with poor thermoregulatory capabilities. Particularly, tropical species like the stingless bee *Melipona beecheii*, may be forced to operate near their upper thermal limits. Elucidating the critical thermal maxima and thermoregulatory abilities of this species is important to understanding how the Cuban meliponiculture system may be impacted by climate change. To measure the CT_{max} of *M. beecheii*, we evaluated worker bees at two different urban locations in Cienfuegos, Cuba using a USA Scientific Digital Dry Bath and ramping the temperature 1°C every five minutes. The CT_{max} was determined to be the point at which bees ceased visibly respiring. The in-flight temperature of the bees' heads, thoraxes, and abdomens were also measured using a thermocouple. *M. beecheii* workers cannot thermoregulate utilizing conductive heat transfer to the head or abdomen. However, the average thorax temperatures during flight (33.3°C at an average Ta of 30.6°C) are substantially lower than the average CT_{max} of 46.2°C. This suggests that *M. beecheii* foragers may have a thermal safety margin in the event of increasing environmental temperatures.

MARISSA HENRY

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Janice Dispoto
Co-Mentor

SEASONALITY IN HAEMOSPORIDIAN INFECTION PREVALENCE IN MIGRATORY AND RESIDENT BIRDS OF SOUTHEASTERN PENNSYLVANIA

Three genera of protozoan parasites in the order haemosporida are known to cause malaria or malaria-like infections in birds. Each of these haemosporidian genera is transmitted to birds via Dipteran vectors: mosquitos transmit Plasmodium, biting midges and hippoboscid flies transmit Haemoproteus, and black flies transmit Leucocytozoon. I analyzed 1,105 avian blood samples collected from migratory and resident birds at Rushton Woods in Newtown, PA, during the spring, summer, and fall of 2015 and 2016. I studied whether the proportion of hosts infected varied across seasons. After extracting the DNA, I conducted two nested PCR screenings including one aimed at Haemoproteus and Plasmodium and the other for Leucocytozoon. This protocol amplifies a fragment of the mitochondrial cytochrome b gene for haemosporidians when an infection is present. The positive samples were sequenced, reconciled into consensus sequences using Geneious, and compared to published DNA sequences in the MalAvi database for identification. I focused analyses on some particularly common groups of hosts. I determined that Plasmodium and Leucocytozoon infections are most prevalent in fall, whereas Haemoproteus has the highest infection rate in spring.

NATASHA REDDY

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **DR. MICHAEL AKINS**
Biology

Danielle DeBartolo
Co-Mentor

ELUCIDATING THE MOLECULAR BASIS FOR OLFACTORY HYPERSENSITIVITY IN FRAGILE X MICE

Fragile X syndrome (FXS) is a form of autism caused by mutations in the gene for Fragile X mental retardation protein (FMRP), a key regulator of the neuronal proteome. FXS patients are hypersensitive to sensory stimuli including odors. Past work from our lab has shown that FXS mice are also hypersensitive to odors and that this reflects at least in part differences in how odors are detected in the nose. To elucidate the molecular basis for altered odor-induced responses in the peripheral olfactory system, we conducted a mass spectrometry analysis of wild type and FXS olfactory epithelia to identify signaling proteins that might be dysregulated in the FXS nose. This analysis implicated dysregulation of proteins that carry out multiple roles including signaling, scaffolding, actin binding, and control of mitochondrial function. We are currently validating the mass spec results to identify which of these pathways are candidates to underlie changes in odor-induced responses in the nose. The results of these studies will inform our understanding of altered olfactory responses in FXS and may suggest therapeutic targets for treating this dysfunction in FXS patients.

JILLIAN SAUNDERS

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

Faculty Mentor: **DR. MICHAEL AKINS**
Biology

Molly Mitchell
Co-Mentor

FRAGILE X GRANULES LOCALIZE NEAR AXONAL PLASMA MEMBRANES INDEPENDENT OF THE FRAGILE X PROTEIN FMRP

Fragile X Syndrome (FXS) is the most common inherited form of autism and intellectual disability. FXS occurs when the FMR1 gene is silenced, resulting in a loss of Fragile X Mental Retardation Protein (FMRP), a key regulator of neuronal translation. FMRP is found in a variety of complexes, including the Fragile X Granule (FXG), which is found only in axons. Past work has identified the neuronal circuits and developmental windows in which FXGs are found but not the localization of FXGs within these axons. Axons in the spinal cord provide an ideal system to address this question: in contrast to the small diameter axons that predominate in the brain, many populations of spinal cord axons are large enough to resolve by light microscopy. We used confocal microscopy to address FXG localization in large axons and whether this localization is controlled by FMRP. We found that FXGs are not distributed randomly throughout axons, and instead are found almost exclusively in close proximity to the plasma membrane. Further, this localization is independent of FMRP as FXG position was the same in wild type and Fmr1 null axons. These findings suggest that FXGs regulate local translation in response to cues detected by cell surface receptors.

ISHAAN BHATT

College of Arts & Sciences
Biological Sciences

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

Kayla Murphy
Co-Mentor

SUPRA-SPINAL EFFECTS OF A TNFR2 AGONIST IN EXPERIMENTAL AUTOIMMUNE ENCEPHALOMYELITIS (EAE)

Multiple sclerosis (MS) is a debilitating autoimmune disease involving demyelination in the central nervous system that primarily affects females. MS symptoms include loss of vision, learning/memory deficits, chronic pain, and loss of motor function. Experimental autoimmune encephalomyelitis (EAE) is an animal model commonly used to study MS. EAE and MS are inflammatory diseases that produce inflammatory molecules called cytokines. Tumor necrosis factor alpha (TNF) is a cytokine known to be upregulated in inflamed nervous tissue. It is detrimental in its soluble form when it activates TNF receptor 1 (TNFR1). However, membrane bound TNF signals through TNFR2, which has neuroprotective and remyelinating properties. An agonist was developed to specifically activate TNFR2 since this receptor has been shown to support remyelination in the spinal cord. However, little research has investigated the role of TNFR2 in cortical and hippocampal brain regions, which are crucial in chronic pain perception, cognition, memory and learning, and affective disorders. Using biochemical and histological techniques, we will test the hypothesis that a TNFR2 therapy will alleviate disease progression and affect changes in synaptic proteins.

HANNAH CHERUSSERIL

College of Arts & Sciences
Biological Sciences

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

Mariah Beaver
Co-Mentor

EPIGENETIC CHANGES ASSOCIATED WITH ALZHEIMER'S DISEASE OCCUR PRIOR TO PLAQUE FORMATION IN DROSOPHILA

Alzheimer's disease (AD) is an illness which affects an individual's cognitive aptitude and mental functionality. While the symptoms are apparent, the underlying mechanisms onset of AD progression remain to be elucidated. By understanding what causes cognitive impairments associated with AD, it is possible to reverse these symptoms. One of the hallmarks of AD are amyloid-beta protein plaques. Aβ plaques are formed from aggregates of the improperly cleaved amyloid precursor protein (APP). However, it is unclear whether these protein deposits are a cause of the disease or if they are alternatively a side-affect. We aim to examine the brains of the APP AD model fly to assess at what developmental stage Aβ plaques are forming and how the formation correlates with the molecular and cognitive defects observed. By studying the larval stage of the AD fly, we hypothesize that there is not Aβ plaque formation. However, during the larval stage of the AD fly, epigenetic regulation and cognition are altered in accordance with AD. This conclusion has been explored using PCR analysis as well as learning and memory studies with the larva.

SHREYA MANDLOI

College of Arts & Sciences
Biological Sciences

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

Haolin Zhang
Co-Mentor

HISTONE ACETYLTRANSFERASE TIP60 RESCUES MEMORY, LOCOMOTION AND LIFESPAN DEFICITS CAUSED BY AMYLOID-βPEPTIDE

Alzheimer's disease (AD) features memory loss, bodily function deterioration and early death. Studies in our lab provide evidence of larval fly memory improvement by restoration of histone acetyltransferase Tip60 in amyloid precursor protein-induced AD neurodegeneration. Whether Tip60 can also protect against amyloid-β (Aβ)-induced memory, bodily function, and lifespan deficits remains unknown. Here we use a double transgenic fly model (Aβ42;Tip60) to restore Tip60 level in Aβ42 overexpression neurodegenerative fly brain. Using larval olfactory memory assay, our results show Tip60 restoration rescues short-term memory deficits. To measure larval locomotion, righting, body wall contraction, and line crossing assay are performed. Locomotion deficits are effectively rescued by Tip60 as well. In survival assay, Tip60 action prolongs life span of Aβ flies. We also monitor whether Tip60 can consistently improve AD symptoms by following-up flies until adulthood. We discover Tip60 reverses compromised locomotion in 28-day Aβ adult flies using geotaxis assay.

SUNDUS PERVEZ

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Biological Sciences

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

Haolin Zhang
Co-Mentor

GENERATION AND CHARACTERIZATION OF Aβ;TIP60 FLY LINE

Histone acetylation modifications play a crucial role in Alzheimer's disease (AD) pathogenesis. The appropriate levels of histone acetyltransferases (HATs) and histone acetylation homeostasis are disrupted in AD. Pilot studies in our lab provide solid evidence of neuroprotective function of Tip60 HAT against amyloid precursor protein (APP) induced AD pathology. Restoring Tip60 levels in APP overexpressed fly brain relieves epigenetic transcriptional repression, reduces neuronal apoptosis and revives cognition. Here we develop a double transgenic fly model (Aβ42;Tip60) that allows us to restore Tip60 level in Aβ42. To validate Tip60 gene expression in Aβ42;Tip60 flies, qPCR and Western blot are performed. Both Tip60 mRNA and protein levels are restored in the Aβ42;Tip60 fly line. Tip60 overexpression can sustainably suppress histone deacetylases 1/2 (HDAC1/2) expression and maintain appropriate histone acetylation levels over time, implying restored epigenetic homeostasis. We will monitor whether Aβ-induced AD pathologies can be rescued by Tip60 action. We discuss the possibility that Tip60 may play essential neuroprotective role in Aβ-induced AD neurodegeneration.

DAOUDA NJIE

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **DR. MARY KATHERINE GONDER**
Biology

Dr. Dana Venditti
Co-Mentor

CHIMPANZEE CONSERVATION

The illegal wildlife trade has resulted in a decrease of biodiversity and threatens many fauna with extinction. Socioeconomic transformations in Central Africa intensify these pressures by increasing accessibility to previously undisturbed regions. In particular, hunting pressures effect the endangered Nigeria-Cameroon chimpanzee (*Pan troglodytes ellioti*). Chimpanzees can provide insights into the health of an ecosystem and can raise awareness of the illegal wildlife trade. Previous studies used wild chimpanzee genetic data from Cameroon to predict the origins of captured Chimpanzees. These findings, in conjunction with data on anthropogenic activities, can be used to predict regions of hunting susceptibility. Using a spatial distribution model, we have identified how varying socioeconomic factors impact the development of hunting hotspots in Cameroon and have determined which factors significantly influence patterns of predicted hunting. Results show that hunting hotspots coincide with protected areas and are impacted by factors associated with development. These results can be used to inform conservation strategies and management within Cameroon.

AKASH BHAT

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **DR. DANIEL R. MARENDA**
Biology

Yianna Yiantsos
Co-Mentor

HEREDITARY SPASTIC PARAPLEGIA TREATMENT DRUG SCREEN OF TBCA

Hereditary Spastic Paraplegia (HSP) is an adult onset disease that causes progressive muscle weakness in the legs. HSP is most commonly caused by mutated spastin protein, an ATPase that cleaves microtubules in the axons of neurons. These microtubules are involved in the transport of intramolecular entities in neurons. Mutated spastin is seen to be less efficient in cleaving microtubules, limiting the growth of microtubules in axons. Two isoforms of spastin are seen in human neurons, M1 and M87. The most popular explanation for HSP is through haploinsufficiency, where axonal degeneration occurs due to a lack of spastin levels. However, this does not explain why HSP occurs in the adult. A possible explanation could be that the mutations of the M1 and M87 isoforms of spastin could be causing an upregulation of other factors that affect the motility of microtubules. The M1 isoform, found only in adult corticospinal cells, has been shown to have a stronger impact on the symptoms of HSP. TBCA, a CK2 inhibitor, is a drug that aids in microtubule stability. A drug screening of TBCA on fruit flies with human spastin could be used to see if any improvements occur and to determine an ideal concentration to use for future behavioral assays.

NIHAR DESAI

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **DR. DANIEL R. MARENDA**
Biology

Jennifer Viveiros
Co-Mentor

EFFECT OF REDUCED HDAC 1, 3 ON KISMET KNOCKDOWN ANIMALS

CHARGE Syndrome is a neurodevelopmental disorder caused by haploinsufficiency of the *Chromatin Helicase DNA (CHD) binding 7* gene. CHD7 is an epigenetic reader that is associated with the activation of gene expression. Our lab has previously shown that reduction of the *Drosophila* homologue of CHD7, Kismet (Kis), can lead to many neuroanatomical and motor function defects. Histone deacetylases (HDACs) are chromatin modifiers that remove acetyl groups to reduce gene expression by strengthening histone-DNA interactions. Pharmacological inhibition of HDACs has been shown to reduce such defects. We hypothesized that using RNA interference (RNAi) can recapitulate these results. The focus of our study was on HDAC1 and HDAC3, which are involved in several late-onset genetic neurodegenerative disorders. We expressed either a HDAC RNAi alone or with Kis RNAi in the fly and performed behavioral assays to observe changes in phenotype. When HDAC1 was knocked down, significant decreases in larval locomotor behavior were observed while knockdown of HDAC3 showed no significant change. When RNAis were coexpressed in the same fly, larval locomotor defects were rescued as compared to Kis RNAi alone.

NICHOLAS SOOKHOO

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **DR. RYAN J. PETRIE**
Biology

Pragati Chengappa
Co-Mentor

REPROGRAMMING OF CELLULAR GEOGRAPHY BY THE MATRIX

Cell migration is crucial in development, wound healing, and cancer cell metastasis. The dimensionality of the extracellular matrix governs the molecular mechanisms used by the cell to move. Currently the orientation of the cell when moving from 2D to 3D is unclear. I hypothesize that cell orientation when moving from 2D-3D is not conserved, suggesting the traditional model for 2D cell motility doesn't apply to 3D matrices. SEPT7 is a cytoskeletal protein that helps initiate the formation of the leading edge in cells migrating on 2D. Establishing how SEPT7 re-localizes within the cell as it moves from 2D to 3D will reveal the fate of the leading edge and dimension-dependent changes to cell orientation. We theorize that SEPT7 localizes differently in cells in 3D since arp2/3 activity is regulated by matrix dimensionality. Understanding how SEPT7 re-localizes cells moving in 3D will help us understand how the matrix reprograms cell behavior. We speculate if any changes are discovered in the distribution of SEPT7, migratory plasticity would be dependent on SEPT7 localization. Discerning the mechanistic changes that drive migration in diverse settings will help us control cancer cell migration in vivo and provide therapeutic benefits.

SARANYA MADAN

College of Arts & Sciences
Psychology

Faculty Mentor: **DR. A. DENISE R. GARCIA, DR. KARI F. LENHART**
Biology

S. Gwen Warrick, *Co-Mentor*

INVESTIGATING THE ROLE OF HEDGEHOG SIGNALING PATHWAY IN NEURON–ASTROCYTE COMMUNICATION IN *DROSOPHILA*

The Central Nervous System (CNS) controls the activities of the body. Defects in CNS due to disease or injury can lead to major impairments of regular body functions. Neurons are the most well-known brain cell, but could not develop and function without glial cells, a secondary neuronal cell type that includes astrocytes, the focus of our project. Research in the mouse brain demonstrates the role of the Hedgehog (Hh) signaling pathway in neuron-astrocyte communication. We used Drosophila (fruit flies) as a model system to address the role of Hh signaling in glia-neuron interactions, as Drosophila are genetically pliable and reproduce quickly. We find that cells do express and respond to Hh signaling in the Drosophila brain at larval stages, but unlike in the mouse, the responsive cells are not astrocytes. Instead, these cells are likely different subtypes of glia, including midline glia. Midline glia are well established to respond to Hh during embryogenesis but have not been studied during larval development. Our study lays the groundwork for future research on the role of midline glia and Hh signaling, particularly parsing differences between mammalian and insect model systems.

MELANIE HUOT

College of Engineering
Chemical Engineering

Faculty Mentor: **DR. HAIFENG JI**
Chemistry

Gregory Schwenk
Co-Mentor

CONDUCTIVE INK FOR FABRIC APPLICATION

Developing a conductive ink that can be used for textile application has grand implications for the future of wearable electronics. Possible uses of having circuits integrated in clothing include health monitoring, sending radio messages, or GPS tracking. The fabric pretreatment used in industries prior to applying ink was researched, which typically involved flattening the surface of the fabric with heat. These processes were simulated in lab using hot plates, gas flames, or iron rods heated in boiling water before application of the ink, which were used on cotton and polyester samples. The two main fabric inks used in screen-printing are plastisol and water-based ink. Where plastisol is designed to sit on top of the fabric, water-based ink directly dyes the fibers. Both were doped with silver powder at varying ratios of ink to silver to vary conductive strength and fabric-binding strength. Water-based ink doped with silver at a ratio of 1:1.5, ink to silver, proved to have the best test results, and after simulating washing and drying, was still able to maintain conductivity. For future research, more combinations of silver and ink can be investigated to compare efficiency to amount of silver.

JASJIT KAUR

College of Arts & Sciences
Chemistry

Faculty Mentor: **DR. HAIFENG JI**
Chemistry

Gregory Schwenk
Co-Mentor

APPLICATIONS OF FLEXIBLE METAL ORGANIC FRAMEWORK CRYSTALS

Metal organic frameworks (MOFs) are compounds with both organic and inorganic components. This unique structure has attracted much attention to their applications in pharmaceuticals, gas storage and sensing, and catalysis. However, MOFs are not commercially available or easily synthesized, as their underlying growth mechanisms are still largely unknown. This research focused on various crystal-growing methods to further analyze the applications of these compounds. The vapor diffusion method yielded the best results of copper acetylacetonate crystals, a MOF that is known to exhibit mechanical flexibility. The flexibility of the MOF was confirmed using nanoindentation to bend the crystals. From the results of an IV curve generated on a Keithley SourceMeter®, the crystals were found to be electrically conductive, and when tested in a Field Effect Transistor (FET), results signified that copper acetylacetonate was an n-type semiconductor. Further tests will be conducted to explore if the compound exhibits piezoelectricity or gas sensing performance.

LE'ANN ROBLES-PICHARDO

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **DR. HAIFENG JI**
Chemistry

Pietro Ranieri
Co-Mentor

PLASMA TREATMENT IN HIGHLY STRETCHABLE GELATIN-POLYACRYLAMIDE HYDROGEL

Non-equilibrium plasma treatment is known to have effects on wound healing and tissue regeneration without being destructive. Not only does it inactivate a multitude of parasites and foreign organisms that reside in the skin, but it can function to achieve a desired medical effect. Which is why in this research the antimicrobial efficacy after plasma treatment of a highly stretchable gelatin-polyacrylamide hydrogel was tested. This was done by treating the hydrogel with a nanosecond pulsed DBD treatment at different voltages, pulse width, and times. After treatment, the hydrogel would be placed inside a petri dish harboring *E. Coli* bacteria. The clearer the hydrogel inside the petri dish, the higher the possibilities of it being antimicrobial. After many trials, it was concluded that the hydrogel that was treated at mid to high range frequencies with plasma, did have antimicrobial properties to it.

LONG TRAN

College of Engineering
Chemical Engineering

Faculty Mentor: **DR. HAIFENG JI**
Chemistry

Zhen Qiao
Co-Mentor

HIGHLY STRETCHABLE GELATIN–POLYACRYLAMIDE HYDROGEL FOR TRANSDERMAL DRUG DELIVERY

Hydrogels have been recently revealed as an efficient carrier for transdermal drug delivery. The purpose of this project is to study, examine, and enhance the in-vitro transdermal drug loading and release on the highly stretchable hydrogel system. This hydrogel system is mainly composed of poly-acrylamide (PAAm) and gelatin. N,N'-Methylenebisacrylamide (MBAA) was used as the cross-linker. To increase the tensile strength of the hydrogel, several divalent metal ions solutions were dissolved before the gelation occurred. The drug loading process was performed by submerging a certain amount of hydrogel into an aqueous drug solution, which would be measured the concentration after the regular time interval. The maximized loading efficiency can be reached after a couple of days. After drug loading, in-vitro drug release was performed under controlled conditions. Cellulose Acetate Membrane was used to replica human skin, and PBS buffer solution within the pH range 5.5 - 5.9 was used to mimic human skin environment. Results showed that this hydrogel system can load and release drug at a high efficiency, which makes it a great candidate for transdermal drug delivery as well as other applications in material science.

JUSTIN YUEN

College of Nursing & Health Professions
Health Sciences

Faculty Mentor: **DR. HAIFENG JI**
Chemistry

Ketao Chen
Co-Mentor

CORE WIRE FET DEVICE COATED WITH P3HT

The application of a field effect transistor (FET) for the use of a chemical or a biological sensor is on the rise. An FET works by having current flowing through three electrodes: the source, drain and gate. More specifically, what makes an FET unique is that when there is voltage applied to the gate, it can manipulate the voltage flowing from the source to the drain by means of a semiconductor channel. In fields such as healthcare, the potential use of an FET device could become an innovative technology to areas such as drug delivery—by getting drugs to specific organic molecules in a very controlled manner. Likewise, FETs could have the same application in the discipline of chemistry by using it as a platform for detecting ammonia and other various compounds. In this study, a new design for an FET was made. This design consists of an insulated copper wire, gold electrode, and P3HT (3-hexylthiophene-2,5-diyl) polymer. The device that was developed is around 50 μm in width, translating to its ability to be placed in very small places. After developing this new FET device and when tested, the curves showed characteristics of an FET effect when applying gate voltage.

PETER LAM

College of Arts & Sciences
Chemistry

Faculty Mentor: **DR. DANIEL KING**
Chemistry

THE STUDY OF UNDERGRADUATE CHEMISTRY CLASSROOM ASSISTANCE TOOLS

Chemistry is known by many to be one of the most difficult STEM fields. Due to this difficulty, many classroom assistance materials have been developed in order to combat the issue. The purpose of this study was to look into the data associated with the use of those classroom assistance tools used by professors in the general chemistry sequence (CHEM 101 and CHEM 102) at Drexel University. The tools looked at were clickers, post laboratory questions, online homework data, and recitation questions. The study of data was divided into two parts, with the first part being comparing exam performance related to the questions that appeared on clickers, post laboratory evaluations, and recitations. The second part was looking at the time spent on online homework questions and the percentage of clicker questions answered. It was found that student performance on the exam questions that were similar to the questions answered using the listed classroom assistance tools was higher compared to the questions that were not similar to the classroom assistance tools. It was also found that the higher the clicker participation, the stronger the exam performance.

EMILY GREBERMAN

College of Arts & Sciences
Criminology & Justice Studies, Psychology

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

TWITTER: FILLING A GAP, OR DIGGING A HOLE BETWEEN POLICE DEPARTMENTS AND THEIR RESIDENTS?

This research examines how the 25 largest municipal and county police departments (PDs) in the US use their Twitter accounts to communicate and share content with residents of their jurisdictions. For each department we collected "Tweets" over the prior 30 days from a given reference date and coded them into message categories based on an iterative process. Our primary purposes were to identify (1) the most common types of information PDs broadcast to their publics, and (2) how departments interacted with people who posted to their accounts. We treated text strings, photos, and videos as distinct message media, and coded them based on message type. The average PD posted 117.38 (SD=87.76) tweets during the study month. We found that when PDs tweeted information related to current community safety issues, residents often tweeted back replies that were favorable to the agency. When departments tweeted out more "humanizing" messages, e.g., community events and/or pictures with kids, they tended to receive a higher number of positive comments as compared to other message types. Current news scandals, however, led to negative posts by residents, regardless of what departments tweeted. The research reports several additional findings.

ELLE GRIFFITHS

School of Education
Secondary Education: English

Faculty Mentor: **DR. DEIRDRE MCMAHON**
English & Philosophy

APPLYING MIND, BRAIN, AND EDUCATION SCIENCE TO THE LANGUAGE ARTS CLASSROOM

Many U.S. educators lack knowledge of how the brain reacts to information, stress, emotions, and sleep, and how neuroplasticity affects learning in the short and long term. The purpose of my research is two-fold: to explore the emergent field of Mind, Brain, and Education Science (MBE), also known as Educational Neuroscience, and to apply MBE theories to the 12th-grade language arts classroom through sample lesson plans on the young adult novel *Brown Girl Dreaming* by Jacqueline Woodson. Through independent research, reciprocal teaching, and collaborative, small group discussion, students will be able to place Woodson's free-verse poetry in its cultural/ historical context before working together to discuss the form and voice of her work. These activities incorporate MBE principles to maximize both student engagement and learning outcomes, offering a framework for student and teacher discussions of metacognition and enabling the development of research skills, thoughtful self-expression, and dialogic exchange that can be applied to other learning experiences.

CLAIRE BAKER

Pennoni Honors College
Custom-Designed Major: Actuarial Science

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

RUTH PATRICK'S GUIDE TO SUCCESS THROUGH RISK ASSESSMENT AND PERSONAL DEVELOPMENT TACTICS (1960–1980)

People all around the globe share the ultimate goal of becoming successful. As would be expected of a universal aspiration, it is extremely tough to attain and even harder to measure. Ruth Patrick exemplifies the characteristics required to achieve such a triumph. As a woman in the STEM field during the early 20th century, her methods were, and continue to be, often overlooked. However, the techniques Patrick used to approach issues of water protection and conservation have been essential in the movement to ensure a habitable earth for future generations. These tactics include using risk assessment as a basis for action, personal development, which incorporates the importance of acknowledging when to delegate tasks, and even straightforward communication skills, such as using tangible examples to make complex topics more accessible to readers. The majority of society was frighteningly uninformed with the status of their environment. Patrick tirelessly worked to reach and impact those she could, with the hope that they would then go on to influence others.

KELSEY DEANGELIS

College of Arts & Sciences
Undeclared Major

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

Jennifer Vess
Co-Mentor

RUTH PATRICK, "THE PATRICK PRINCIPLE" AND ITS IMPACT ON INDUSTRIAL ENVIRONMENTALISM, 1950–1980

Ruth Patrick's innovative and collaborative ideas, truly set her apart from the other scientists in her field, and allowed her to make a true impact on the scientific and corporate understanding of the industry's impact on fresh bodies of water. This type of understanding, that Patrick, introduced coined the term "The Patrick Principle." Her combination of natural history and ecology lead her to develop new ideas and apply them to the current issues of her time. She studied fossilized diatoms and the biodiversity of the Great Salt Lake which lead to her discovery that diatoms determined the type of pollution in fresh bodies of water. This discovery prompted her to invent the diatometer in 1945, which is an instrument used to determine the presence of diatoms in fresh bodies of water. Apart from being one of the only women to create such a revolutionary invention, what really set her apart was her ability to partner with large corporations, a skill her peers did not possess. Dr. Patrick's creativity and communication skills allowed her to educate industries, such as DuPont, about pollutants from industries and its negative impact on fresh bodies of water.

KSHITIJ KAYASTHA

College of Arts & Sciences
Mathematics

Faculty Mentor: **DR. ANATOLII GRINSHPAN**
Mathematics

IMAGE CRYPTOGRAPHY

This project focuses on encrypting a monochrome text or image. The programming is implemented in python. The goal is to encrypt the original input as an image rather than a text. Python's image library and numpy library are used to convert the original image to grey-scale and extract its matrix. This matrix is subjected to an encryption process, resulting in an array of new values, which are used to create a new (encrypted) image. Decrypting the encrypted image also requires the extraction of the image matrix. The image recognition process is done using linear algebra. This yields the required information needed to recreate the original image.

SPENCER SCHADE
College of Engineering
Architectural Engineering

Faculty Mentor: **DR. RON PERLINE**
Mathematics

SIMULATION OF THING FILM OPTICS

We study a set of differential equations which model highly reflecting light rays in thin films of heterogeneous thickness. The solutions depend strongly on the shape of the film. In general, the equations cannot be solved exactly so we compute the solutions numerically.

For particularly simple film configurations (a ``flattened sphere'') the solutions can be computed explicitly, using elliptic functions and elliptic integrals, which are generalizations of trigonometric functions. Using properties of these special functions, we can explicitly calculate the periodic solutions (closed path) for this particular configuration.

KATHRYN VICTORIA RYAN

Pennoni Honors College
Custom-Designed Major: Actuarial Science

Faculty Mentor: **DR. XIAOMING SONG**
Mathematics

A COMPARISON OF MEN AND WOMEN SALARIES AT PUBLIC UNIVERSITIES

Research conducted by AAUW showed that on average, women were paid 80% of what men were paid in the US in 2016. Our study looked at the average salaries of assistant professors divided by gender in the year 2016 for 105 different public colleges within PA, NJ, NY, DE, and MD to determine if a gender salary gap exists here. Data was gathered from data.chronicle.com, which collects all of its faculty pay data from the US Department of IPEDS. Comparisons were made using hypothesis testing with H0: men and women have the same average salary and Ha: men have a higher average salary than women. After constructing normal probability plots, it was determined that both sets of data for men and women showed approximate linearity, which means that both men and women salaries display an approximate normal distribution. Thus, using a 95% significance level with μ = \$70,748.45 and σ = \$12,125.14 for men and μ = \$68,254.54 and σ = \$10,989 for women, a z test was conducted. The z-test resulted with a z-value of 1.56 and a p-value of .0594. Since the p-value is larger than α = .05, it can be concluded that men do not have a significantly larger salary than women at public colleges as assistant professors within these states.

OTHON T. TZAMTZIS

College of Arts & Sciences
Physics

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

Erin Hansen
Co-Mentor

NOISE REDUCTION ANALYSIS FOR A LIQUID XENON PURITY MONITOR

Neutrinos are subatomic particles with tiny masses that rarely react with ordinary matter. Nevertheless, liquid xenon can be used to search for a process known as neutrinoless double beta decay, a rare decay during which a nucleus simultaneously emits two electrons without the corresponding electron antineutrinos expected by traditional beta decay ($0\nu\beta\beta$). The detection of this hypothetical process could give physicists insight into the properties of neutrinos - specifically the relationship between neutrinos and their antimatter counterparts. With this information, physicists will then be able to apply this knowledge to other fields in particle physics and cosmology research.

Drexel University participates in an international collaboration to develop the next generation of this experiment, nEXO. Due to the large scale of nEXO, the survivability of signal electrons is of paramount importance; a novel liquid xenon purity monitor is in development at Yale University and is currently taking data. My work focused on understanding the purity monitor response and building a framework for an automated process of analyzing data pulses. I developed methods of filtering out the persistent noise in the signal while maintaining pulse shape information critical for the purity monitor measurements. This will help in deriving sensitive measurements of the purity of the liquid xenon.

THOMAS REESE

College of Arts & Sciences
Physics

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

A NEW METHOD OF BLOOD SPECTROPHOTOMETRY

We have augmented a Leitz Inverted Microscope (with x20 objective) that permits efficient capture of Hb spectra from a whole blood sample. A 150 watt xenon arc lamp is used to funnel light through a 1500µm, 0.39 NA multimode fiber, above a 100 µL capillary and above the objective, to analyze the light absorbance in the sample in an Ocean Optics USB4000 Spectrometer. We added an exterior slit and collecting lens, ensuring that we only captured the center of the capillary, and observe wavelengths from 400-700 nm. Then, we addressed the problem of light scattering of blood cells through similar experiments of concentrated Hb.

We performed a series of titrations with carbon monoxide to see its effect on absorption and are working on a mathematical model to correct the effect of stray light distortion on the absorption spectra, as deduced by observing the intense flattening of the soret band. This spectrometer will be a critical addition to a capillary-based viscosity measurement system recently developed by determining the degree of oxygenation. This capillary device will be useful for diagnosing sickle cell disease in resource challenged areas.

TARA N. FEENAN

College of Arts & Sciences
Physics

Faculty Mentor: **DR. DAVID GOLDBERG**
Physics

FINDING HABITABLE PLANETS USING MICROLENSING

Gravitational microlensing is a phenomenon where massive objects bend the paths of light sources behind them, thus altering and warping the image of the light source as perceived by the observer, all over the course of a few days to weeks. Current applications of microlensing observations include finding and classifying the non-light emitting mass in space, particularly exoplanets. With a concentration on exoplanet discovery, we then focused on the Drake Equation: a formula that predicts the probability of extraterrestrial intelligence based on preexisting knowledge and assumptions pertaining to our galaxy. Combining the Drake Equation with microlensing analysis, as well as these preexisting assumptions, we predicted the potential observations of future large-scale telescope projects. WFIRST is a NASA-planned infrared telescope with a field of view 100 times greater than that of the Hubble Telescope, and given this wider field of vision, we can combine its future potential microlensing observations with the Drake Equation's factors, and more accurately predict the answer to the age-old question of whether or not we are alone in our galaxy.

NICHOLAS DEFILIPPIS

College of Computing & Informatics
Computer Science, Mathematics

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

Joseph Glaser
Co-Mentor

THE EFFECT OF CLOSE STELLAR ENCOUNTERS ON PLANETARY STABILITY

In 2017, astronomers discovered seven potentially habitable planets orbiting the star TRAPPIST 1. Interestingly, they all orbited very close to their star, less than a tenth of the distance between the Earth and the Sun. Stars like TRAPPIST 1 form in star clusters, gravitationally bound clumps of stars that form from giant clouds of hydrogen-rich interstellar gas. Stars in clusters frequently have close encounters, which can potentially disrupt existing planetary systems. Because the TRAPPIST 1 system is so compact, however, it might be less vulnerable to these stellar encounters. To answer this question, we simulated the effects of close encounters on the long-term orbital stability of planetary orbits utilizing the AMUSE software framework and the SecularMultiples integrator.

The results of this study can be used to determine how vulnerable systems like TRAPPIST 1 are to stellar perturbation. This can be used to estimate the survival probability of similar planetary systems in a typical clustered environment, allowing us to assess whether such habitable systems are a common occurrence throughout the galaxy, or if they are rare anomalies.

OMESH DHAR DWIVEDI

College of Arts & Sciences
Physics

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

Johannes Wagner, Matthew Brassler
Co-Mentors

BUILDING GEANT4 SIMULATIONS OF THE DREXEL BUBBLE CHAMBER FOR DARK MATTER DETECTION

Observable Matter refers to materials that interact with both gravitational and electromagnetic forces. Consequently, every form of matter we encounter around us every day is observable matter. However, recent studies of the universe have led to the conclusion that observable matter constitutes only approximately 5% of the known universe. The remaining parts of the universe are constituted by hypothetically predicted Dark Matter and Dark Energy. Dark Matter is a form of matter that doesn't undergo electromagnetic interactions and therefore cannot be perceived physically. The prime candidates to be the constituent of Dark Matter are WIMPs (Weakly interacting Massive Particles). Attempts are being made to detect the presence of WIMPs using Bubble Chambers by PICO, an international scientific collaboration. Drexel University hosts a prototype PICO Bubble Chamber.

My research in particular, involves building and performing a GEANT4 Monte Carlo Simulation of the radioactive source at the Drexel Bubble Chamber. The GEANT4 simulation allows us to calculate the probability of any kind of background radiation, such as gamma or cosmic radiation, nucleating a bubble in our experiments, therefore affecting the outcome of our experiments.

KAYLEY DIPAOLO

College of Arts & Sciences
Physics

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

Angelica Rivera
Co-Mentor

PROBING UV-X RAY CORRELATIONS IN QUASARS

Quasars, or luminous active galactic nuclei (AGN), can exhibit characteristics such as strong/weak accretion disk winds based on their X-ray properties; therefore we are attempting to categorize species of them. Accretion disks are rotating disks of matter that surround a large gravitational body, and radiate in the X-ray part of the electromagnetic spectrum. This research lays the foundation for a better understanding of how X-rays influence quasar disk winds and how the UV emission lines reflect those winds. Our project includes running a data set of quasars through a digital database of previously recorded objects, known as the Chandra archive. This allows us to see which objects have associated X-ray properties. Our project also allows for the confirmation of unbiased targeted selection, with the goal of improving the Chandra archive as a whole. If we find the Chandra archive to be biased, we will add observing times to address this issue.

JOSHUA WEISBERG

College of Arts & Sciences
Physics

Faculty Mentor: **DR. BRIGITA URBANC**
Physics

Andrew Antczak
Co-Mentor

TOWARD A COARSE-GRAINED LIPID BILAYER: DISCRETE MOLECULAR DYNAMICS STUDY

Alzheimer's disease (AD) is the prevalent form of dementia in elderly. AD pathology is associated with aberrant assembly of amyloid β-protein (Aβ) into oligomers, which are hypothesized to get embedded into a cellular membrane and form pores acting as ion channels, which cause influx of calcium ions, leading to cell death. The goal of our research project is to simulate a lipid bilayer using efficient discrete molecular dynamics in order to study interactions between Aβ oligomers and a membrane. In our simulations, we modeled each lipid molecule by three beads, one representing the hydrophilic head and two corresponding to hydrophobic tail beads. To simulate a bilayer, we placed 200 spatially separated lipid molecules into a cubic lattice and coded in attraction potentials between the tail beads, which facilitated their self-assembly into a bilayer. After simulations of lipid self-assembly at different temperatures, including room to physiological temperature range ($0.13 < T < 0.15$), were completed, we calculated the specific heat to identify the temperatures, at which the gas-liquid and liquid-gel phase transitions occurred. Using Visual Molecular Dynamics to display the lipid self-assembly trajectories, we confirmed that a stable liquid phase of a lipid bilayer in the temperature range [0.12, 0.25]. We will further characterize the gel and the liquid phases of the lipid bilayer in terms of its orientational order, density profiles, and diffusion constants.

ETHAN W. KONYK

College of Arts & Sciences
Physics

Faculty Mentor: **DR. MICHAEL S. VOGELEY**
Physics

SPATIAL DISTRIBUTION OF GAS CLOUDS IN VOIDS

Most of the gas in the universe is spread throughout the intergalactic medium, the space between galaxies. Recent work (Pan et al. 2012; Watson et al., in preparation) shows that low density stretches of space, called voids, contain gas clouds that are significantly cooler than gas in dense groups and clusters of galaxies. The distribution of the clouds in space allows us to infer physical information about the intergalactic medium. We use galaxy observations from the Sloan Digital Sky Survey Data Release 12 focused on the Northern Galactic Cap to map out large-scale structure in the nearby universe. We use a catalog of voids constructed using the ZOBOV algorithm which divides space into dense or void regions. Hubble Space Telescope Cosmic Origins Spectrograph observations of distant quasars (accreting supermassive black holes) reveal the locations of Lyman-alpha clouds, or cold hydrogen clouds, with respect to the voids. We can now quantify the spatial distribution of the observed Lyman-alpha clouds, which provide a strong test of our understanding of structure formation in the universe.

ASHLY CHTEH

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Political Science

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

CIVILIAN LIFE IN ARMED CONFLICT: SOCIAL MEDIA AND SELF-EXPRESSION IN SYRIA, 2018

In this study, I examined what civilian life looks like in the midst of armed conflict. Specifically, I looked at the everyday aspects of life and where social media and self-expression fit into that. How is political rhetoric formed? What does political participation look like? How do citizens express themselves? Using systematic searches of social media content, I analyzed how life is portrayed by civilians themselves, focusing on the state of Syria. In particular, I examined YouTube videos by individuals posting independently of any organization or coterie, visiting and/or living in Syria, and a sample of social media posts from accounts based in Syria. Contrary to most published literature about life during a conflict, I found that the way of life for many civilians is fairly normal, although circumscribed by both armed conflict and authoritarian government.

KLEA DHIMA

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Political Science

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

WHY POWER-SHARING? REBEL GROUP DECISION-MAKING IN MOZAMBIQUE, IVORY COAST, AND THE DEMOCRATIC REPUBLIC OF THE CONGO

A significant literature in political science discusses the outcomes of armed conflicts, specifically their long-term implications for peace. However, the reasons that wars end with power sharing agreements are not fully understood. Why would rebel groups who fight to overthrow a government agree to go to work with, or for, their enemies? In this theory-building paper, I study three rebel groups and examine why each decided to work with the government instead of continuing to fight. In Mozambique, the rebel group Renamo had no choice but to surrender and work closely with the government for reasons such as their supplies running low. In the Ivory Coast, the terms of the peace agreement were more appealing than continuing to fight against the government. Lastly, the main rebel group involved in the conflict in the Democratic Republic of Congo (DRC) had close ties with neighboring countries, and these outside influences had an impact on the group's decision to work with the DRC's government officials. Understanding what factors influence power-sharing decisions could limit the duration of civil wars.

KEJSI SHAHAJ

College of Arts & Sciences
Political Science, Communication

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

WOMEN COMBATANTS, RECRUITMENT RHETORIC, AND POST-WAR LIVELIHOODS IN THREE REVOLUTIONARY FORCES

A large social science literature examines the role of women combatants in armed conflict. This research typically examines the recruitment of women in terms of group strategy or individual women's socioeconomic situations. Here, I examine in depth the recruitment processes themselves, specifically the different promises that groups make about improving the condition of women after the war. I find that female combatants often view participation in armed violence as a step towards their own personal liberation in society. I ask: How do the recruitment methods armed groups use to lure women affect their status post-war? Are they happy with these outcomes? Examining these factors is vital, since armed groups often play a central role in post-war politics and society. This study will examine and ask these questions of three armed groups: the FMLN in El Salvador, the PKK in Turkey, and the LTTE in Sri Lanka.

AMINA FONG

College of Arts & Sciences
Communications and Political Science

Faculty Mentor: **DR. CHRISTIAN HUNOLD**
Politics

GREEN GENTRIFICATION IN URBAN CITIES

In highly densely populated cities across the world, landscapes and infrastructure are constantly redesigned and renewed in order to accommodate growing cities. This includes many different types of spaces and features, such as urban green spaces. Green spaces have diverse purposes, including revitalizing communities, providing places for physical activity, and connecting humans to nature and wildlife. However, an unexpected and often overlooked result of green spaces is a story that rings true for many low income neighborhoods: green gentrification. This research project focuses on the effects of green spaces in urban areas. There is also a review of cases in which additions of green spaces have led to the area's gentrification. Additionally, this paper includes an analysis of a survey distributed to residents of Philadelphia, PA in response to the newly built Rail Park. Research suggests that, despite the potential for green spaces to lead to gentrification, Philadelphia residents still value their green spaces and believe that they make great additions to their neighborhoods.

ANGELA MYRONOVYCH

Close School of Entrepreneurship
Entrepreneurship and Innovation

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Psychology

MEASURING THE EFFECTS OF TRANSCRANIAL DIRECT CURRENT STIMULATION ON BRAIN PLASTICITY WITH CONCURRENT FUNCTIONAL MAGNETIC RESONANCE IMAGING IN MAJOR DEPRESSIVE DISORDER

Depression is the most common mood disorder and the second greatest cause of disability worldwide. Despite years of pharmacological and psychological research, over 30% of patients with major depressive disorder (MDD) fail to respond to such interventions alone. Studies show that transcranial direct current stimulation (tDCS), a new noninvasive and painless neuromodulation method involving the application of weak direct currents (1-2 mA) through electrodes on the scalp, can be a very effective treatment for depression. Despite its safety, low cost, and convenience, tDCS treatment has not progressed from proof-of-concept to clinical practice because of a lack of understanding of tDCS' precise effects. The goal of this research study is to identify with functional magnetic resonance imaging (fMRI) the specific effects of tDCS on brain activity while patients with major depressive disorder and healthy control subjects perform emotion regulation tasks. Our preliminary analysis of the fMRI data suggests different profiles of responsiveness in prefrontal cortex for the patient group under active, but not placebo stimulation. This study contributes to our understanding of tDCS as a possible treatment for major depressive disorder.

CLARE MANGUBAT

College of Nursing & Health Professions
Nursing

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

Rebecca Crochiere
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DIETARY LAPSE TYPE BY LOCATION IN THE CONTEXT OF A WEIGHT LOSS TREATMENT

Enhancing weight loss treatments is critical for treating obesity. Non-adherence to weight-loss diets, called dietary lapses, impedes weight loss. Understanding frequencies of lapse type at different locations could improve tailoring of treatments. Participants followed a weight-loss diet and answered surveys 6 times a day about lapse triggers and if a lapse occurred, lapse location--home, school, work, and restaurant/cafe--and lapse type--eating an unknown amount of calories (UC), planned lapse or eating more calories presently while planning to eat fewer later (P), eating an avoided food item (AF), having an unintended eating episode (U), and/or eating a larger portion than intended (LP). Frequencies of lapse type were the following at each location: home: 27.5% (AF), 22.7% (LP), 21.4% (P), 17.4% (U), 10.9% (UC); school: 28.1% (P), 27.1% (UC), 19.8% (AF), 17.7% (LP), 7.3% (U); work: 28.5% (AF), 20.7% (P), 18.9% (UC), 15.6% (U), 16.3% (LP); restaurant/cafe: 29.1% (P), 25.4% (LP), 18.0% (AF), 16.7% (UC) 10.8% (U). Our results imply that patterns of lapse type may differ based on location, which can inform tailoring of weight loss treatments through teaching coping skills related to frequency of lapse type in certain locations.

KANYINSOLA YOLOYE

College of Arts & Sciences
Psychology

Faculty Mentor: **DR. MICHAEL R. LOWE**
Psychology

Amani D. Piers
Co-Mentor

THE IMPACT OF DIETING TO LOSE WEIGHT IN WOMEN WITH EATING DISORDERS

Restrictive eating is a distinguishing feature of Anorexia Nervosa (AN) and Bulimia Nervosa (BN). Although dietary restraint is a core feature of these disorders, the motivation behind restrictive eating can vary amongst afflicted individuals and may differentially relate to the psychological severity of the disorder. The purpose of the study was to characterize the subgroup of those "dieting to lose weight" (DLW) from the overall group of individuals seeking residential treatment for AN or BN. Participants completed measures such as the Anxiety Sensitivity Index, Eating Disorder Examination and the Center for Epidemiologic Studies Depression Scale. Physical measures like Body Mass Index and weight suppression (the difference between someone's historically highest weight and their current weight) were also obtained. Using t-tests, differences on all measures between those DLW and non-dieters were examined. Individuals DLW had worse psychological symptoms (e.g., anxiety, eating disorder severity) compared to non-dieters. This may suggest that dieting reflects particularly intense distress about oneself and one's body in patients with either AN or BN. Dieting may be a counterproductive attempt to cope with the eating disorder.

SANIYA SONI

College of Arts & Sciences
Psychology

Faculty Mentor: **DR. DANETTE MORRISON**
Psychology

EXAMINING LEARNED HELPLESSNESS AS A PREDICTOR OF DEPRESSION AMONG DREXEL UNIVERSITY UNDERGRADUATE STUDENTS

Research has shown that depression among college students in the United States is on the rise. Academic failure can be a major stressor during college and can often cause students to feel out of control (Misra & Castillo, 2004). Learned helplessness is a perceived loss of control, which may be exhibited in an academic setting for students who have developed loss of motivation and are now faced with challenging tasks. Studies over the years have found a strong positive correlation between learned helplessness and depression (e.g., Garcia, 2017; Susic, 2015). However, less is known about whether learned helplessness is a significant predictor of depression, especially with college students.

Results show that coping competency and parental emotional support significantly correlated negatively to each other and depression, respectively. Also, our regression analyses showed that coping competency and emotional support from parents/guardians significantly and individually predicted the development of depression. These findings suggest that for undergraduate college students, we should examine the factors related to emotional support as well as their sense of self in responding to difficult situations leading to better interventions.

RACHELLE ST. FLEUR

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

Alexander Duff
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MACHINE LEARNING WITH IOT DEVICES

IoT devices, specifically, personal assistants are very prominent in the world we live in today. Many people are unable to go a day without using their personal assistants to carry out daily activities such as catching up on the news or making doctor appointments. This daily dependence put personal information at risk. For example, if someone were to hack into an Amazon Alexa device, all personal information would be exposed and could potentially be misused. IoT devices such as Amazon Alexa is built off the understanding of machine learning. This research explores the use of machine learning in order to understand IoT devices such as Amazon Alexa. This research involves learning and understanding the various topics that fall under machine learning through creating a virtual machine, implementing ubuntu, and understanding sys call sensors.

STEPHEN HANSEN

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

SIGNAL DETECTION FOR A BIOMEDICAL TWO-TAG RFID SYSTEM

Current wearable medical devices require constant tethering to an outlet. The Bellyband, being developed by the Drexel Wireless Systems Laboratory, seeks to address this limitation by using powerless and wireless Radio Frequency Identification (RFID) technology. An RFID antenna is sewn into the band, expanding and contracting while the patient breathes, which alters the signal strength that is received.

The changes in signal can then be interpreted as changes in breathing rate. However, RFID is a weak signal, and as a result interference and movement distorts the data. To solve this issue, a two-tag system is used, where a reference tag records noise data and a main tag records noise and respiratory data. The main data tag is then compared to the changing reference distribution window by using various linear algebra techniques. A Python framework automates this process and returns detection and visualization of the differences between the two distributions, where the magnitude of the difference correlates with the rate of breathing. Machine learning techniques estimate the exact times when breathing rate changes. Future modules which find optimal algorithm parameterization will improve the effectiveness of this software.

CHRISTOPHER LYNCH

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Computer Science

RESPIRATORY RATE MEASUREMENT USING WIRELESS SENSORS

Modern respiratory monitoring of infants has the potential to detect life-threatening events in realtime. However, current monitoring devices require adhesive tethered sensors that can be invasive to the patient due to limited body surface area and inhibit mobility. Using Radio Frequency Identification (RFID), it is possible to collect telemetry from a patient using passive wearable sensors powered only by the signals it receives. Currently, one sensor is used on a programmable mannequin to infer respiratory state from changes in power of the signal received. This has indicated feasibility for ambulatory monitoring; to do this, we need to better characterize the RF and mechanical noise to enable classification in motion. In this research, a second, stationary, RFID tag is placed on the mannequin's shoulder as a baseline reference. This tag is used to collect data about the noise of the environment, unaffected by breathing. Statistical signal processing, combined with filtering of environmental dynamic noise based on the data collected from the stationary tag, is used to estimate the breathing rate of the baby. We have observed improvements in the accuracy breathing rate measurement using these techniques.

DARIAN YULIN SHI

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Computer Science

TRACKING DEVICES IN THE IOT USING BLUETOOTH LOW ENERGY

Defined as a system or network of mechanical and digital devices that are embedded with technology and connect to each other, the concept of IoT focuses on bridging the physical and digital worlds to increase the efficiency of standing protocols. Bluetooth Low Energy (BLE), a Bluetooth technology that significantly reduces power consumption but maintains similar communications ranges, has been implemented in devices called Beacons, which transmit information to local devices. They are often used in places such as retail to track and gather information on consumers, bringing up many ethical and privacy issues. Since new technology standards like this are still growing, they are susceptible to unethical hackers, placing our personal digital data at risk. To demonstrate this risk, we used an open source Bluetooth sniffing program, Blue Hydra, on a Raspberry Pi and were able to track ~40 local Bluetooth devices, while also gathering each device's name, manufacturer, MAC address, etc. Using a simple Python script in conjunction with Blue Hydra, we are able to keep a log of when a specific Bluetooth device enters or leaves the Raspberry Pi's range. We conclude that the privacy implications of BLE are significant and need further study.

GULAM SIMNANI CONTRACTOR

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Computer Science

Scott Haag
Co-Mentor

AUTOMATION OF WATERSHED RETRIEVAL

Watersheds are defined as upslope regions that contribute to the flow of water to a common outpoint. Mapping watershed boundaries is critical for managing natural resources and is used to estimate the conditions of rivers, streams, and lakes. These models help scientists connect impacts (land cover, point sources, atmospheric conditions) to potable water, agriculture, and manufacturing. Modern computational methods to retrieve a watershed start by the creation of Digital Elevation Models (DEM). The DEM is most often created using remotely sensed technologies to map and measure the 3-D shape of the earth's surface. The DEM is then converted into a Flow Direction Grid (FDG) that indicates how water flows over the land surface from one location to another. The most common FDG is the D8 model which stores the identity of the neighboring cell (1 to 8) where water is predicted to flow to. Raw FDGs created from DEM contain internal sinks that do not flow out. To create accurate FDG, sinks must be filled in the original DEM.

The goal of this research is to automate the process of identifying sinks in a DEM, filling them, and making a flow corrected D8 FDG. The corrected grid will then be used to retrieve watersheds boundaries.

BLAKE PARKER

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Computer Science

EXPLORING WIFI LOCALIZATION TO CREATE INTERNET OF THINGS (IOT) EMPOWERED SPACES

The IoT is a popular trend in technology being researched around the globe. Everyone and everything from individual people to big companies use the IoT to create more efficient products, services, and spaces. This project aims to investigate the IoT with the objective to design smarter buildings and safer spaces.

Data will be drawn from how people interact with different parts of a building such as lounges, workspaces, bathrooms, etc. This is made possible by analyzing how a person's WiFi-enabled device (i.e. smart phone) interacts with different access points, or WiFi routers, set up throughout a building.

This study employs WiFi localization in order to pinpoint someone's location. Essentially, several different Raspberry Pi 3B+ computers running Kali Linux will be set up around the office space and act as access points that communicate with nearby WiFi-enabled devices. These Raspberry Pi's implement an open source software called FIND3 that is able locate a person's phone, computer, tablet, etc. by tracking a device's media access control (MAC) address. After completing machine learning, FIND3 is able to track a WiFi-enabled device using its MAC address and determine what part of a building, house, etc. the device is located.

KEVIN YOUNG

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UTILIZING THE INTERNET OF THINGS (IOT) TO BUILD SMART CITIES

According to the Brookings Institute, more than 50% of the world's population lives in urban areas and, with current urbanization growth rates increasing, it is expected that urban dwellers will swell to 75% of the population by 2050. With such high rates of urban population growth, city managers and planners are increasingly interested in Smart City technologies as a means to more cost-effectively and equitably provide a wide range of critical resources and services to urban population.

A smart city is essentially an urban area that utilizes various technology such as sensors for data collection, which may include people, cars, buses, trains, bikes, etc. This research project entails the development of an application used to monitor and visualize the movement of vehicles in the specified areas of a given location, creating data that could potentially improve the productivity of the city. It is envisioned that the data created by tools like this can be fed into algorithms that may help cities plan public transportation routes, and help in the management of ride sharing applications, among many other applications.

AMY ENG

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Faculty Mentor: **DR. BRIAN L. STUART**
Computer Science

THE EFFECT OF PARAMETERS ON THE CYBERNETIC AUTOMATON

The Cybernetic Automaton, created by Dr. Brian L. Stuart, is an adaptive automaton that exhibits machine learning. This particular automaton demonstrates the different properties in classical conditioning such as first-order delay conditioning, extinction, and latent inhibition. These properties are based upon three parameters that control the rate at which expectation is gained and lost, the rate at which confidence is lost, and the rate at which learning occurs. The parameters are then adjusted both higher and lower from the original value. The ultimate goal of this research is to analyze the effects the parameters had on the adaptive automaton.

In this research project, a program was developed that implemented the steps of the Cybernetic Automaton to examine the different properties of learning. The machine ran with its original set of parameters along with its newly adjusted set of parameters. From there, the data of the experiment was collected and graphed. This study shows the accuracy of the adaptive automaton and how each of the parameters affected the original results.

DANIEL SCHWARTZ

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Faculty Mentor: **DR. BRIAN L. STUART**
Computer Science

EMULATING NATURAL INTELLIGENCE IN AN ADAPTIVE FINITE STATE AUTOMATON WITH PROBABILISTIC OUTPUTS

Artificial Intelligence (AI) is the theory and development of computer systems able to perform tasks that normally require human intelligence. In previous AI research, there has been little success in creating biologically plausible models that mimic naturally intelligent behavior. This research focused on understanding how learning works through decision making. The model developed was an adaptive finite state automaton with probabilistic outputs. Through a series of experiments, we determined if the model in question presented key properties psychologists have found in nature through classical and operant conditioning. The objectives of this research were to reproduce past results to corroborate the validity of the model illustrating natural intelligence and portraying a biologically accurate structure. This investigation was accomplished through simulating 100 trials of each experiment to compare the results to data observed in nature. In the end, the results were positive and showed that this model is a compelling candidate for mirroring low level natural intelligence and clearly demonstrated many properties of conditioning studied by psychologists.

NEHA KAMIREDDI

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Swathi Jagannath
Co-Mentor

SPEECH MODELING FOR AUTOMATIC ACTIVITY RECOGNITION IN TRAUMA RESUSCITATION

Trauma is the leading cause of death and disability in children and young adults. Although trauma teams follow a standardized protocol, Advanced Trauma Life Support (ATLS), errors are still observed. In trauma resuscitations, verbal communication carries invaluable information for an activity recognition system. However, two main challenges in using speech are: (1) few existing models concerning the nature of speech in a medical setting, and (2) due to frequent parallel speech, verbal communication often becomes jumbled and information gets lost.

For this project, 98 audio recordings were collected from a level 1 trauma center of an urban, pediatric teaching hospital in the U.S. mid-Atlantic region. These audio recordings were manually transcribed into spreadsheets and the speech lines were correlated to twenty-nine activities defined in the ATLS protocol. This speech was then analyzed to construct speech workflow models, or narrative schemas for all activities. These schemas will serve as the conceptual basis for speech input in an automatic activity recognition system that will be able to provide real time feedback about errors and process deviations to clinicians.

JACOB WILLIAMSON

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Information Science

Leah Kulp
Co-Mentor

DEVELOPMENT OF A TOOL FOR ORGANIZING PRE-HOSPITAL INFORMATION

Trauma resuscitations occur in a fast-paced setting where minor errors can have significant consequences. An important aspect of patient care includes a transfer of information from the Emergency Medical Services (EMS) team to the trauma team about patient injuries and en-route treatments. To ensure efficient care, team leaders use a checklist. In this project, we aim to support the pre-hospital information transfer through the use of the checklist.

We first analyzed leaders' notes in the margins of 221 paper and 115 digital checklists to inform the design of a tool for organizing the pre-hospital report. This analysis showed that leaders record seven information types: demographics, injury mechanism, injury types, symptoms, treatments, medical history, and arrival details. We then designed two prototypes and evaluated them with three team leaders. We found that leaders preferred an adaptive design with adjustable options based on previous selections. The revised prototype allows for quick data entry by selecting a set of information items that best describe the patient status upon arrival to the hospital. The next steps include developing a functional prototype and testing it before a future deployment at the hospital.

VICTORIA YOUNG

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Swathi Jagannath
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ELECTRONIC DOCUMENTATION EFFICIENCY AND ACCURACY IN MEDICAL RESUSCITATIONS

Electronic Health Records (EHR) play a key role in care continuity and decision making by keeping a record of a patient's hospital visit. Due to their time-critical nature, resuscitation settings in emergency departments have not fully adopted electronic flowsheets. This work examines temporal aspects of documentation in the electronic flowsheet at our research site and identifies delayed and missed entries, and free-text field (FTF) usage. We used video recordings of 58 resuscitations and timestamped the verbal reports from team members about activity completion. We compared the video timestamps to actual timestamps in EHRs to identify information that was recorded before verbal reports, in near real time, or in a delayed manner. We found that only 13% of the documentation occurs in near real time (within two minutes of the verbal reports). We examined the FTFs and found that most entries were recorded within the first 20 minutes of the resuscitation. FTFs were used as a key mechanism for data entry and substituted formal recording into the respective sections as activities occurred more rapidly. We next aim to recommend improvements to the current EHR design to support real-time documentation during resuscitations.

DUY HOANG

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DEVELOPING AN AUTOMATED DOCUMENT EDITING SYSTEM WITH COLLABORATIVE EDITING DATA

Imagine if there were a tool that could not only proofread writing in terms of syntax, grammar, and style, but could also review content and update it with new information. This research aims to build an automated document editing system using a dataset constructed from Wikipedia's collaborative article editing process. We're constructing this dataset by tracking differences in versions of Wikipedia articles. For each page's revision history, we compare every two consecutive revisions to identify the revised content in the new version and the deleted content in the original version.

The intended architecture for this system is based on a neural sequence-to-sequence model, consisting of two long short-term memory networks (LSTMs): one LSTM maps the input sentence to a fixed-size vector while the second maps this vector to the output sentence. We train the models on different Wikipedia content area categories. Following a performance evaluation, we will make available pre-trained and category-specific models with code for public use.

SIDDHARTH SRINIVASAN

College of Computing & Informatics
Software Engineering

Faculty Mentor: **DR. JAKE RYLAND WILLIAMS**
Information Science

IDENTIFYING VIOLENT PROTEST ACTIVITY USING DATA MINING AND MACHINE LEARNING

In this project, I am establishing a data collection stream and access system to employ a computational framework designed to understand collective action using machine learning. An original prototype system used a basic machine learning algorithm on a sample of a static database of more than 600 millions geo-tagged Tweets from around the world. However, the need for better performance and a changes to Twitter's data (exact lat-lon tweet locations are now rarely provided) require more agile ML development and data access. Ultimately, project output will likely be of interest to social scientist researchers and government officials, in addition to individuals who wish to understand the nature and aggregation of political activity occurring a fine levels of time and location.

PALASH PANDEY

College of Computing & Informatics
Data Science

Faculty Mentor: **DR. ERJIA YAN**
Information Science

ANALYZING GENDER BIAS IN PEER REVIEW USING NATURAL LANGUAGE PROCESSING

Publication and knowledge sharing are at the core of scientific communication and so the decisions made by conferences and journals are non-trivial. Publication venues have profound impact on attention and exposure a work gets and thus it is crucial that processes of publication be as unbiased as possible. There have been some studies that analyze available data quantitively to identify bias but most of these studies do not consider quality of papers themselves but rather rely on authors' attributes. These analyses can be flawed because of huge variance in quality of work that journals receive and making it difficult to generalize results as substantial evidence for bias. We are using a peer reviewed dataset of reviews and analyzing individual reviews for their sentiments. We assign sentiment scores to reviews and these scores act as normalizing factor for acceptance/rejection decisions. Our objective is to identify if more favorably reviewed papers, i.e., papers with high sentiment scores, are more likely to be accepted. Results show that overall, there is noticeable difference of sentiment for accepted and rejected papers. We find that there is no sentiment difference between accepted papers whose lead author is male and female.

RYAN LIGHT

College of Engineering
Chemical Engineering

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

CHARACTERIZATION AND FERMENTATION OF WASTE BAGASSE

Paper from non-traditional sources is becoming increasingly important to the paper market. Conventional processes of paper pulping create significant waste streams that are considered toxic to the environment. New softer paper pulping technology utilizing sugarcane bagasse results in lignocellulosic waste streams with refining potential. In this project we identify the dissolved and undissolved species via filtration, precipitation, and analytical methods such as mid-FTIR. We have identified key ingredients as unsulfonated lignin, dissolved sugars, and a species that resembles xantham gum. The relative quantities of these species are reported and compared to multiple samples provided by the industry partner. The potential of using the waste stream as a source of bio-ethanol via fermentation is also explored. We examine the viability of three different yeast strands: generic beer, generic bread, and specific Saccharomyces strands.

TRIET (TONY) TRUONG

College of Engineering
Chemical Engineering

Faculty Mentor: **DR. JASON B. BAXTER**
Chemical & Biological Engineering

ELECTROPHORETIC DEPOSITION OF CZTS NANOCRYSTALS UNDER CONTINUOUS FLOW

Copper zinc tin sulfide (CZTS) has gained remarkable traction in renewable energy research for its potential in making affordable, sustainable, and eco-friendly solar cells. To reduce wastage and create a scalable technique of coating nanocrystals (NCs) onto solar cells and other optoelectronic devices, this research explores the electrophoretic deposition (EPD) method. EPD involves the migration of charged particles within an electric field and adsorption onto a surface. This method enables NCs to deposit onto conductive fluorine-doped tin oxide glass substrates in a continuous flow microreactor. Comparing to a batch reactor, deposition under flow is potentially more efficient and enables film thickness tunability. The deposition pattern depends on many factors: the potential difference between the electrodes, the concentration of the NCs, and the volumetric flow rate of the NCs through the microreactor. My research studies how these variables influence the EPD process to improve the reactor design and make a better model to understand the physics and chemistry behind EPD. With improved understanding, EPD could offer a low-cost manufacturing route for solar cells and other nanocrystal-based devices.

JARED WALLACE

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Chemical & Biological Engineering

SCALABLE COATING METHODS FOR PEROVSKITE SOLAR CELLS

Solar cells are a vital technology in the renewable energy field and have a range of applications. Recently, there has been a growing interest in organic metal halide perovskite photovoltaic cells due to their low cost and relative abundance. Devices have been made with power conversion efficiencies of up to 22.7%. To mass produce these devices, both doctor blading and slot die coating were explored due to their low cost and scalability. Experiments were run using a doctor blading method to coat fluorine-doped tin oxide glass substrates with $CH_3NH_3SnI_3$ nanocrystal precursor ink. Manual tests were run in an inert atmosphere using a rail system to move a blade coater across a substrate covered in ink. After achieving relatively uniform films, an automated process was made to obtain reproducible results. This required programmable syringe pumps to move the substrate at an exact speed and ink to be dispersed at a given flow rate using a 3D-printed slot die. Fixing the speed of the substrate and the flow rate of the precursor ensures a controlled thickness of the film by preventing human error. Automating the process will help uncover relationships between processing parameters and enable the production of more efficient devices.

JESSE EFYMOW

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Chemical & Biological Engineering

PURIFICATION OF FREE FATTY ACIDS FROM WASTEWATER RESIDUAL GREASES

Brown grease is a low-value, dirty form of lipids that are extracted from wastewater systems. Prior research at Drexel has demonstrated conversion of brown grease into crude biodiesel and has identified removal of sulfur-containing contaminants as a critical hurdle to meeting biodiesel fuel specifications. This project explores extraction and purification of Free Fatty Acids (FFA) from brown grease prior to conversion to biodiesel. Saponification and acidulation reaction of brown grease with filtration and hexane extraction enables converting triglycerides to FFA, removing insoluble impurities, removing unsaponifiable impurities, and maximizing the yield of FFA. The FFA produced is lighter in color, solidifies at a higher temperature and has less than half the sulfur content of brown grease. Further purification of FFA to remove color bodies and reduce sulfur content was evaluated using hydrophobic filters, Nano-Filtration, absorption, and Raney Nickel reactions. Purification of FFA provides potential commercial flexibility because it can enter the chemical market or be easily converted into biodiesel or renewable diesel.

NAOMI NAKAJIMA

LeBow College of Business
Business and Engineering

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Chemical & Biological Engineering

EXTRACTING SUGARS FROM BAGASSE WASTE FOR BIOFUEL AND BIOPRODUCT PRODUCTION

Sugar cane refining produces a biomass by-product called bagasse that can be used as a fuel for powering the electrical utilities but is often underutilized. The Sugar Cane Growers Cooperative of Florida (SCGC) uses bagasse to produce consumer products and produces a bagasse residue wastewater stream that is still rich in dissolved sugars and lignocellulosic material. The bagasse residue is being evaluated at Drexel for recycling into fuels and chemicals. Analysis of the composition is challenging because the residue contains both monomeric sugars and polysaccharides in addition to lignin, salts, and other impurities. This project quantifies the composition of the bagasse residue and analyzes methods for extraction of useful components. This poster presents several techniques for evaluating sugar composition including gas chromatography, high-performance liquid chromatography, acid precipitation, and the phenol sulfuric acid method.

DARIUS OLEGA

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Computer Engineering

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Chemical & Biological Engineering

REMOTE-CONTROLLED STUNT KITES: AIR MONITORS OF THE FUTURE

Monitoring the concentration of environmental pollutants is critical for effective decision-making about how to improve air quality. Airborne devices, such as drones and weather balloons have been used to monitor air quality, but are hindered by battery life, regulations, mobility, and other factors. This poster presents initial research into Kite-Based Environmental Monitoring and Mapping Systems (KEMMS) with a remote-controlled stunt kite that can travel in three dimensions powered by wind to monitor air quality. Because it is mainly wind-powered and tethered, it requires less energy to remain airborne, is subject to fewer restrictions, and can cover a wide area for data collection using an attached sensor system. Several types of sensors were used with a data logger to monitor tension in the kite tether line, air quality metrics, wind speed, and atmospheric conditions. Several prototype flight control systems were constructed to evaluate capabilities of different motor types, control configurations, mounting structures, and pilot interface. Field testing with single-line kites and multi-line stunt kites was conducted to evaluate overall system performance.

UMA PATEL

College of Arts & Sciences
Chemistry

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Ian G. McKendry
Co-Mentor

CONVERTING FILMS OF ELECTROPHORESIS TO QUANTIFIED DATA

As the world's population continues to grow, the demand for cheap and efficient sustainable energy is monumental. Nanocrystal thin films have shown great promise for low-cost and scalable photovoltaics (i.e. solar cells). Photovoltaic devices create an electric current in a material upon the exposure to light. These thin films previously relied on inefficient spin coating and dip coating. Research has shown that electrophoretic deposition (EPD) is a low-waste, low-cost, high throughput solution to fabricating photovoltaics. EPD uses an electric field to deposit charged particles on an electrically conductive surface.

My research required knowledge in both chemistry and computer science to develop a Python application that converts a video of an EPD experiment into graphed quantitative data on the deposition kinetics. Automating this process allows researchers to obtain valuable data necessary to better understand the efficiency and kinetics of the deposition process. Graphical data illustrates how the spatial uniformity of the film develops over time. Utilizing computer science in a lab adds an additional layer of knowledge about chemical processes that would otherwise have been manually produced, saving both time and resources.

PETER PEECHATT

College of Engineering
Chemical Engineering

Faculty Mentor: **DR. AARON FAFARMAN**
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Subham Dastidar
Co-Mentor

INVESTIGATING THE PROPERTIES OF SINGLE PEROVSKITE CRYSTALS TO OPTIMIZE THE STABILITY OF SOLAR CELLS

Solar cells offer one method to provide renewable energy. Perovskites are semiconductors that are currently being researched as an efficient solar cell material. When implementing perovskites in solar cells it is important to consider their instability. For example, Formadinium Lead Iodide $FAPbI_3$) is a perovskite with a stable functional black phase that is obtained at a high temperature, however when cooled, it destabilizes forming a non-functional unstable yellow phase. The objective of the experiment is to formulate single crystal perovskite alloys to determine the most structurally stable composition. Optimal conditions to synthesize perovskite single crystals were determined and the resulting product employed to perform stability tests on a uniformly composed sample. Thermo Gravimetric Analysis (TGA) and Differential Scanning Calorimetry (DSC) will be conducted to observe the phase change energetics of $FAPbI_3$ and the alloy FA Cesium Methylammonium Lead Bromide Iodide $(FA/MA/Cs)Pb(Br/I)_3$. It was hypothesized that unlike $FAPb_{I3}$, the $(FA/MA/Cs)Pb(Br/I)_3$ perovskite sample would not destabilize from the black phase to the yellow phase after being cooled down and therefore it would function with more stability in a solar cell.

RAJ PATEL

College of Engineering
Chemical Engineering

Faculty Mentor: **DR. MAUREEN H. TANG**
Chemical & Biological Engineering

AN EXPLORATION INTO LI-ZN HYBRID AQUEOUS BATTERIES

With the growing demand for renewable energies, efficient storage for the such energy must be addressed. One promising technology for stationary energy storage is that of hybrid aqueous ion batteries. A hybrid cell takes advantage of a different intercalating ion on each electrode instead of traditional batteries which tend to have the same ion intercalate between electrodes. Not only do these hybrid cells have high energy densities, but due to their aqueous nature, they also tend to be cheap and safe due to the lack of toxic organics. This project specifically explores the intercalation of multivalent zinc ions and monovalent lithium ions. This project explores the impacts of different cathodic materials, such as Lithium Nickel Manganese Cobalt Oxide and Lithium Iron Phosphate, and electrolytes, such as Lithium/Zinc Chloride and Lithium/Zinc Nitrate, on the effectiveness of the cell. This project involved optimizing, designing, and fabricating every component of the cell. Some preliminary results show that the system tends to be dependent on avoiding side reactions, such as the reduction of zinc or the reduction of nitrate, and as such future research will be focused on minimizing most side reactions in the system.

OLUDAMILARE YINKA-ADEWALE

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Civil Engineering

Faculty Mentor: **DR. AGHAYERE ABIEYUWA**
Civil, Architectural, & Environmental Engineering

ANALYSIS OF THE VARYING COMPLEXITY IN LATERAL WIND LOAD CALCULATION UNDER DIFFERENT UNITED STATES CODES AND STANDARDS

With a focus on optimization, many structural engineers have pondered the question: what is the necessity, if any, behind the increased complexity in lateral wind load calculations observed in newer building codes and standards? This research aims to answer that question.

The lateral wind loads on four sample buildings were calculated using the NYS 2001 code, ASCE 7-2010 load standard, and ASCE 7-2016 load standard. The sample buildings included a 3-story building, a 7-story building, a 10-story building, and a 15-story building, each with a 10 ft. floor-to-floor height and measuring 100 ft. x 100 ft. in plan. Overturning moment and base shears were then calculated with each code and for each sample building for increased comparison. The moments and base shears obtained using the three codes remained comparable for all heights up to 100 ft. Larger discrepancies in the moments and base shears calculated using the ASCE standards and the NYS code became evident as the building height increased beyond 100 ft., suggesting that for taller buildings, there is some validity to the complexity found in the newer codes. However, the increased complexity in the newer codes appear to be unwarranted for low to moderate height buildings.

JACOB ROGERS

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Ziwen Yu
Co-Mentor

THE IMPACT OF GREEN ROOFS ON THE HYDROLOGICAL RESPONSE OF URBAN ROOFTOPS

Because they are impervious, conventional urban roof generate large quantities of stormwater runoff. This runoff enters combined sewer systems and can cause flooding of streets, sewer overflows, and in turn, pollution of surface water bodies. Green roofs are one approach to mitigating these effects, by detaining and evapotranspiring incident precipitation before it flows offsite. This research focuses on a 70m² section of rooftop on the St. Mary's Recreation Center in Bronx, New York. Its cross section includes a layer of vegetation positioned on top of a growing medium, a water retention layer, and a root barrier. To calculate the effectiveness of this potential solution, a special flume was installed in the drainage system. This flume records depth of runoff flowing through it, and can be converted total runoff through a series of empirically derived equations. By comparing discharge to rainfall, the performance of this green roof was computed. After in depth analysis, the results of this project turned out extremely promising, with each rain event having 20-100% runoff reduction, and a total of 25% decrease in runoff. The long term goal of this research is to show the effects of greenroofs, and encourage others to utilize them.

KIERAN VAN SANT

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Faculty Mentor: **DR. FRANCO MONTALTO**
Civil, Architectural, & Environmental Engineering

Karly Soldner
Co-Mentor

MONITORING PHILADELPHIA'S RAIN GARDENS TO IMPROVE WATERING SCHEDULE EFFICIENCY

To manage its urban stormwater, the city of Philadelphia implemented the "Green City, Clean Waters" project in 2011. The city will invest more than 1 billion dollars to construct distributed green stormwater infrastructure (GSI) systems. Rain gardens are one form of engineered GSI where cultivated plants absorb stormwater runoff and prevent pollutants from reaching waterways. The city currently waters the gardens if there have been four dry days even if the forecast for the fifth day calls for rain. Due to the high cost of just a single watering and the increasing number of gardens, the city's current watering policy will not remain feasible.

The main aspect of this project was to custom-make and install sensors in various rain gardens around the city so as to inform irrigation with field monitoring. Multiple soil moisture sensors were planted in each garden: one in the trough and one at the top. Together with weather and soil infiltration data, the aim is to create a data-driven watering schedule based on climatic activity. The first step is to analyze the wetting and drying rates of the different garden soils. The sensors could help improve the efficiency of green infrastructure irrigation activities in Philadelphia and beyond.

BETHEL XU

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Civil Engineering

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Civil, Architectural, & Environmental Engineering

Ziwen Yu
Co-Mentor

COOLING EFFECT OF IRRIGATION ON GREEN ROOFS

Urban impervious surfaces inhibit the infiltration of precipitation, causing stormwater runoff, carrying pollutants into urban water bodies. These surfaces also store incident solar radiation, forming urban heat islands. Green infrastructure such as green roofs are believed to be a natural, effective, and economical strategy for reducing water pollution, while also mitigating the urban heat island effect. The goal of this research was to investigate the environmental performance of the Jacob K. Javits Convention Center, the second most extensive green roof in the United States (6.75 acres), specifically whether green roofs with greater soil moisture have significantly cooler surfaces due to a larger fraction of incident precipitation used for evapotranspiration. Evapotranspiration rates and thermal gradients were measured using thermal imaging and three weighing lysimeters positioned in roof bays subjected varying irrigation frequencies. Initial results showed that increasing the irrigation frequency accelerates the evapotranspiration rates, reducing residual energy flux, and lowering surface temperatures of the green roof.

DANIEL BOLTON

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Architectural Engineering

Faculty Mentor: **DR. SEYED NARIMAN MOSTAFAVI**
Civil, Architectural, & Environmental Engineering

URBAN INFLUENCES ON ENERGY USE

Energy is an important resource and a major expense for businesses and private residences across the country. Understanding how we use our energy is key when making decisions to protect our environment and manage our resources. This study examines site energy use in individual buildings across nine major U.S. cities- Atlanta, Austin, Boston, Chicago, Minneapolis, New York, Philadelphia, Seattle, and Washington DC. The energy use intensity (EUI) data has been collected from energy benchmarking programs in these nine cities. The relationship between energy use and building/urban characteristics including floor area, building age, urban population density at the block level, neighborhood affluence, and regional climate factors is explored. Building, climate, and population data are collected from the United States Census Bureau, Zillow Data, a national weather database, and individual government offices in each city. The influence of these factors on building energy use are analyzed using multivariate regression. The results of this project can be used by government agencies and private corporations to inform energy policy making.

SIMA NOORANI

College of Engineering
Electrical Engineering

Faculty Mentor: **DR. ANDREW R. COHEN**
Electrical & Computer Engineering

CNN BASED CLASSIFICATION OF MITOTIC PARENT STEM CELLS IN TIME-LAPSE MICROSCOPY

Time-lapse microscopy of living cells is a fundamental tool for studying human disease and development. Microscopes capture high spatiotemporal resolution images showing the dynamic behaviors of clones (family trees) of stem and cancer cells. Making sense of these images requires computer algorithms to process the data, extracting metrics of cell behaviors. One key cellular behavior that impacts all other studies is mitosis. A new model-based classifier has been developed for identifying mitotic events in live cell microscopy movies. The model-based classifier uses segmentation and tracking results to identify mitotic events with an accuracy of 78%. During the summer STAR research, a new deep learning Convolutional Neural Network (CNN) was developed to classify the distinctive pattern that the cell nuclei exhibits pre-mitosis. This new classifier was able to achieve 95% accuracy at identifying the distinctive pattern associated with mitotic parent cells. The next step will be to combine the model-based and CNN classifiers, improving the accuracy and robustness. This fall the work will be submitted to the IEEE International Symposium on Biomedical Imaging conference.

TRI LE

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Computer Science

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Electrical & Computer Engineering

Logan Henderson
Co-Mentor

RADIO WARS AUGMENTED REALITY

We are surrounded by waves: sound waves, light waves, radio waves, etc. Some of these waves e.g. light waves, are visible, while some are not. As a result, it can sometimes be difficult to learn more about wave properties, especially of those that cannot be seen or interacted with. There has been increasing demand in education technology for new ways to visualize unseen information.

This project aim to display radio waves, normally not visible to the human eye, using the latest Augmented Reality Kit framework on iOS. This will tremendously help those who want to learn more about radio waves, especially in the education field.

The current design of the project contains two parts. The first part is to collect data from the radios sending packets to each other and save the real-time data. The current data is being saved on a MongoDB database, contained in a Docker service. The second part is to visualize the data in an Augmented Reality environment on devices with iOS, with the use of Apple ARKit 2.0.

GISELLE C. MATLIS

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

Faculty Mentor: **DR. KAPIL DANDEKAR**
Electrical & Computer Engineering

Dr. William Mongan, Austin Gentry, Chelsea Knittel
Co-Mentors

USING SMART FABRICS AND 3D PRINTING TO IMPROVE DVT TREATMENT DEVICES

Deep Vein Thrombosis (DVT) occurs when a large blood clot forms in the deep veins of a person's limbs. This can be fatal if a clot breaks off and lodges in the lungs, leading to a pulmonary embolism and cardiac arrest. DVT can occur as a complication from surgery or after long periods of immobility. This condition is common in pregnant women and the elderly, although there is a genetic risk factor.

Current treatment involves application of pressure to the affected area through compression socks or intermittent pneumatic compression (IPC) devices. IPC devices massage the leg to increase blood flow to the heart to prevent clots. Although IPC devices can be helpful in preventing clots, they are bulky, uncomfortable and require a doctor's visit. They are often deployed while immobile.

The intent of this project is to use smart fabrics and 3D printing to develop a sleeker, more portable and user-friendly device as compared to DVT devices currently on the market. The particular focus of this research is to design a more appealing housing unit for the circuitry, increase the number of actuators, and test multiple smart fabric yarns against shape memory alloys with a series of custom designed test rigs using 3D printing.

FINN P CLEMENTS

College of Engineering
Electrical Engineering

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Electrical & Computer Engineering

Richard Vallett
Co-Mentor

RECREATING HUBO'S INTERFACE

Programming robots can be challenging. For example, robots have many individual systems that must come together to create even a simple motion. If these systems are not perfectly aligned, the robot won't be able to work properly. Even systems specifically designed for robotics programming include many small, "low level" , commands such as motor movements, velocities or motion timing. The robot my research has been focused around is HUBO, a humanoid robot created and advanced at the Korea Advanced Institute of Science and Technology (KAIST). He operates solely on low level commands which is extremely tedious to program. My solution to this problem was to create a new syntax that operates using higher level commands. These commands combine multiple low level operations to create a behavior such as, an arm movement or kicking his leg. Using these commands enables us to avoid worrying about low level command to focus on the overall movement. This new code is much more approachable and inclusive to all generations and backgrounds. This system makes it much easier to create new movements and dances, which has helped to inspire children in the ExCITe summer programs, Young Dragons and the Summer Music Technology Camp.

EKENE D. ILLOH

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Faculty Mentor: **DR. YOUNGMOO KIM**
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Dr. Brandon Morton, Dr. Andy Stutzman
Co-Mentors

WEB DESIGN WITH WORDPRESS AND CSS

Small businesses in local areas often find it difficult to grow their business on a digital platform. The Drexel ExCITe Center participates in a program called the Community Business Collaborative (CBC) whose mission is to help such local businesses create a digital presence for their brands through the use of websites, mobile apps, etc. One of the tools used to achieve this goal is WordPress – a free, online web-design platform. This summer my role in this program was to create a set of tutorials for WordPress that would help students looking to participate in the CBC learn how to use the WordPress platform to create posts, pages and sites. I created sets of tutorials known as digital playlists which users complete to earn digital badges, which are badges received online that show the credentials for completing a task. The playlists were structured such that after completion, a user would be familiar with most of the services WordPress has to offer. The tutorials will be published on the 'LRNG: Philly' website – a free website where teens 13 and older visit to learn new skills and discover new opportunities. I also carried out research on CSS, a coding language that can control the layout of webpages. I learned how to use CSS to further improve the design of websites made with WordPress, providing more professional layouts for the webpages.

TRISTAN MARSHALL

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Richard Vallett
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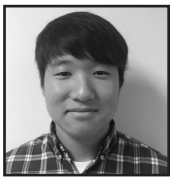
HUMANOID ROBOTICS SIMULATION

One of the issues facing the creation and programming of robots is approachability. Even the simplest projects, like moving one motor, can be challenging to the beginner. That project only involves one degree of freedom, meaning the robot can only move in one axis. The problem of complexity is multiplied in humanoid robots, such as the ExCITe Center's HUBO, which can have dozens of degrees of freedom. HUBO is a sophisticated, world-class robot that stands about four feet tall and has 41 degrees of freedom. Thus, simulators are often used for movement planning and visualization. Simulations, virtual robots in this case, are used to determine if a program is possible and safe to run on the robot. Accuracy is important to prevent expensive damage. The current simulator was created in 2008 and lacks important physics features for real-world suitability. To remedy this, I am developing a new simulator in Unity, a platform used for creating video games that involves features such as realistic physics, including gravity, collisions, and friction. Another purpose for the simulator is to provide people with access to a realistic virtual humanoid robot. As multi-platform software, Unity allows this simulator to run on most computers.

RYAN WON

College of Engineering
Electrical Engineering



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

Dr. Brandon Morton
Co-Mentor

INNOVATIVE WEB APPLICATION FOR AN EASIER PARDON PROCESS

With the wealth of background information that is available publicly, possessing any criminal record offers a major disadvantage to job or loan applicants. This disadvantage exists even if the record only consists of a low degree misdemeanor that occurred decades ago. While it is possible to receive a pardon, the lengthy and complicated process often dissuades eligible people from applying for one. The Philadelphia Lawyers for Social Equity (PLSE), a non-profit legal aid group that advocates for low-income individuals in the Pennsylvania criminal justice system, has partnered with Drexel's ExCITe Center to create a web application to shorten and simplify the pardon application process. In this project, I designed an interactive walkthrough of the form to reduce the tediousness of filling out information. The walkthrough features an achievements system to encourage and reward in-depth answers to questions. In addition, I structured the website to break up the information into easily digestible chunks to enhance readability. Although it remains in the early developmental stages, the web application continues to focus on assisting local low-income Philadelphians of all educational backgrounds to get the pardons they require.

JACOB D. WONG

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

Jeff Gregorio
Co-Mentor

ACTUATED VIBRAPHONE

Significant advances have come to digital devices within the past two decades through their user-interfaces, more specifically as low barrier to entry touch devices. Most digital devices are not expressive or interesting when viewing a presentation of their interfaces and are not fully showing the interface capabilities. Alternatively, instruments are highly expressive with a high barrier to entry. My research was in actuated instruments or the ability to control instruments through a custom user-interface. By actuating them, their user-interface (normal play) can be made easier and more user-friendly. This specific project used a series of microcontrollers to recognize musical data from a computer and then play specific notes on a vibraphone. I researched the fragility of the electrical system and how to stop the power supply from destroying the microcontrollers. Since the system is as compact as possible, it is also fragile especially when transferring a lot of electricity. I decided to use opto-isolators which use light to separate the different parts of the system to stop damage from occurring to the microcontrollers. The vibraphone is meant to engage professional and general audiences in musical/technical concepts.

RHEA DUTTA

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Faculty Mentor: **DR. BARIS TASKIN**
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Ragh Kuttappa
Co-Mentor

AUTOMATIC LAYOUT GENERATION FOR CUSTOM CELLS

Modern microprocessors are designed using complementary metal oxide semiconductor (CMOS) logic to design transistor level circuits. Technology scaling and energy efficiency of modern processors require novel techniques to address the growing needs of the semiconductor industry. CMOS logic involves a standard pull-up and pull-down system where energy is often dissipated between high and low transitions. Most recently, charge recovery logic (CRL) has been recognized as a way to recycle power dissipated to power up the designs. CRL can reduce power dissipated by a logic block to improve power efficiency and save on area. CRL employs sinusoidal power-clock signals that require less power for operation. CRL designs require full custom design motivating the need for design automation. In this research project, a methodology to automate the layout design for CRL and CMOS gates is presented. This methodology can be scaled to any technology node and bring down the design time of the layout. On an average the time to design the layout is reduced by 60%. The CRL gates operate at the same frequency of the standard CMOS gates while consuming 40% less power on an average.

KATHRINA WAUGH

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Ragh Kuttappa
Co-Mentor

EXPLOITING ENERGY EFFICIENCY VIA CHARGE RECOVERY LOGIC

A plethora of electronic systems are powered by batteries and reducing the power consumption is beneficial to increasing battery life. Low power VLSI design has become the core focus of circuit design to reduce power consumption. However, as researchers attempt to lower power dissipation, there is an evident risk that lower power dissipation limits the overall performance. Subsequently, power and energy consumption, with speed, are now the most critical design parameters for electronic systems design. Most recently, charge recovery logic (CRL), has gained interest for low power applications that demonstrates high energy-efficiency via energy recycling compared to that of CMOS while operating at high speeds in the GHz ranges. To do this, CRL employs a sinusoidal signal that provides both energy and timing for the logic gates. Statistically, there are significant power savings of 82% between a CRL inverter and a CMOS inverter: A CRL inverter consumes 215μW whereas a CMOS inverter consumes 1178μW. This project explores the design automation of the circuit layout, for both CMOS and CRL circuits while addressing the future needs of design scalability and diminishing transistor sizes.

YU-CHIEH (JAMIE) WU

College of Engineering
Engineering Technology

Faculty Mentor: **DR. RICHARD CHIOU**
Engineering Technology

BUILDING A ROBOTIC 3D SCANNER AND SORTATION SYSTEM

Robots are often used to automate dangerous and/or repetitive tasks in manufacturing industries. These systems usually deal with mass production and need to pick and place products to different locations for further processing and shipping. Such labour intensive tasks can be manual, semi-automated or fully automated. This research seeks to understand and build a fully automated environment integrated with a 3D scanner system on a small scale. A product would first be picked up by a 6-axis robotic arm and placed onto a rotating table. A sensor would then scan the product and translate its analog output data for 3D plotting purposes. In this case, an infrared sensor is preferred to an ultrasonic or LIDAR sensor as the infrared sensor yields the most accurate readings for short distances. The devices are controlled by Arduino and the data collected will generate a 3D point-cloud plot using MATLAB. A fully automated, 3D scanner system will significantly reduce labour costs, increase efficiency and accuracy, and maximize the utilization of space in a factory.

ABHIGYAN KHULLAR

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Electrical Engineering

Faculty Mentor: **DR. YURY GOGOTSI**
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Dr. Xuehang Wang
Co-Mentor

ENHANCING PERFORMANCE OF MXENE SUPERCAPACITORS IN HIGHLY SATURATED NEUTRAL AQUEOUS ELECTROLYTES

The world needs portable devices that can store more electrical energy with fast charging rate. Higher charging speed allow electrochemical energy storage (EES) device to be fully charged in minutes while high energy storage capability extends battery life. A Supercapacitor is an EES device known for their, high power output and safety, but it has a low energy density compared to a battery. Recently, a two-dimensional nanomaterial, known as MXene has shown a high volumetric capacitance and high rate capability due to its highly conductive and layered structure. Currently MXene supercapacitors have limited storing capability as it uses corrosive electrolytes. Our research aimed to substitute the corrosive electrolytes with saturated neutral aqueous electrolytes. Effectively reducing corrosion to the device, improve its safety and extending the voltage window, allowing for more energy storage. We used electrochemical tests, to test the performance of electrolytes, such as Lithium TFSI and Lithium acetate. A larger voltage window was observed using the saturated LiTFSI compared to diluted aqueous electrolyte, however, the results also indicated a salt dependent change in voltage window.

CHRISTINA STROBEL

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Simge Uzun
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DEVELOPING CONDUCTIVE MXENE YARNS FOR SMART TEXTILE APPLICATIONS

Research exploring conductive yarns can push the future of seamless wearable technology. These yarns allow for various applications, including energy harvesting and storage and electromagnetic interference shielding. Here, the yarns are made using a highly conductive nanomaterial, Ti3C2 MXene. The desirable properties of MXenes for smart textile applications are high conductivity, electrochemical activity and chemical stability.

To produce conductive yarns, low-cost, natural yarns including fine and coarse cotton, bamboo, and linen were dip-coated in a Ti3C2 MXene dispersion. The concentration and flake size distribution were tailored to ensure uniform coating around the individual fibers and yarn. A mass loading of 2 mg/cm was achieved without MXene flaking, and the resistance of the yarns was 5-10 Ω/cm with a conductivity of 250 S/cm. This is within the upper range of conductivity for commercially available conductive yarns. The yarns were knitted by industry size digital knitting machines. Of the four types of yarns knitted, fine cotton and bamboo produced better knitted samples due to their flexibility. The scalability of this method allows conductive yarns to be cost-effectively produced and knitted on a large scale.

SIMON KASCHOCK-MARENDA

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Mechanical Engineering

Faculty Mentor: **DR. LESLIE LAMBERSON**
Materials Science & Engineering

Stelios Koumlis
Co-Mentor

RELAXATION IN MILITARY FOAMS

In the military world, soldiers must avoid injury, both in their training and via the uniform and gear they don. One of the most important areas to protect is the head, susceptible to injury from direct impact, falls or blasts, as well as potential concussions that may result after a trauma. This research focuses on characterizing and optimizing soft open cell polyurethane foams used in current military helmets in order to maximize protection and comfort. This work is performed in collaboration with Team Wendy, a company that supplies helmets to the United States Army and Marine Corps. The foams were examined in compression on a universal load frame in displacement control at varying loading rates and dwell times. Due to their complex nonlinear behavior and heterogeneous microstructure, the amount of force required for the foam to reach equilibrium changes over time, and this data was used determine the different relaxation times upon unloading under various conditions. The findings were analyzed and plotted, and a viscoelastic spring-dashpot model was created to analytically describe their resistance to motion. These results provide insight on how the architecture and composition of protective foams effects performance, which contribute critical information to their optimization for military applications.

ADITI BAWA

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

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

Tony Yu
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3T3 FIBROBLAST CELLULAR RESPONSE ON ANNEALED AND NON-ANNEALED 3D PRINTED PEEK SPINAL LUMBAR FUSION CAGES

As over 480,000 spinal fusion surgeries are performed each year and the need for implant materials in the biomedical field grows, poly-ether-ether-ketone (PEEK) has proven to be a bioactive material showing potential in the orthopedic area, particularly with spinal fusion cages. Originally used in the aerospace/aviation industries, the semi crystalline polymer with high thermal flexibility is advancing to be used in the biomedical area. Despite this increase in health applications, knowledge about properties of cell adhesion onto PEEK materials is restricted. Previous research indicates that heat treatment increases crystallinity. Therefore, the purpose of this study was to begin the process of seeding fibroblast cells on annealed and non-annealed 3D printed PEEK spinal cages to test cell adhesion because of increased crystallinity. 24 samples of each group were characterized and seeded with 2 groups of 12 annealed and non-annealed cages, each split into textured and smooth surfaces. A live/dead cell assay was performed, and morphology was examined under SEM. This cell study provides the basis for further surface analysis conducted by a collaborative effort between the Drexel Implant Research Center and the Biomaterials Lab Group.

DANIEL THOMPSON

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Materials Science & Engineering

Dr. Katsiaryna Prudnikova
Co-Mentor

MOLECULAR INTERACTIONS BETWEEN BPGS AND MATRIX MOLECULES

Proteoglycans (PG) are biomacromolecules that are found in all tissue throughout the body. They help with hydrating tissue as well as keeping the structural integrity. Over time, the properties of the tissue are compromised due to enzymatic degradation of the PGs. This results in diseases such as osteoarthritis. To counter this, a process has been made to synthesize biomimetic proteoglycans (BPGs). The BPGs are made up of a synthetic poly(acrylic acid) backbone and natural chondroitin sulfate bristles to create a 3D bottlebrush architecture. The BPGs have been shown to diffuse into rabbit articular cartilage in vivo after an intra-articular injection and localize in the PCM.

In this study, we explore the mechanical interactions between BPGs and the tissue matrix molecules using atomic force microscopy (AFM). Firstly, BPGs will be functionalized at different primary amine:BPG ratios for AFM analysis. Secondly, affinity of BPGs to major matrix molecules will be explored by quantifying the adhesion force and energy between the BPGs and natural molecules.

As a result, we will first develop a working protocol for BPGs functionalization. Then, we will get an insight into BPG affinity, localization in PCM and effect on PCM biomechanics.

WILLIAM KRAFT

College of Arts & Sciences
Physics

Faculty Mentor: **DR. STEVEN MAY**
Materials Science & Engineering

Yizhou Yang
Graduate Student

FLUORINATION OF $CA_2FE_2O_5$ THIN FILMS

Atomic substitutions are one of the central strategies for tuning material properties. Oxyfluorides, in which some oxygen anions are replaced by fluorine anions, can exhibit different optical, magnetic, and structural properties than those of oxides. However, to fully utilize anion substitutions in these materials, fundamental studies are needed to understand how to control the amount of fluorine that substitutes for oxygen. In this work, $Ca_2Fe_2O_5$ thin films with the brownmillerite crystal structure were grown on different substrates via molecular beam epitaxy and fluorinated using a vapor transport process which employs argon gas and fluoropolymer pellets as the fluorine source. Depending on the substrate on which the films were deposited, those vacancies were oriented either parallel or perpendicular to the substrate. By fluorinating an oxygen-deficient brownmillerite with a controlled vacancy ordering, one might be able to insert different amounts of fluorine depending on the vacancy ordering direction of the film. X-ray photoelectron spectroscopy was used to determine the fluorine content of each of the films, revealing the relationship between the orientation of the vacancies and the fluorine concentration.

ENGY KHOSHIT

College of Engineering
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Faculty Mentor: **DR. CAROLINE SCHAUER**
Materials Science & Engineering

Dr. Reva Street
Co-Mentor

HEAVY METAL FILTRATION VIA ELECTROSPUN NATURAL POLYMERS

Lack of safe drinking water has continued to be one of the biggest humanitarian issues over the past few decades as the CDC estimates that almost a billion people do not have access to a safe water source. To prevent further depletion of the earth's resources, natural polymers such as keratin, chitosan, pectin, gelatin, and alginate can be used for filtering heavy metal contaminants such as hexavalent chromium, arsenic, and lead. Creating nanofiber meshes via electrospinning would allow for adequate filtration testing as well as allow for larger scale fiber collection via touchspinning or other apparatuses. Since keratin has not yet been successfully electrospun on its own, utilizing the four other natural polymers would allow fibers to be electrospun in different ratios to analyze the differences on a nanoscale and expand it to a larger, more viable system.

DENG A.D KUOL

College of Arts & Sciences
Physics

Faculty Mentor: **DR. JONATHAN E. SPANIER**
Materials Science & Engineering

Dr. Radhe Agarwal, Liyan Wu, Andrew Benett-Jackson
Co-Mentors

THE CHARACTERIZATION OF DOPED PEROVSKITES FOR PHOTOVOLTAIC APPLICATION

The bulk photovoltaic effect (BPVE) is a light to energy conversion mechanism, which occurs in crystal structures which lack a center of symmetry[1]. This allows the entire material to be both a light absorber and photon-induced electron-hole pair separator[2], unlike conventional photovoltaic (PV) devices which operate by a pn junction or interface. Furthermore, the BPVE, which can be found in ferroelectric oxides is reported to produce open-circuit voltages much larger than the band gap of the given material[3], but prohibitively low photocurrents[1]. This class of materials has exciting prospects for the next generation of PV devices due to their lack of need for a pn junction, use of earth abundant-element and nontoxic materials, and high photo voltages. As such this work aims to increase the light absorption of wide bandgap ferroelectric oxides via bandgap engineering[4], where a dopant is introduced into the material structure. Thus, altering the electronic and optical properties. Pulsed laser deposition was used to grow a series of thin films from a doped perovskite oxide target. The films were characterized using X-ray diffraction techniques, UV-visible light transmission, and ferroelectric hysteresis.

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DAVID HARUCH

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INVESTIGATING THE EFFECTS TWO POTENTIAL ANTI TUMOR DRUGS ON ANGIOGENESIS

Angiogenesis, the formation of new blood vessels from existing blood vessels, is important to tumor growth and metastasis . Endothelial cells, which line the inner walls of blood vessels, direct angiogenesis and are therefore a target for many chemotherapy drugs. We hypothesized that endothelial cell tube formation, an in vitro angiogenesis assay, would be changed by several inhibitors of metabolic activity and cell adhesion. To test this hypothesis, human umbilical vein endothelial cells were sparsely seeded onto Matrigel in serum-free media. The selected treatment was then added to the cells, and cells were imaged by phase contrast microscopy after 24 and 48 hours. Tube formation was quantified in the images by measuring the number and length of the tubes using ImageJ processing software. Multiple assays were performed and showed that none of the peptides affected endothelial tube formation. Since at least one of the peptides has been shown to decrease angiogenesis in other assays, future work will investigate the peptides' effects using a different in vitro angiogenesis assay, such as an aortic ring assay.

ZEAL JINWALA

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Mechanical Engineering & Mechanics

Dr. Swathi Swaminathan
Co-Mentor

INVESTIGATING THE EFFECTS OF TWO METABOLIC INHIBITORS ON ANGIOGENESIS

Angiogenesis, the process of new blood vessel formation from existing blood vessel, is thought to be a driving factor in tumor growth. Endothelial cells, which line the interior surface of blood vessels, play a leading role in angiogenesis through migration, and proliferation. Recent studies have shown that endothelial cell metabolic activity is essential to angiogenesis. We decided to test two metabolic inhibitors, namely 3PO and OGTi, in an endothelial tube formation assay to determine their effects on angiogenesis. 3PO is known to inhibit glycolytic activity, and OGTi decreases the protein O-GlcNAcylation through the hexosamine biosynthetic pathway. Endothelial cells were seeded on Matrigel coated 8-chambered cassettes in basal media. After five hours, the cassettes were treated with the peptides in varying concentrations and two wells were set as controls. Endothelial network formation was imaged after 24 and 48 hours using a phase contrast microscope and was quantified using the Angiogenesis Analyzer plugin in ImageJ software. The results we obtained did not show any significant change in endothelial tube formation with the inhibitors. In the future, we will try the same inhibitors in an endothelial spheroid assay to study angiogenesis in a 3-D model.

XIN YUE JOCELYN LIU

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Tobias Konow
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COMPARISON STUDY OF THE TIBIAL TRAYS OF TOTAL ANKLE REPLACEMENTS

Total Ankle Replacements (TARs) are frequently used to restore joint function and relieve pain induced by osteoarthritis or trauma. However, these devices still show unacceptably high failure rates. Common reasons are loosening or migration of the tibial tray. The goal of this study is to compare different tibial trays of TARs for primary stability and find the optimal design. Tibial trays were ranked, on a 100-points scale, with regards to implantation technique, satisfaction, follow-up results, fixation, bone ingrowth area, and kinematic behavior. The results show the Hintegra has the least tibial bone resection (6.98 cm^3) while the Agility has the most (16.6 cm^3). The Zimmer and Hintegra tied for the highest AOFAS Hindfoot Score (85 pts.) while the Agility has the lowest Hindfoot Score (76.4). The Salto has both the greatest area for bone ingrowth (27 cm^2) and the highest survival rate (95.8% five year rate). The Agility has the lowest survival rate (86% six year rate). The Hintegra has the smallest area for bone ingrowth (12.7 cm^2). The Salto was ranked highest score overall while the Agility was ranked lowest. Thus, the Salto provides the best tibial tray fixation.

DAVID HANNA

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Mechanical Engineering & Mechanics

TRANSLATION OF VECTORING THRUST ON A MOVABLE PLATFORM

Quadcopters are used more every day, and the development of new technologies are essential for the broadening market. Most quadcopters have standard yaw, pitch, and roll features which move the entire vehicle to the desired location. The vehicle itself will tilt in the direction of the movement by leaning left, right, forward, and backwards. Dr. Yousuff and his students have developed new rotor groups to place on quadcopters that would allow the vehicle to turn in any direction without a complete shift of the entire body. These rotors will give the quadcopter the ability to hover in any orientation. Before flying, a testing platform was required to safely demonstrate the outstanding capabilities of the new rotor groups. I designed and constructed a movable semi-frictionless platform that has the ability to slide in two coordinate planes. A custom-made mount for the rotor can be easily attached to the platform, and the thrust provided from the propeller will be converted into movement along both axis. This platform will be used to test each rotor individually as well as the full quadcopter. It can be used to translate movement from any type of mountable thrust machine, and will be used for years to come.

SANJOG KARKI

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Mechanical Engineering & Mechanics

COMPRESSED CO2 THRUSTER AND LOW-FRICTION PLATFORM TO STUDY THE DYNAMICS OF DOCKING IN CUBESATS

CubeSats are a class of nanosatellites originally developed in 1999 for education and space exploration. The standard CubeSat size uses 1U (one unit) measuring 10x10x10cms and typically weighs less than 1.33kg. Recent researches are focused on docking CubeSats in space to enable in-orbit assembly of larger structures like space telescopes or solar panels. Synchronizing position and attitude and maintaining relative speed are the major concerns for docking two CubeSats in space. Failure to precisely control speed, position, and attitude could result in collision of the CubeSats. This research focuses on creating an assembly to study the impact of contact between the chaser and the target CubeSats during docking maneuver. A low friction platform was crafted using laser-cut light weight wooden plank on top of lubricated ball bearings. The thruster, assembly of compressed CO2 cartridge and two electric solenoid valves, was placed atop the platform keeping the center of gravity at the center of the platform. The thrusters, controlled by an infrared remote programmed using Arduino, created thrust in two directions: forward and lateral. Using this assembly, researchers can study the dynamics of CubeSats in two-dimension.

TYLER KEOUGH

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Noah Alessi
Co-Mentor

STATION REPARATION VEHICULAR UNIT

It is a concern among the space community that astronauts are spending a great number of resources on spacewalks to complete menial tasks such as fixing loosened screws and bolts on the outside of stations. The goal of this research was to create an autonomous device that repairs the exteriors of space stations and saves astronauts time and resources. An in depth look at just how essential repair tools are in space was done, and it was found that a device like this could help save millions of dollars a year on repairs and training for astronauts. In general, the results of this project won't have much impact on life on Earth but would be a huge asset to NASA and other space programs. With a device to do some of the astronaut's work, the time that spacewalks take could be cut down substantially from the current average of five to eight hours. Though this research acted more as a proof of concept, there are numerous applications for this device if research were to be continued. The final product of this research demonstrates a fairly simple system with electromagnets to hold the device on a surface, as well as a robotic arm to repair loose screws or bolts.

MERLIN KOCHUNILATHIL

College of Arts & Sciences
Biological Sciences

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

Dr. Arun Ramakrishnan, Katrina Carroll-Haskins
Co-Mentor

VIRTUAL REALITY & ART THERAPY

Virtual reality is a form of 3D environmental simulations that has been successfully making its way into forms of therapy such as brain injury rehabilitation and pain management therapy. Conventional art therapy is confined to paper but with the availability of VR and software such as Google Tilt Brush, it is beneficial to combine virtual reality with art therapy because it offers a cleaner and more storage friendly alternative to conventional art making. The applicability, compatibility and usability of VR with the art making process will be observed due to a lack of extensive preexisting research. Participants were fitted with the HTC Vive headset and controllers and then allowed time to draw and experiment on Google Tilt Brush. Data was collected using a pre and post survey going over key aspects of the research such as usability, judgement, experience, and emotions. All the participants enjoyed the art making process in VR and were very engaged. Any difficulties were mostly centered around the controls and development of skills. Observing the art making process and user's experiences in virtual reality software such as the Google Tilt Brush offers a new world of options and techniques to this form of creative therapy.

MEGAN WALSH

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Health Sciences

Faculty Mentor: **DR. JOAN R. BLOCH**
Doctor of Nursing Practice

Yosefa Birati, MSN, M. Velma Weitz, DNP, PhD(c)
Co-Mentor

A POPULATION STUDY OF MATERNAL ASTHMA AMONG PHILADELPHIA PREGNANT WOMEN WHO RECEIVED PERINATAL NURSE HOME VISITS DUE TO DIABETES

Study Purpose: There is a critical need to delve deeper and study high-risk pregnant women in the context of the Philadelphia neighborhoods they reside. Asthma is the most common respiratory disease that complicates pregnancy and is associated with adverse pregnancy outcomes, despite this it is surprisingly understudied. Thus, the purpose of this study is to describe individual and neighborhood characteristics of the population of pregnant women who have diabetes and asthma that received home visits by nurses. Methods: Individual-level data was obtained from a research clinical database. For neighborhood-level data, a geographic information system database, Policy Map was used. Descriptive statistics were conducted for all data. Data-driven maps were created to illustrate neighborhood variation. Results: Among this medically-high risk cohort with diabetes, 6.9% (n=58) also were known to have asthma. Maps of Philadelphia revealed neighborhood variation in diabetes and asthma also aligned with patterns of neighborhoods where maternal and infant mortality is highest. Conclusions: Neighborhood tailored health care services to medically and socially high-risk pregnant women with high morbidity burden is critically needed.

KAITLIN KELLY

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Doctor of Nursing Practice

Dr. Michael S. Weingarten, Dr. Vaishali Purohit, Dr. Michael Neidrauer, Alec Lafontant
Co-Mentors

EARLY DETECTION OF DEEP TISSUE INJURY IN SURGICAL PATIENTS

The purpose of this pilot study is to establish the feasibility of using non-invasive optical measurements of blood flow as a screening tool for pressure injury (PI), more commonly known as pressure ulcer, in surgical patients. Many PIs begin as deep tissue injury (DTI) beneath the skin's surface and are not clinically apparent until it spreads through subcutaneous tissue and into the skin. However, by this time the PI may be too extensive to avoid advanced ulceration, impacting the patientâ€™s quality of life. Our long-term goal is to develop and validate a method for early detection of DTI by measuring blood flow in the dermis and subcutaneous tissue with a non-invasive optical method, diffuse correlation spectroscopy (DCS). A pilot study was recently completed in spinal cord injury patients at a rehabilitation hospital suggesting that sacral blood flow measurements, obtained using a DCS system, can predict sacral PI development. For this pilot study, we recruited 16 patients from the Surgical floors at Hahnemann Hospital and gathered data on the blood flow, clinical, nutrition and metabolic characteristics of these patients. Our next step will be to continue collecting data in surgical patients during the perioperative period.

PURVA REGE

College of Nursing & Health Professions
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Doctor of Nursing Practice

THE BENEFITS OF USING MUSIC THERAPY IN PEOPLE WITH DEMENTIA

Dementia is a degenerative, progressive disease that results in severe cognitive decline, including memory loss. The majority of people affected by dementia are elderly, and over the age of 65. Though no cure has been found for this disease, a music therapy intervention has proven to be very useful in alleviating behavioral symptoms in people with dementia (PWD). In this project, five PWD were selected from a life plan community in Souderton, PA to be part of a "Music and Memory" program. This program aims to study the effects of familiar music on the cognition and overall mental health in PWD. The participants were assessed using a questionnaire, relating to their musical interests. An individualized playlist was made and utilized for PWD when they were perceived to be anxious, upset, or withdrawn. Typically, these behaviors were observed during dinner, bath time, and before getting dressed. Observed outcomes of the intervention included increased calmness, cooperation, and communication with staff members. This research provides an important first step to change the way that PWD interact with their environment, including their family and caregivers.

J'ANNA-MARE LUE

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Faculty Mentor: **DR. SHANNON P. MARQUEZ**
Environmental & Occupational Health

Idris Robinson
Co-Mentor

WATER IN LESOTHO- THE DIFFERENCE BETWEEN AVAILABILITY AND ACCESSIBILITY

The 2015-2016 Southern African drought dramatically affected the citizens of Lesotho while the government exported water to South Africa. El Niño is a warming of the tropical Pacific Ocean's surface - causing droughts in some parts of the world and heavy rainfalls in others. During the latest El Niño-induced drought, residents of Lesotho, especially those living in rural areas, struggled with food security, illness, and loss of livelihood. This research investigated the effects of drought on water, sanitation, and hygiene (WASH) infrastructure as well as community attitudes and knowledge regarding WASH in Sekameng.

Data on water-related illnesses was collected at health centers to analyze trends from 2015 until present. Community gatherings were held to conduct group interviews to evaluate the general knowledge level regarding WASH behaviors. Water quality tests were done on the sources communities normally use and the sources used in time of drought. Water was also tested in the homes to determine if contamination occurred upon fetching.

There is a lot of water in Lesotho, but not enough water infrastructure to mitigate the effects of drought, therefore, the onus is on the community members to survive any upcoming droughts.

GABRIELLA MACERA

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **DR. SHANNON P. MARQUEZ**
Environmental & Occupational Health

A STUDY ON THE EFFECTS OF CLEAN WATER ON PHYSICAL AND MENTAL HEALTH IN MALAWI

In Malawi, life expectancy at birth is 59 years, the 14th lowest in the world, and a major contributing factor to this is lack of access to reliable water. Four million Malawians lack access to safe water, leading 30,000 citizens to die each year from illness related to unclean water. The WASH department of World Vision Malawi has taken on the initiative to provide reliable water sources across the country, already reaching over 500,000 people. This study focused on how access to clean water impacts the physical and mental health of both Malawian women that run the household and their children. Three different communities were surveyed: those without access to a borehole, those with a borehole for a year old or less, and those with one for over three years. In each community, the female heads of thirty households were asked a series of questions regarding their water sources and the occurrence of illness for them and their children. Water's impact on mental health was evaluated in women by stress levels regarding water and in children by school absences and the frequency of play time. The results of this study can lead to improvements in sustainable health outcomes.

KRISHNA VENIGALLA

Pennoni Honors College
Custom-Designed Major

Faculty Mentor: **DR. SHANNON P. MARQUEZ**
Environmental & Occupational Health

EDUCATING A CHILD TO EDUCATE THE COMMUNITY

Education can often be essential for the future of a child and their community. This study explored how the education system in rural schools in the Southern Province of Zambia can assist the students in bettering their communities. Furthermore, the research explored potential methods that can be integrated into their learning in order for them to better utilize their resources and skills such as the WASH initiatives, existing gardens and community resources. After interviewing the teachers and headmasters in some suggested schools in the Southern Province of Zambia, it was found that all schools integrated classes such as business studies and computer classes and extracurriculars such as debate.

After interviewing many students, teachers and the school's headmasters, it was established that technology would be incredibly useful in connecting students. An event was then arranged to connect the two schools in which the students could interact and discuss certain topics. This research project has established that although this method of implementation requires some training for the schools, ultimately a project like this could deem a huge benefit to the sustainability of these schools and communities for the future.

BETEL YEMANE

LeBow College of Business
Business Analytics

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Environmental & Occupational Health

SANITATION AS A BUSINESS

2.4 billion people (about one-third of the global population) lack access to basic sanitation services, such as toilets or latrines. Of these, 946 million defecate in the open. Sanitation as a business is a new concept / approach which involve business entrepreneur and household there by solve current unhygienic sanitation problem faced by the population. It creates an ongoing relationship between household and entrepreneur providing sanitation services to solve current sanitation problems. This research is a proposal to World Vision based on models that were seen effective in both preurban and rural areas of Malawi to ensure the sustainability. The research is a qualitative approach and uses grounded theory methodology. The sample groups were selected based on locations where sanitation as business was practiced widely within the last 5 years. Data were collected from interviewing 7 participants with open-ended questions, researcher's observation in fieldwork, 3 focus groups and study of texts on different articles that used sanitation as business models. The collected data was analyzed using NVivo software where the data were coded to create themes / nodes to analyze the relationship between nodes and visualize data. From this, it was able to conclude how World Vision can improve its current sanitation approach by comparing with other similar models that were implemented.

DREXEL UNIVERSITY COLLEGE OF MEDICINE

APOLLONIA QUIROS

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **DR. YANICK M. VIBERT**
Pediatrics

Dr. Shannon P. Marquez
Co-Mentor

REDUCING NEONATAL MORTALITY IN THE GAMBIA WITH PREVENTATIVE ACTION FROM A MIDWIFE

Neonatal deaths are the highest in resource-limited countries. Many programs like Helping Babies Breath (HBB) give a checklist for how to deliver a healthy baby in countries that do not have as many resources. This research will focus on babies in The Gambia. Mary Joof, a well-known midwife in The Gambia, has been working at the Brufut Health Center for over 50 years. She has played an integral role in developing the health center and delivering countless babies safely. Many programs have a detailed checklist of everything that is needed for a safe delivery, but in places with limited resources, they may not have access to all of those items. Mary Joof will provide us with what she thinks is important for a safe delivery. This research in addition to programs such as HBB will continue to assist low-income countries in meeting their 2030 Sustained Development Goals (SDG) charge, which will continue to lower the devasting numbers that surround neonatal mortality.

DREXEL UNIVERSITY COLLEGE OF MEDICINE

MEGHA SANGAM

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Biological Sciences

Faculty Mentor: **DR. YANICK M. VIBERT**
Pediatrics

Dr. Shannon Marquez
Co-Mentor

ANALYZING THE INITIATIVE HELPING BABIES BREATHE AT BWIAM HOSPITAL IN THE GAMBIA

2.4 billion people (about one-third of the global population) lack access to basic sanitation services, such as toilets or latrines. Of these, 946 million defecate in the open. Sanitation as a business is a new concept/ approach which involve business entrepreneur and household there by solve current unhygienic sanitation problem faced by the population. It creates an ongoing relationship between household and entrepreneur providing sanitation services to solve current sanitation problems. This research is a proposal to World Vision based on models that were seen effective in both preurban and rural areas of Malawi to ensure the sustainability. The research is a qualitative approach and uses grounded theory methodology. The sample groups were selected based on locations where sanitation as business was practiced widely within the last 5 years. Data were collected from interviewing 7 participants with open-ended questions, researcher's observation in fieldwork, 3 focus groups and study of texts on different articles that used sanitation as business models. The collected data was analyzed using NVivo software where the data were coded to create themes/ nodes to analyze the relationship between nodes and visualize data. From this, it was able to conclude how World Vision can improve its current sanitation approach by comparing with other similar models that were implemented.

DREXEL UNIVERSITY COLLEGE OF MEDICINE

ALYSSA TRUXON

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A LOOK AT MATERNAL AND CHILD HEALTH IN RURAL GAMBIA

The transition from womb to world is one of the most important and dangerous transitions in a person's life. A child is 500 times more likely to die on the first day after birth than at one month of age. The UN's Sustained Development Goal (SDG) 3.2 attempts to "reduce neonatal mortality to at least as low as 12 per 1000 live births" by 2030. Although progress has been made, the neonatal mortality rate has decreased at a lower rate in resource-limited countries as compared to resource-rich ones. As of 2016, the neonatal mortality rate in The Gambia was 27.5 per 1000 live births and has been on a steady decline since the sustainable development goals were put in place. However, The Gambia and countries like it are not on track to meet the 2030 goal. A major part of the issue is the fact that rural villages do not have access to a plethora of things including skilled birth attendants and in the most extreme cases, clean water. The purpose of this project is to travel to different Health Centers within The Gambia and observe how they ensure and support maternal and child health with limited resources. This project also focuses the important tools needed for a safe delivery for the Health Center as compared to the major hospital.

ERICA WESSNER

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

Faculty Mentor: **DR. YANICK M. VIBERT**
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ASSESSING MATERNAL AND CHILD NUTRITION IN THE GAMBIA

Deaths during the neonatal period, the first twenty-eight days of a baby's life, continue to threaten resource-limited nations around the world. In 2016, neonatal deaths accounted for 46% of deaths in children under five years of age in The Gambia (West Africa). Of these neonatal deaths, 12% are the result of preventable infection, and as much as 35% of deaths are the result of preterm births. Maternal and child nutrition within The Gambia heavily contribute to these statistics; a lack of proper nutrition during pregnancy can cause health problems for both the mother and the baby during and after birth. As a result, the Regional Health Directorate in Brikama has implemented programs to help The Gambia meet their Sustainable Developmental Goals (SDG) to promote maternal and child health. In order to meet these goals, it is crucial that persons caring for expecting mothers and their children in The Gambia promote adequate nutrition. Creating a maternal and child nutrition checklist will improve the health of these vulnerable populations.

DREXEL UNIVERSITY COLLEGE OF MEDICINE

HANNAH S. JOHNSON

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Faculty Mentor: **DR. PETER J. GASKILL**
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SELEGILINE AND SIV MAY INCREASE CNS INFLAMMATION IN DOPAMINERGIC BRAIN REGIONS

Globally, around 37 million people are infected with HIV, despite advancements in antiretroviral therapy. HIV enters the central nervous system (CNS) soon after initial infection. This results in a variety of neurologic effects which are thought to result from infection of CNS macrophages, the primary targets for HIV in the brain. Drug abuse is a common comorbidity in HIV infection, with 10-20% of HIV+ individuals abusing drugs worldwide. All drugs of abuse increase dopamine, and our research shows increased dopamine enhances HIV infection in macrophages. To study this in vivo, we used the rhesus macaque model of NeuroAIDS. Macaques were mock-infected or SIV-infected in the presence or absence of selegiline, which increases CNS dopamine. Dopaminergic brain regions, such as the substantia nigra (SbN), and control regions, such as the brain stem (BStem), were stained for HLA-DR, which identify general inflammation. Analysis showed increased inflammation in dopamine-rich regions (SbN) relative to regions with less dopamine (BStem). This suggests HIV infection and dopaminergic tone have an effect on neuroinflammation associated with HIV infection.

EXTERNAL – INDIAN INSTITUTE OF TECHNOLOGY: MADRAS

JARED BUNCH

College of Engineering
Mechanical Engineering

Faculty Mentor: **DR. KRISHNAN BALASUBRAMANIAM**
Applied Mechanics

Avinash Kumar
Co-Mentor

ROBOTIC RAPID INSPECTION OF PIPELINES UTILIZING ACOUSTIC EMISSIONS AND ULTRASONIC WAVES

In our modern industrial infrastructure, pipelines play a crucial role in the transportation of resources. Due to corrosion and old age, pipeline systems crack and develop leaks. This inefficiency leads to large-scale waste of product, huge financial loss, and potential health risks. It is evident that an accurate detection method is imperative to increase the lifetime of a pipeline. Through this project, two new robotic devices were created to find leaks within a pipeline. One of these new devices, the Pipe Inspection Gauge (PIG) takes a preemptive approach, using ultrasonic waves to detect thinning pipe walls before they develop leaks. The other device is a small autonomous robot, called the iGLOBUS which compiles acoustic emissions generated by the gradient of pressure around a crack to detect leaks. For these projects, I coded a generalized program in MATLAB that analyzes, complies, and graphs raw data gathered by the PIG and I assisted in creating controlled experiments for the testing of the iGLOBUS. These newly created devices have the potential to map large sections of pipeline networks, finding harmful leaks that can be precisely located and repaired, reducing financial losses and public health risks.

EXTERNAL – INDIAN INSTITUTE OF TECHNOLOGY: MADRAS

TANISHA GOEL

LeBow College of Business
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Faculty Mentor: **DR. S. RAMAKRISHNAN**
Applied Mechanics

Punitha N.
Co-Mentor

MELANOMA DETECTION USING DEEP LEARNING TECHNIQUE

Melanoma is the deadliest type of skin cancer that occurs due to the rapid metasizing of the melanocytes. According to World Health Organization, each year 132,000 new melanoma type skin cancer cases occur across the globe. The purpose of this research is to analyze the dermoscopic images using Deep Learning Technique(DLT) which distinguishes between benign and malignant cases. Dermoscopic images are obtained from the PH2 database. These images may be corrupted by artifacts like hair particles, air bubbles etc. which affects the conventional methods of detection of melanoma. DLT benefits in providing better accuracy by using raw images in the network, without pre-processing the image. This work involves building a Convolutional Neural Network(CNN) for distinguishing benign and malignant melanoma. A CNN consists of alternate pooling and convolutional layers and makes use of its powerful convolve filters. The proposed framework has 7 hidden layers to extract critical features from the dermoscopic images. The network is trained for 3 epochs each having 109 iterations using the cross-validation method. After testing the network, the accuracy is analyzed and compared with the state-of-the-art methods.

EXTERNAL – INDIAN INSTITUTE OF TECHNOLOGY: MADRAS

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Software Engineering

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Applied Mechanics

Dr. Sriram Balasubramanian
Co-Mentor

NON-INVASIVE ESTIMATION OF MUSCLE FATIGUE THROUGH DEEP LEARNING

This project aims to apply a Deep Learning algorithm to detect percentage of total muscle fatigue condition using surface electromyography (sEMG) signals acquired from the biceps brachii muscle group. This capability is useful in the fields of sports science or medicine, aiding professionals in understanding the progression of muscle fatigue in a subject.

The sEMG signals from the biceps brachii muscles of normal subjects are recorded at the Non-Invasive Imaging and Diagnostics Laboratory, IIT Madras. Subjects were instructed to perform an isometric contraction exercise of the biceps until muscle fatigue. The signals are preprocessed by conversion to a sequence of time-frequency images, reducing noise and distortion. Each image from these sequences is input to a Convolutional Neural Network, which extracts spatial features. These feature representations are provided to a recurrent LSTM network to extract temporal features. A simple Neural Network interprets the output, assigning the signal a percentage of total muscle fatigue.

Regression in this network allows for automated labeling of new data. This also allows medical practitioners to see the gradual progression of muscle fatigue in subjects.

EXTERNAL – INDIAN INSTITUTE OF TECHNOLOGY: MADRAS

HAR PATEL

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Electrical Engineering

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Applied Mechanics

Gayathri Sukumaran
Co-Mentor

DEVELOPMENT OF A PULSE WAVE VELOCITY MONITORING SYSTEM

Assessment of arterial stiffness in the management of arterial hypertension is a novel biomarker that can estimate cardiovascular risk efficiently. For this purpose, pulse wave velocity (PWV) measurement serves as the gold standard method to assess arterial stiffness. PWV is the velocity at which the arterial pulse circulates through the cardiovascular system. The primary objective of this study is to develop a cost-effective solution to accurately estimate PWV. In this work, PWV is computed from the observed time delay in a two-point pressure signature recording. Pressure signals are acquired from subjects by using two force sensing resistors on the radial artery at an affixed distance of three centimeters, while an Arduino Uno monitors the data. The sampling rate is set at 100 Hz. The recorded signals contain a considerable amount of noise from motion artifacts. A Butterworth band pass filter is utilized to de-noise the signal at a frequency range of 0.5-9 Hz. Cross correlation is performed to the two filtered signals in order to acquire the delay of the signals. Finally, PWV is calculated using a distance over time equation, where distance is the length between the two sensors and time is the measured delay of the signals.

EXTERNAL – SHRINERS HOSPITAL

RADIYANA MANCHEVA

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

Faculty Mentor: **DR. ROSS CHAFETZ**
Motion Analysis Center

Spencer Warshauer
Co-Mentor

CROSS- SECTIONAL TESTING OF SPINE MODEL COMPARING MOTION CAPTURE ANGLES TO THOSE OBTAINED BY A GONIOMETER

Background: The Motion Analysis Center at Shriners Hospital performs clinical evaluations of the spine on patients with scoliosis pre- and post-surgery. The purpose of this study was to validate a spine model used for clinical assessments by comparing motion capture angles to those obtained by a goniometer. Methods: A wood model to mimic the human trunk was built by connecting three boxes to represent three segments- thoracic, lumbar, and pelvis. Sixteen markers were placed on each box segment. The angles were modeled using linear algebra to represent spine motion. Each segment was moved 15 or 30 degrees in the sagittal or coronal plane, representing trunk flexion/extension and lateral side bending. Data was collected using a 12 camera Vicon system and Nexus. The difference from actual displacement was collected for each motion. Results: The average difference for lateral bending was -0.7 + 2.5. For the forward flexion and extension, the average difference was -1.7 + 2.4. The results did not differ with combined motions. Discussion: This study validated the spine model for clinical use. Future work should include repeating the trials and using a different approach to measure rotation and combined motions to eliminate variability.

NADIM AMIN

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Faculty Mentor: **DR. A. KAVITHA**
Biomedical Engineering

Ms. R. Nithya
Co-Mentor

HAND EXOSKELETON FOR REHABILITATION

This research focused on the design of an affordable, printable, compact, wearable, powered hand exoskeleton for both daily life assistance and physical rehabilitation for stroke survivors. The exoskeleton aims to speed up the process of rehabilitation while allowing users to go about their daily routine's uninhibited. The design process began with a detailed study of hand anatomy and kinematics to ensure that each digit could be actuated individually to a close to full range of motion. A simple rigid linkage structure is used to connect the back of each segment of each finger to a base structure on the back of the hand. The exoskeleton incorporates five mini linear actuators that power the flexion and extension of each individual finger. Control of the linear actuators is achieved using small, wearable EMG sensors that capture and transmit EMG data to an equipped microcontroller in real-time. This design allows for the user to control grip strength and hand position at any given time without the usage of another body part. The simplicity of the design and use of small, reliable components results in an easy to assemble and use rehabilitation device.

ASHLEY BISHOP

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Faculty Mentor: **DR. A. KAVITHA**
Biomedical Engineering

Ms. Anandha Sree, Ms. Sandhya
Graduate Student

CLASSIFICATION OF VOWEL PHONEMES FROM IMAGINED SPEECH EEG SIGNALS

Integration of speech imagery, the idea of imagining speech in one's brain without physical vocalization, with brain computer interactions is a rising field prominently centered on the application of providing an easier communication means for those with severe speech impairments. This work focused on the concept producing a speech synthesizer from speech imagery and the classification of the English vowel phonemes 'a','e','i', 'o', 'u' by recording and processing electroencephalogram (EEG) signals. These signals were acquired through the Emotiv Epoc+ system and taken from student volunteers, who all were bilingual English and Tamil speakers. After data was recorded, the EEG signals were then denoised through a series of different band-pass filtering techniques, dependent on the target feature. Overall, six statistical features and four brain connectivity features were extracted from the filtered signals and were used as inputs for a machine learning algorithm which served as the basis for a speech synthesizer.

MALENA FARBER

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Faculty Mentor: **DR. S. VIDHUSHA ME**
Information Technology

Viswath Narayanan R, Yaamini D
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DEVELOPMENT AND TESTING OF A VIRTUAL REALITY ENVIRONMENT'S EFFICACY AS A LEARNING TOOL FOR AUTISTIC CHILDREN

Autism Spectrum Disorder (ASD) affects the ability of a person to engage socially. People with ASD struggle with holding eye contact and maintaining attention among many other things. It has been shown by previous research that virtual reality (VR) may be a useful tool to teach these children social skills or more generally as an alternative learning platform. Other research has also shown that specific metrics extracted from EEG signals can serve as a form of validation for improved learning. Therefore, the goal of this project was to see if-through phase locking value (PLV) and power coherence-attention and mental activity within the brain associated with the processing of information is increased when high-functioning autistic children (age 4-7) are taught simple numbers, colors, or letters within a virtual reality environment. In the future, more work is likely to be done in terms of expanding this project into teaching autistic children harder concepts or social skills.

CLAYTON FRANCIS

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Chemistry

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School of Life Sciences - Chemistry

Stavroula Sampani, Jack Devonport
Co-Mentors

SYNTHESIS OF 3D/4F MOLECULAR MATERIALS WITH SCHIFF BASE LIGANDS

Coordination chemistry presents as one of the more exciting fields of research in modern chemistry. Not only do the complexes synthesized and studies have fascinating geometry, but many of the materials produced have industrial uses as catalysts. More recent research has led to interest in polynuclear coordination clusters, or CCs, as studies into these materials have shown them to have great catalytic ability. Our research was an attempt to synthesis a tetranuclear CC containing 3d and 4f metals, more specifically Co and Y or Dy, and to bond Schiff Base ligands to the CC. Once synthesized, we were to test the catalytic ability of the complexed material. A secondary objective of the project was to reduce the imine double bond of the Schiff Base ligand to see how it would affect the stability and catalytic ability of the complex. Due to unfavorable conditions, none of the attempts to form the CC ligand complex successfully crystallized, which meant that the materials could not be analyzed or tested for catalytic ability. The specific Schiff Base ligand used was successfully reduced and precipitated as a high purity solid, and the procedure for the reduction was refined and documented for future work on the project.

C. ANJIAO WETHERHOLD

College of Engineering
Materials Science and Engineering

Faculty Mentor: **DR. GEORGE KOSTAKIS**
School of Life Sciences - Chemistry

Jack Devonport
Co-Mentor

CREATION AND SYNTHESIS OF COPPER CATALYSTS

Copper has been shown to be an effective catalyst in a number of synthetic organic of reactions and compounds. Copper's redox potential and ability to for heteroatom bonds is what allows it to be such an effective catalyst. Previous studies has shown copper to be a catalytic in A3 coupling and C-N coupling reactions. In this project, two organic ligand structures were proposed and their corresponding copper complexes was attempted with the aim of studying their individual catalytic abilities. A number of synthetic pathways towards the Liga das and their complexes were proposed and tested with varying degrees of success. The research will help to further the understanding and uses of copper complexes as a catalyst, especially in the place of the more expensive metal catalyst.

ANJELIKAL ROGERS

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Media Arts & Design
Animation and Visual Effects

Faculty Mentor: **DR. MELINDA LEWIS**
Marketing & Media

GRAPHIC NOVELS AS A FORM OF STORYTELLING

Throughout this summer I decided to work on an independent research project that focused on graphic novels as a form of storytelling. I wanted to know how I could successfully tell a story through images like some of my favorite artists, so I closely examined the storytelling tactics of various graphic novelists; taking note of their choice of art style and various other storytelling devices. With the information from the notes I took I am developing a graphic novel about toxic masculinity. In addition to researching investigating graphic novelists I also researched toxic masculinity as an individual subject so that I would be able to tell accurate information. Though I only got as far as far as a bare bones concept, I intend to build upon the idea in the future when I acquire more skills so that I am able to better deliver the concept visually.

LILA VANNI

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Media Arts & Design
Film & Video

Faculty Mentor: **DR. MELINDA LEWIS**
Marketing & Media

ME ALSO

Being a woman in the media industry, I was interested in the current rise of women's narratives surrounding an ambiguity that I felt demanded answers: the motivations behind the Me Too movement. Overwhelmed by the outcries of women that inspired me, I followed their narratives to uncover how this all happened. From the allegations, the actions behind them, and the motivation that caused these women to finally take their stands, I embarked on the path to unravel the past and contemporary moments of these remarkable women in the industry.

Through various forms of media — podcasts, albums, films, long-form essays, and books — I heard the many narratives of women that embodied the sobering truth that there was still much progress to be made to change the industry. In addition, reading others' stories with the #MeToo inspired me to share my own voice and feelings through a collection of short writings that link these stories together to tell my revelation of a whole narrative of how women, past and present, have worked to cultivate this modern feminist movement.

EMILY MCKEON

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English

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Pennoni Honors College

WILLIAM SHAKESPEARE AND AGE CRITICISM

This project was focused on William Shakespeare's *Romeo and Juliet* as well as *King Lear*. While many interpretations can be made through Shakespeare's works, the question being raised through this project was how elder audiences perceive the texts in comparison to the interpretation of younger audiences. The project collected data through a questionnaire on audience interpretations of *King Lear*, while *Romeo and Juliet*'s interpretations were analyzed through a thorough analysis between myself and Dean Cohen. This data was then applied towards age criticism, a theory established around audience interpretations based on age and life experiences.

William Shakespeare's works, particularly his plays, have been examined by a multitude of scholarly networks. Research on age criticism has been minimal as more emphasis has been placed on gender response. Additionally, the relatively recent reader-response theory has led to a renewal of interpretations. However, age theory is a relatively unexplored area of reader-response. Through the development of two groups, a clear picture was formed as to how age leads to a unique differing as well as a surprising link in interpretations of the texts, adding to the growing theory of age criticism.

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

STEPHEN ABBATE

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Adrian Curtain
Co-Mentor

ELECTROMYOGRAPHY-BASED CONTROLLER THAT ALLOWS FOR SEAMLESS HUMAN-COMPUTER INTERACTION

Human-computer interaction is becoming an increasingly integral part of society, thus causing a push new methods of interaction. The following project's goal was to design a device that employs Electromyography (EMG) to measure muscle signals in order to act as a computer controller. EMG refers to the process of measuring changes in muscle cell's electrical potential resulting from contraction. An Olimex EKG Arduino shield was used to amplify low muscular signals to the 0-5V range, suitable for an Arduino Uno to digitize. In order to act as a controller, the system must analyze the live data to find indications that a specific gesture was performed. This was done by identifying specific frequencies, using Matlab's FFT function, that correspond to different gestures. Iterative testing showed placing surface electrodes on the forearm and one ground on the elbow, produced the most distinct waveforms. Also, a 1 MB circular buffer was designed to store incoming data while previous data is being analyzed by the Matlab, guaranteeing that no data points are lost. Overall, the project successfully operates as a basic computer controller and provides opportunity for implementation in medical devices, such as for prosthetic control.

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

KYLE SMITH

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ELECTROMYOGRAPHY BASED HUMAN COMPUTER INTERFACE

A Human Computer Interface (HCI) is a term used to describe a system that has the intention of allowing a person to directly interact with a computer environment in a way that is more natural than typical computer interfaces such as a keyboard and mouse. Current HCI's are typically used in clinical settings to gauge participant behavior. Additionally, HCI's have a wide number of uses in the broader medical field such as control of robotic exoskeletons or prostheses. HCI's can also be used to assist everyday computer usage and even video games.

A working prototype of a HCI using Electromyographic (EMG) sensors and arm movements was implemented to provide a control system for a simple video game platform. This was done as a proof of concept on the feasibility of using EMG sensors in higher level computer interactions scenarios. Further work must be done to make the overall system more compact and robust to provide the necessary control for such systems. The next progression of this project would be the integration of multiple EMG sensors to allow for more unique signal combinations, hence allowing for wider array of possible outputs.

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

HANH DIEU DO-PHUNG

College of Engineering
Computer Engineering

Faculty Mentor: **DR. SRIRAM BALASUBRAMANIAN**
Biomedical Engineering

Dr. Valentina Graci, Thomas Seacrist
Co-Mentors

DESIGNING THE TESTING ENVIRONMENT FOR A STARTLING WARNING SYSTEM IN AN AUTONOMOUS DRIVING SCENARIO

Nowadays, motor vehicle crashes are the leading cause of death in young adults [1]. With autonomous driving becoming a reality, drivers may become involved in secondary tasks. Therefore reaction times during crash avoidance maneuvers may be increased if the vehicle requests manual control. The purpose of this research is to develop a novel auditory warning system that uses a starling sound to decrease drivers' reaction times during evasive swerving. A driving environment consisting of a custom made driving compartment within an oscillating sled simulating evasive swerving will be designed and built. A startling sound, consisting of a 1000 Hz sine wave, will be tested at 105 dB, 120 dB and 124 dB, and will occur in a 40 ms duration. Because the startling sound will need to occur 250 ms before the sled oscillation (Mang et al 2012), a relay controller will be programmed to time the sound accurately with the sled motion. The efficacy of the starling sound will be tested by collecting kinematic and kinetic data on human subjects.

[1] CDC, "Teen Drivers: Gets the Facts," pp. 3 – 4, 2018

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

MATTAN ORBACH

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ESTIMATION OF NORMATIVE LUNG VOLUMES FROM TWO-DIMENSIONAL LUNG MEASURES IN PEDIATRIC SUBJECTS

Lung volume is assessed using pulmonary function tests (PFTs) such as spirometry. Because of the challenges of collecting pediatric PFTs, computed tomography (CT)-based estimates of lung volume have been used. Although these CT-based methods provide reliable estimates, they involve extensive radiation exposure. While clinical radiographs are routinely used for evaluating lung pathologies, they do not provide a direct estimate of lung volume. So, the objective of this study was to estimate lung volume from 2D radiographs in normative male and female pediatric subjects. Retrospective chest CT scans from 69 normative male and female subjects ages 1-19 years were obtained from the Children's Hospital of Philadelphia, and the right and left lung volumes were calculated from digital reconstructions using medical image processing software (MIMICS, Materialise Inc., Belgium). Polynomial regression equations, using age as the independent variable, were used to estimate 3D lung volume for both sexes from 2D lung measures collected from projected X-rays of the same subjects derived from the CTs. Such data can aid in the surgical treatment of pediatric subjects with complex thoracic deformities and inhibited lung growth.

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

ALISON KANE

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Faculty Mentor: **DR. JOSEPH SARVER**
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REVISION AND OPTIMIZATION OF SHOULDER TORQUE AND RANGE OF MOTION (STROM) DEVICE FOR FUTURE USE IN LONGITUDINAL STUDY

Medical professionals use shoulder stiffness to diagnose injury or document progress in overhead athletes, neurological patients, or those with orthopedic injury. Current methods of shoulder stiffness evaluation rely on range of motion data and leave medical professionals unable to determine if stiffness changes independently of range of motion. The Shoulder Torque and Range of Motion (STROM) device, developed by Dr. Joseph Sarver, compares angular displacement and torque through shoulder internal and external range of motion, producing a graph where the slope is stiffness. A previous version was capable of detecting small stiffness changes when range of motion remained consistent, between male and female shoulders, and before and after exercise. Mechanically, the previous device was limited in terms of size, weight, stability, and functionality. The newest revision of the device was improved through reduced size and weight, and increased stability and overall functionality. The improvements, as well as newly upgraded software, provide opportunity for use in future longitudinal study of overhead athletes since it is the first device of its kind that can be transported to the site of athletic activity.

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

PRATISHTHA GUCKHOOL

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Biomedical Engineering

Linda Solomon
Co-Mentor

THE ROLE OF NEUREXINS AND NEUROLIGINS IN NEURITE STRUCTURE AND SYNAPTIC CONNECTIVITY

Correct neurite arborizations and synapse formation are fundamental for neural network function. The adhesion molecules neurexins (Nrx) and neuroligins (Nlg) participate in proper alignment of synaptic components and stabilization of nascent contacts that lead to the formation of functional synapses. However, recent work has demonstrated that Nrx and Nlg may also participate in neuritic adhesion complexes, prior to synapse formation, that direct the growth and refinement of axonal and dendritic arbors. Here, we investigate these putative dual roles in neural circuit development within the model organism Drosophila melanogaster. Our RNA sequencing data suggest Neurexin-1 (Nrx-1) and Neuroligin-4 (Nlg-4) are highly expressed between synaptic partners. We expand upon these data by knocking down Nrx and Nlg with RNA interference. Following immunocytochemistry and confocal microscopy, we quantify changes in synaptic density and axonal and dendritic morphology. Since Nrx and Nlg have been implicated in neurodevelopmental disorders, including autism, our data will enrich our understanding of Nrx and Nlg's role in neural development and may enable the generation of more effective therapies for neurodevelopmental disorders.

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

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Linda Solomon, Brennan Mcfarland
Co-Mentors

THE ROLE OF DSCAMS IN SYNAPTIC DEVELOPMENT IN DROSOPHILA

One long-standing hypothesis states that synaptic adhesion molecules, on pre- and post-synaptic neurons, provide a molecular "code" that determines whether a synaptic connection is established. However, the developmental role of many putative synaptic adhesion molecules remains relatively unexplored. Here we determine the role of Down syndrome cell adhesion molecules (DSCAM) in establishing correct synaptic connections within fruit fly, Drosophila melanogaster. Of the four DSCAM genes in Drosophila, only Dscam 1 has been determined to provide repulsive cues that prevent unintended synaptic connections. The role of Dscam 2, 3, and 4 remain undetermined. Our RNA sequencing data suggest that Dscam 2 is abundantly expressed between synaptic partners within a defined neural circuit. To investigate how the loss of DSCAM may alter connectivity, we use the Gal4/LexA system to selectively express Dscam 1-4 RNAi in synaptic partners. Following immunohistochemistry and confocal microscopy, we quantify changes in axon and dendrite area, length, location, and synaptic density. Studying the developmental role of DSCAM Drosophila may provide insight on how DSCAM overexpression contributes to neurodevelopmental defects in Down syndrome in humans.

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

IMAN AYAZ

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Faculty Mentor: **DR. MARGARET A. WHEATLEY**
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Brian Oeffinger
Co-Mentor

INVESTIGATING THE STABILITY OF OXYGEN DELIVERING MICROBUBBLES

Tumors develop chaotic blood vessels, and as a result do not receive an adequate supply of oxygen. This results in the development of a resistance to radiation, but by increasing the partial pressure of oxygen to 20 mmHg, the radiosensitivity of tumors nearly triples. We have developed microbubbles (SE61) which are freeze dried to allow the incorporation of oxygen, which is then delivered to tumors using ultrasound. SE61 is protected during freeze drying using 3.6% (200mM) glucose solution used as a lyoprotectant. This research has found that the shelf-life of SE61 is less than 1 week. Acoustic testing has shown that the maximum signal reflected by SE61 is approximately 23 decibels (dB) on day 0, decreasing to 15 dB by day 7 and to 13 dB by day 14. A drop in half-life was also observed. Additional research further investigated the effect of using different lyoprotectants, such as 10% glucose, 10% polyvinylpyrrolidine (PVP) and 10% trehalose, on the stability of SE61. These lyoprotectants produced varying initial protection during freeze drying, but all failed to improve SE61 stability. Future work will involve investigating using a bulking agent, such as glycine, to increase the shelf-life of SE61.

JOY IACONIANNI

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Biomedical Engineering

Mr. Brian Oeffinger
Co-Mentor

INCREASING LOADING CONCENTRATION ON POLYMER MICROBUBBLES

Many existing treatments for illnesses affect all cells, lacking the ability to target a desired location. Drug delivery via injectable, targeted microbubbles (MBs) is a potential solution. Traditionally used as contrast agents, MBs can form nanoparticles in the presence of ultrasound, delivering therapies to the desired site. Our focus is on developing polymer MBs, loaded with small interfering RNA (siRNA), to treat spinal cord injury by hindering the formation of scar tissue that inhibits neuronal restoration. This study aims to increase concentration of siRNA on the MBs, while maintaining acoustical and morphological properties. This was achieved by reducing the batch size by half. Maximum backscatter in response to dosage for both full and half batch was found to be 13.36 dB and 15.16 dB, respectively, and stability with time was found to be over 15 minutes for both processes. MB size was less than 2.0 μm and MB charge was between -20 mV and -22 mV for both methods. The half batch results mirrored the stability, size, and charge of the full batch. The outcomes for decreased batch size of the bubbles look favorable and should increase the concentration of the siRNA to be loaded onto MBs.

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

GABRIELLE VANFOSSON

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

Faculty Mentor: **DR. YINGHUI ZHONG**
Biomedical Engineering

Robert Schultz
Co-Mentor

DEVELOPMENT AND CHARACTERIZATION OF CHITOSAN-COUPLED AGAROSE HYDROGEL WITH MODIFICATIONS FOR NEURONAL CELL ATTACHMENT

Within the treatment of spinal cord injury, there is a dearth of clinical treatment strategies focusing on the possibility for regeneration and restoration of function by introducing new neural growth within the lesion. To achieve cell attachment and neurite growth, the cells must be introduced and supported independently of the damaged tissue of the lesion. It has been seen previously that E9 chick DRGs can be supported and successfully extended neurites in a chitosan-coupled agarose hydrogel. To model neurons, PC12 cells were used to analyze the effectiveness of various hydrogel formulations in supporting cell attachment, viability, and neurite outgrowth into the scaffold network. Biocompatible hydrogel scaffolds were fabricated by combining oxidized agarose and thiolated chitosan in a myriad of modifications. 250 um thick hydrogel disks were formed on cover slips, placed into well plates and fed with media supplemented with neurite growth factor. Cells were cultured for approximately 6 days before fixation or staining for quantification of neurite growth or cell death, in an attempt to find an optimized gel support for the neuronal cells.

SCHOOL OF EDUCATION

ELIZABETH PHAM

School of Education
Secondary Education Social Studies

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

SCHOOLED IN CORRUPTION IN VIETNAM

Corruption is common in Vietnam, especially within the education system. Briberies, score fixing, and cheating on exams are some examples of the corrupt practices that plague Vietnamese schooling. In the context of development, there is increased competition for seats in the best schools, access to higher education, and competition for teacher attention in overcrowded classrooms. Bribery has become rampant and serves to mediate lack of transparency and inequality for many families unsure of their children's opportunities. Educational corruption highlights social stratification in Vietnamese society, allowing students of wealthy and middle-class families to pay for additional learning services to help improve their academic profile. The road to fighting corruption in schools has proven difficult because these practices have become normalized to many students, parents, and educators. This research provides insight on aspects of Vietnamese culture and society that allows for the normalization of corrupt acts, and how they impact the future of the country's education system, and development in general. This study draws on interviews with parents, students, and educators to understand their lived experiences with corruption and its impact on educational opportunity. Preliminary findings suggest that for urban families with means, negotiating corruption in education has become an everyday practice. Most of the students and parents in this study have concluded that rampant corruption has led to an increased desire for students to study and live abroad, affecting the economy of the country.

FRANCES VELAY FELLOWS

The 2018 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 10 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.

VERTICALLY INTEGRATED PROJECTS

Continuing the tradition of experiential learning that has made Drexel University a national leader, we introduce our latest initiative – the Vertically Integrated Projects (VIP) Program. With its 100-year history of co-operative education and industry engagement, Drexel is a natural fit for the VIP model already flourishing at universities across the world.

VIP team members work as part of a multidisciplinary group of undergraduate students, graduate students, research staff, and faculty members to tackle novel research and design problems around a theme. Undergraduate students that join VIP teams earn academic credit for their participation in design/discovery efforts that assist faculty and graduate students with research and development issues in their areas of expertise.

VIP teams are:

- **Multidisciplinary** - drawing students from all disciplines on campus;
- **Vertically integrated** - maintaining a mix of freshman through PhD students each academic term;
- **Long-term** - each undergraduate student may participate in a project for up to three years and each graduate student may participate for the duration of their graduate career.

The continuity, technical depth, and disciplinary breadth of these teams are intended to:

- Provide the time and context necessary for students to learn and practice many different professional skills, make substantial technical contributions to the team project(s), and experience many different roles on a large, multidisciplinary design/discovery team.
- Support long-term interaction between the graduate and undergraduate students on the team. The graduate students mentor the undergraduates as they work on the design/discovery projects embedded in the graduate students' research.
- Enable the completion of large-scale design/discovery projects that are of significant benefit to faculty members' research programs

VIP participation at this year's STAR Showcase is the culminating event to the program's pilot, which began in Spring Quarter of the 2017-2018 academic year. This pilot consisted of the establishment of five teams. While spearheaded by the College of Engineering, these five teams attracted the participation of 27 undergraduate students from across the university, including students from the College of Engineering, the College of Computing and Informatics, the College of Arts and Sciences, the LeBow College of Business, and the School of Biomedical Engineering, Science, and Health Systems.

As the VIP Program at Drexel moves into its full launch in the 2018-2019 academic year, it looks to expand the number of active teams in all disciplines and broaden participation by both students and faculty. Please contact Chad Morris at cam83@drexel.edu for more information.

SARAH MALIK
LeBow College of Business
Business & Engineering
Expected Grad Year: 2020

KRZYSZTOF MAZUR
College of Engineering
Mechanical Engineering
Expected Grad Year: 2019

Faculty Mentor: **DR. ANTONIOS KONTSOS**
College of Engineering
Materials Science & Engineering

INTERNET OF THINGS AS A METHODOLOGY FOR IMPROVING DIAGNOSTICS AND PROGNOSTICS IN STRUCTURAL HEALTH MONITORING APPLICATIONS

Structural Health Monitoring (SHM) defined as the process that involves sensing, computing and decision making to assess the integrity of infrastructure has been plagued by data management challenges. The Internet of Things (IoT) provides a way to decisively address SHM's big data problem. The purpose of this IoT poster is to present a framework that is currently being developed at Drexel University that intends to connect sensor data with processing to provide diagnostic/prognostic capabilities. Specifically, the proposed IoT model will be comprised of 3 components: the Cloud, the FOG and the EDGE. The Cloud will be used to store data as well as to perform demanding computations such as remaining useful life estimations. The FOG is the hardware that will perform prognosis using information received both from sensing and the Cloud. The EDGE is the bottom level hardware that will filter data at the sensor level. Machine learning at the FOG and EDGE layer will provide a mechanism to reduce noise and find key metrics regarding the material. The poster presents details on the conceived IoT framework as well as initial results of applying it at the laboratory scale.

KWEKU NYADU ABOAGYE
College of Engineering
Electrical Engineering
Expected Grad Year: 2022

KYLE MOYNAHAN
College of Engineering
Chemical Engineering
Expected Grad Year: 2022

Faculty Mentor: **DR. ANTONIOS KONTSOS**
College of Engineering
Materials Science & Engineering

INTEGRATED SIMULATION–EXPERIMENTATION–ANALYSIS APPROACH TO ADVANCED MANUFACTURING

Additive manufacturing diverges from traditional manufacturing techniques due to its promising capability to create complex geometries using several materials with faster production rates and less material waste. In this aspect, fused deposition modeling (FDM) is one of the most common 3D printing methods. There are various parameters that need to be considered during the manufacture process by FDM such as porosity, build orientation, layer thickness, and raster angle, among others. Additionally, the type of filament has a crucial impact on the mechanical properties of 3D printed structures. In this framework, this study branches in three fields and focuses on designing a manufacturing process for producing a continuous fiber-reinforced plastic (CFRP) filament that can be used in current commercial 3D printers, devising a sensor system that would monitor the process ongoing during fused deposition modelling, detecting irregularities and failures in the process and observing the impact of build orientation on mechanical properties of structures. Furthermore, 3D-printed structures are topologically and geometrically characterized using imaging methods such as microscopy. Such parametrization, microstructure representations and mechanical performance data are subsequently used as inputs to 3D Finite Element Analysis (FEA) in which filament is directly accounted.

RAHEL KANG
School of Biomedical Engineering, Science,
& Health Sciences
Biomedical Engineering
Expected Grad Year: 2020

Faculty Mentor: **DR. ALISA MORSS CLYNE**
College of Engineering
Mechanical Engineering & Mechanics

DEVELOPMENT OF NOVEL COMPUTATIONAL METHODS TO ANALYZE CELL METABOLIC ACTIVITY

Endothelial metabolism has recently emerged as a powerful tool to modulate vascular function. The goal of this research is to develop computational tools to identify important changes in endothelial metabolism in varied mechanical environments. 13C6-glucose mass spectroscopy data was gathered from human endothelial cells cultured in static conditions or in steady laminar or oscillating disturbed flow. Two different metabolomics methods were then developed in MATLAB using toolboxes like INCA and COBRA. In the first method, principle component analysis (PCA) and k-means were applied to mass spectroscopy data to identify important metabolite differences among the data sets. In the second method, the carbon movement was tracked as glucose entered the cell and went through glycolysis followed by the TCA cycle. While these computational methods provide important insight into endothelial cell metabolism, more samples are needed to fully evaluate the accuracy of these novel metabolic analysis methods. In the future, these computational techniques can identify important metabolic targets in cardiovascular disease.

TRI LE
College of Computing & Informatics
Computer Science
Expected Grad Year: 2022

Faculty Mentor:
DR. KAPIL DANDEKAR
College of Engineering
Electrical & Computer Engineering

SAHITHI PISUPATI
College of Computing & Informatics
Software Engineering
Expected Grad Year: 2020

Faculty Mentor:
DR. RAJNEESH SURI
LeBow College of Business
Marketing

RADIO WARS IN AUGMENTED REALITY

We are surrounded by waves: sound waves, light waves, radio waves, etc. Some of these waves e.g. light waves, are visible, while some are not. As a result, it can sometimes be difficult to learn more about wave properties, especially of those that cannot be seen or interacted with. There has been increasing demand in education technology for new ways to visualize unseen information.

This project aim to display radio waves, normally not visible to the human eye, using the latest Augmented Reality Kit framework on iOS. This will tremendously help those who want to learn more about radio waves, especially in the education field.

The current design of the project contains two parts. The first part is to collect data from the radios sending packets to each other and save the real-time data. The current data is being saved on a MongoDB database, contained in a Docker service. The second part is to visualize the data in an Augmented Reality environment on devices with iOS, with the use of Apple ARKit 2.0.

BRANDON LISTON
College of Engineering
Electrical Engineering
Expected Grad Year: 2020

Faculty Mentor:
DR. KAPIL DANDEKAR
College of Engineering
Electrical & Computer Engineering

Faculty Mentor:
DR. RAJNEESH SURI
LeBow College of Business
Marketing

SPECTRUM DECONFLICTION ALGORITHM (SDA) USING DEEP LEARNING

The goal of the research for the SDA algorithm is to implement a successful collaborative channel based deconfliction algorithm applicable to a multichannel cognitive radio. The algorithm is to use a deep neural network approach by treating the problem through either a classification or state machine approach. The goal is to have the network be able to train real time on a cognitive radio's collected IQ of the spectrum in a given collaborative and interfered with environment, then use the learned non-deterministic solutions to efficiently enact channels of the radio based on the previous spectrum analysis. In final testing of the algorithm, the algorithm is to be implemented in fully converged, feed forward only applied function that holds its weights static to make decisions about the spectrum per channel of the radio.

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SPECIAL THANKS

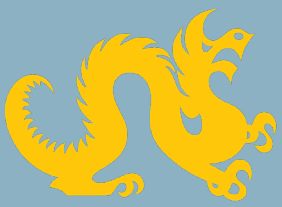
We would like to extend our sincere gratitude to all Faculty Mentors, Graduate Students, and others at Drexel University and at our international partner locations who have helped teach, guide, and mentor these STAR Scholars.

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

THE STAR SCHOLARS PROGRAM IS ADMINISTERED BY THE OFFICE OF UNDERGRADUATE RESEARCH, A UNIT OF THE PENNONI HONORS COLLEGE.



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